

CHAPTER 6

PRESERVATION MAINTENANCE

INTRODUCTION

This chapter describes the tools, techniques and skills necessary to safely preserve and maintain the Fort Ross historic orchards following the implementation of stabilization measures.

Preservation maintenance consists of on-going or cyclic practices that perpetuate an orchard's historic character and the individual trees within. In the Fort Ross orchards, preservation maintenance protects the extant historic fruit trees, supports new or replacement trees, and maintains the orchard spaces (including the groundcover and perimeter fencing) in good condition.

Scope of Preservation Maintenance

Many of the tools and techniques of preservation maintenance are the same as those used in orchard stabilization, and in contemporary horticulture generally. The difference between standard orchard maintenance and orchard preservation maintenance is the shift in priority from fruit production (commercial orchards) to landscape preservation (historic orchards). Commercial and private orchards are maintained to produce abundant, high-quality fruit for sale and consumption. In historic orchards such as those at Fort Ross State Historic Park, the fruit trees are the primary cultural resource and fruit production is secondary to preservation.

ORCHARD SAFETY

Working safely to avoid injury is always the top priority during orchard maintenance activities. Orchard work requires the

frequent use of sharp tools, power equipment, working aloft on ladders or underneath tree canopies, stability on uneven ground. . .and many other potential hazards. The first step towards orchard safety is recognizing all potential hazards, followed by the use of properly rated safety equipment (also known as Personal Protective Equipment, or “PPE”). The following section addresses some of the common hazards that are likely to be present in an orchard.

Orchard Ladders

Figure 6.1: *(left)*
Set the ladder up at arms-length to ensure level treads.

Figure 6.2: *(right)*
Place body weight on the bottom rung to dig the ladder’s feet into the soil.

Working aloft is inherently dangerous. No person should work on fruit trees from an orchard ladder unless they are properly trained in its use and wearing the correct Personal Protective Equipment. Do not use standard four-legged ladders for orchard work: they are designed for hard level surfaces only.



Orchard ladders, also known as tripod ladders, are specifically designed for use on uneven ground such as an orchard floor. The articulating front tripod leg can also be carefully inserted over low scaffold branches to allow closer work within the tree canopy. Inspect aluminum ladders for dents or cracks in the metal, inspect wooden ladders for cracked or split wood, loose treads or flimsy tripod leg hinge. Remove any damaged ladders from service or repair before using.

The tripod leg should be open and extended between 30° - 45° from the ladder treads, or far enough to be stable when standing on the highest permissible tread. Do not climb an orchard ladder that stands too narrowly or too splayed out. The treads must be as level as possible. Gauge this distance by standing on the ground with arms outstretched: a properly extended ladder with flat treads will allow the worker's hands to grasp the side rails.

Figure 6.3: *(left)*
Tripod orchard ladders offer flexibility in placement as well as stability on uneven ground.

Figure 6.4: *(right)*
Never ascend higher than the red step, or place knees above the top of the ladder.





Figure 6.5: *The proper way to carry an orchard ladder is over the shoulder.*

After standing the ladder in place, ascend the first rung and gently shift from side to side to test for balance and settle the ladder feet into the soil. Climb with three points of contact (i.e. two feet and one hand on the ladder at any moment) and holster pruners and tools while climbing to avoid dropping them.

Never let the knees rise higher than the top of the ladder and always stand with both feet on the treads. Many ladders include a red tread near the top that should not be climbed above. Do not extend the feet or legs outside the ladder rails to avoid tipping sideways. Orchard ladders are unwieldy by nature. Carry the ladder efficiently by balancing on one shoulder. Some ladders have a plate to make carrying more comfortable and also indicate at-a-glance the fulcrum point of the ladder.

Natural Hazards

Natural hazards within the orchard pose a significant threat to orchard workers' health. The most prevalent natural hazards in the orchard are poison oak and ticks. In addition, Yellow jackets, honeybees, snakes, and larger animals may be present.

Yellow jackets

Yellow jackets make nests in abandoned gopher runs or other subterranean holes. Small openings provide access to the nest and can be difficult to see. Walking or mowing

over the nest opening will cause yellow jackets to become aggressive and potentially sting or bite. Identify known nests with flags, cones or some other visible barrier. Spraying with insecticide is the most effective and expedient means of eliminating a yellow-jacket nest. Another option is to cover the entire entry hole with a large plastic sheet and secure it tightly to the ground with rocks or soil to trap the insects. This method requires several people to assist and must be left in place for a week or more to be effective.

Honeybees

European honeybees are often present in the canopy of a tree in bloom and should be treated with respect. Generally, honeybees will not harm a person working in the tree during bloom time, but try to schedule tree work before or after bloom time to minimize contact.

Ticks

Ticks are a major concern in the orchards at Fort Ross particularly in spring before the orchard grass has been mown. The Western black-legged tick (*Ixodes pacificus*) is the only species in California believed to transmit the virus that causes Lyme disease. Tick bites are painful and potentially harmful so it is advisable to conduct regular tick checks throughout the day followed by thorough whole-body checks after work or before showering. Light-colored work clothes allow the dark-colored ticks to be more readily spotted while in the field. Long pants and shirts with long sleeves are recommended.

Snakes

Venomous snakes such as rattlesnakes have not been observed in the Fort Ross orchards. The habitat may be too close to the water for this species. However orchard workers should be aware that snakes do exist at Fort Ross. Two species of non-venomous snake have been observed: Garter snakes and Northern rubber boas, both of which are shy and unlikely to be aggressive towards humans. Snakes provide ecosystem services by controlling small mammal populations such as voles and mice. They should not be discouraged in the orchard.



Figure 6.6: (left) *Poison oak at base of a walnut tree with characteristic three-lobed leaves.*

Figure 6.7: (right) *Poison oak detail.*

Poison Oak

Poison oak (*Toxicodendron diversilobum*) is endemic to California and is present within and around the orchards at Fort Ross. Poison oak oils can cause dermatitis and all contact with the plant should be avoided. The plant has a diverse growth habit and can form a shrub, a vine or even a groundcover depending upon the environmental conditions. Orchard workers should be able to recognize the plant in all its forms.

Poison oak is growing at the base of the Russian Orchard deer fence in several locations, including by the entry gate. It is also growing rampantly over the grape stake fence near the orchard entrance, in the forested area along the fault, and at the base of fruit trees within the Russian Orchard. Exercise caution when conducting work within the orchard.

If any contact with the plant occurs, use Tecnu lotion to disperse and rinse away oils as soon as possible after contact. Long pants, long sleeves and gloves are recommended to protect skin from direct contact with poison oak leaves and stems. Disinfect and wash all tools that may come into contact with poison oak to avoid secondary exposure. In addition, do not burn poison oak that has been cut. The smoke and ash from the plant can cause a severe reaction if inhaled.

Large Animals

The only orchard areas that provide fenced protection from grazing animals are the Russian Orchard and the Rotchev House. All other orchard areas are open to animals such as deer, cattle and wild pigs. The Call Orchard presents the highest likelihood of encountering one of these animals and workers should be cautious. Cattle regularly congregate within the Call Orchard and they may also be encountered along the forest road between the Russian Orchard and the Call Orchard. Cattle, deer and pigs are not typically aggressive but they must not be approached. Cows, does and sows are protective of their young and may charge if provoked or threatened.

Personal Protective Equipment (PPE)

Personal Protective Equipment is a general term for equipment and clothing utilized to ensure safety when performing specific tasks. The following range of PPE should be considered standard issue when working in the orchards at Fort Ross: a first aid kit, sturdy shoes, light-colored pants, work gloves, eye protection, ear protection, and a helmet.



Figure 6.8: *First Aid Kit.*

A basic first aid kit should always be at hand when working with fruit trees. A basic first aid kit should include adhesive bandages, gauze pads, waterproof tape, hydrogen peroxide, anti-microbial ointment, tweezers, anti-histamine, and saline eyewash. Tweezers are useful for removing ticks and anti-histamine pills will ease swelling in the event of an insect sting or bite. Saline eyewash can be used to rinse pollen, dust or dirt out of eyes.

Sturdy Shoes

Good shoes are important for safe and comfortable work in the orchard areas at Fort Ross. Leather boots are recommended, or closed-toed hiking or tennis shoes at a minimum. The orchard terrain at Fort Ross ranges from flat (Call Orchard and Rotchev House) to steeply inclined (Sweet cherry area north of Russian Orchard). Generally the orchard is covered with dense grass or accumulated debris that may be hard to navigate. Grass cover becomes very

damp with dew in the morning or when fog is present. In addition to sturdy shoes, a pair of tall rubber or waterproof boots is highly recommended for winter and spring orchard work.

Light-Colored Pants

As mentioned previously, long pants that are light in color are the best choice for orchard work wear. Light-colored pants render ticks and insects more visible. Long pants also protect legs from cuts, scrapes and poison oak.

Gloves

A quality pair of comfortable work gloves is highly recommended when working in the orchards. Many glove styles and materials exist, but gloves that fit snug around the wrists are preferred over gauntlet-style gloves, which can snag on branches or tools.

Eye Protection

Protective eyeglasses are highly recommended for orchard work such as pruning, mowing, weed eating or for work conducted within or below a tree canopy. Sawdust from cuts and debris from branches can fall or be blown into eyes and branch tips can also poke unprotected eyes. Tree work activities such as sawing and cutting require eye protection per the American National Standards Institute (ANSI) Z133 standards for arboriculture.

Ear Protection

Protecting ears is important when operating gas-powered equipment such as chainsaws, weed-eaters, mowers or tractors. Foam insert-type earplugs are sufficient, but over-the-ear earmuffs are more convenient, comfortable and usually offer better protection.

Helmet

A helmet is possibly the single most important piece of PPE when working within or under a tree canopy, particularly when using extension pruners or saws from the ground. Any person working or assisting with work under the canopy of a tree should wear certified head protection.

Figure 6.9: *Safety helmet with integrated ear protection.*



PRESERVATION MAINTENANCE TOOLS AND TECHNIQUES

Many different techniques will be employed to maintain fruit trees and orchards, including: pruning mowing, brushing, aerating, irrigating, fertilizing, and mulching. Integrated Pest Management can be used to control pests and diseases in the orchard and fruit thinning can improve fruit harvest. As fruit grows, it may be necessary to prop fruit laden branches in order to prevent damage. Finally, fruit should be harvested using proper techniques that do not damage the tree. When used in combination, these practices will improve the condition of trees in the orchard and promote tree health and longevity.

Pruning

Tools

Making good, clean pruning cuts on fruit trees is predicated upon using the right tools. The following section lists the types of tools recommended for pruning fruit trees.

Hand Pruners

Sharp and clean hand pruners are mandatory for orchard preservation maintenance. More than any other tool, workers will rely upon hand pruners to make proper cuts and keep trees in stable condition and good health. Hand pruners are used to remove or trim branches smaller than



Figure 6.10: *Bypass pruners with wire brush for cleaning pruners and file for sharpening pruner blades.*

$\frac{1}{2}$ " in diameter only; do not attempt to prune larger branches as hand strain can occur. Bypass-style pruners (Felco, ARS, Corona, etc.) are recommended rather than anvil-style pruners. Bypass pruners cut material more cleanly, like a pair of scissors, rather than crushing the plant parts. Left-handed models are available from most manufacturers.

Handsaw

Hand saws are effective at removing limbs and branches larger than $\frac{1}{2}$ " up to several inches in diameter. The nature of the cut is rougher and less clean than that of bypass pruners, however. Handsaws are available in various lengths and sizes. They are extremely sharp and can cut skin or damage thin tree bark with even a light touch, so they must be used very carefully.

Figure 6.11: (top)
A folding handsaw and bypass hand pruners are basic tools for pruning.

Figure 6.12: (below)
Loppers are useful for material $\frac{3}{4}$ " diameter or less



Loppers

Loppers are a good choice for safely removing branches between ½” and 1” in diameter. Loppers operate on the same bypass principle as hand pruners but their longer handles allow more force and leverage to be applied to larger material. It is not recommended to use loppers when standing on a ladder because loppers require two hands to operate and do not allow the worker to maintain three points of contact.

Pole Saw and Pole Pruners

These tools are the long-reach versions of hand pruners and handsaws and allow limbs and branches to be trimmed or removed from the ground. Some models are extendable by adding additional sections, others telescope from 6’ up to 21.’ Beware of attempting to prune or saw material that is too high, too heavy or too thick to be safely removed. Very long pole tools flex substantially and control over the cut is greatly reduced as the tool is extended. Always wear headgear and eye protection when working on tree material overhead.



Figure 6.13: *Extendable pole saw and pole pruners should be used with a helmet.*

Chainsaws (qualified professionals only!)

Chainsaws are effective at cutting large limbs or tree trunks quickly, but must only be used by someone qualified and trained in their safe use. Chainsaws are extremely dangerous and can cause injury or death if mishandled. Full PPE includes eye, ear and head protection, gloves, long pants, sturdy boots and chainsaw-rated protective chaps. The use of chainsaws in orchard preservation maintenance should be limited to avoid altering the historic character of the fruit trees or removing too much living tissue at one time.

Figure 6.14: (left)
Personal Protective Equipment for chainsaw use.

Figure 6.15: (right)
Chainsaws must only be used by qualified professionals with full Personal Protective Equipment.



Tool Sanitation & Maintenance

Keeping pruning tools clean, sharp, oiled and sterilized helps them perform effectively and with less effort from the worker, an important factor when many cuts are made on multiple fruit trees. Correct cuts with the right tools facilitate tree health by allowing trees to close wounds quickly and prevent entry by disease agents.

Below is a list of tools and materials to keep tools clean and sharp:

- Rubbing alcohol: to sterilize blades in between removal of diseased material
- Wire brush: for removing sap and build up on saw and pruner blades
- Scotch pad or steel wool: for sap and debris removal, and polishing blades
- Coarse and fine files: a round or flat file for sharpening pruner blades
- Lubrication (oil or grease): for the moving parts of tools and to prevent rust

Goals of Pruning

The form of a fruit tree is shaped by the sum total of all the pruning cuts applied over its lifetime. A regularly pruned fruit tree may be old yet still retain its intended shape and conversely a young fruit tree that did not receive structural pruning may have an entirely different form. Pruning the

Figure 6.16: (left)
Cleaning hand pruners with a wire brush.

Figure 6.17: (right)
Sharpening hand pruners.



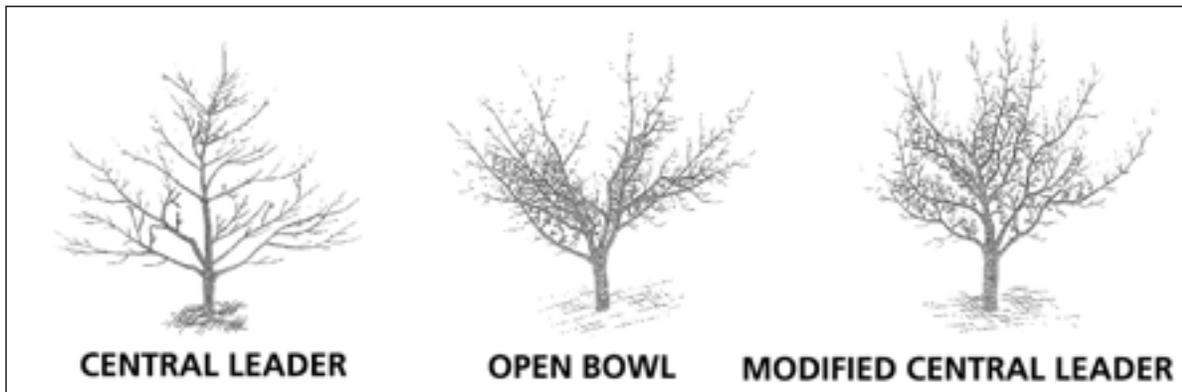


Figure 6.18: *The most common fruit tree pruning styles.*

historic fruit trees of Fort Ross should be performed in a manner consistent with preserving their historic character.

The historic fruit trees at Fort Ross date from the Russian and Ranch Eras. As mentioned earlier, they have natural, untrained forms or no pruning style, as a result of their history. In the Russian Era, the fruit trees were not pruned into a style as Russian-American Company employees were novices in orchard horticulture. In the Ranch Era, the fruit trees received minimal pruning and no apparent style as the orchards were a secondary priority and source of livelihood for the ranch families. In both eras, the fruit trees were non-stylistic, left to assume a natural form shaped only by livestock and wildlife browsing.

The non-stylistic, historic character of the following fruit tree species are:

- Apple: tall, open and broad
- Capulin cherry: tall, open and broad
- English walnut: tall, open and broad
- Olive: tall, open, broad, multi-trunked
- Pear: tall, narrow and upright
- Plum: shorter than apple, open and broad
- Sweet cherry: tall, narrower and upright

While the fruit trees of Fort Ross weren't regularly pruned in the Russian and Ranch Eras, their advanced age and historic significance necessitates pruning in order to extend

their lives and preserve the character of the landscape. Appropriate pruning requires familiarity with the intended (historic) tree character, the types of pruning cuts, where and when to use them, and how the tree responds to each cut. At Fort Ross, the goal of pruning as part of preservation maintenance is to perpetuate the non-stylistic historic character of the orchards and fruit trees. This means avoiding transformation of the tree scaffold (the major limbs) into a regular central leader or open bowl style. To the extent possible, the extant scaffold limbs should be preserved rather than be replaced with new major limbs.

How to Prune

Heading Cuts

A ‘heading cut’ is targeted midway along a branch to shorten its length and stimulate new growth near the end of the cut. Heading cuts are used when the historic tree canopy has grown long and terminal branches hang down over each other. Heading shortens the terminal branches and brings the canopy closer to the trunk. Heading cuts give a stubby appearance to the branch if there is no side branch to cut back to, but the goal is to induce the branch to sprout new growth that can be formed into new side branches. To preserve the historic character of the trees, avoid making heading cuts to the major scaffold limbs.

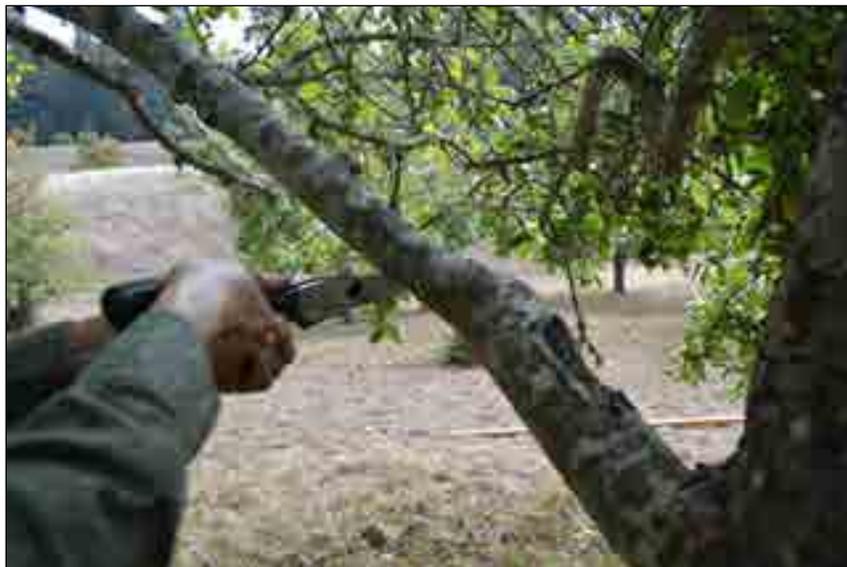


Figure 6.19: *A heading cut targeted mid-way along a branch.*



Figure 6.20: *A thinning cut is made back to a shorter lateral branch.*

Thinning Cuts

Thinning cuts reduce the overall length of a branch or stem by removing part of it back to a shorter lateral branch closer to the scaffold limb. This technique effectively transforms long branches into shorter stout branches. If performed correctly, the tree will not look overtly pruned. Pruning to a lateral branch of the appropriate size retains the appearance of an entire branch by allowing the lateral branch to become the new dominant leader of that branch. An appropriate-sized lateral branch is one that is no less than $\frac{1}{2}$ the diameter of the removed part, or in other words the lateral must be large enough to avoid a conspicuous disparity between branch vs. lateral size. Thinning cuts are used to control tree height and spread. They are also used to control the direction of growth on certain branches by pruning to a lateral that is better directed for growth or fruit production.

Removal Cuts

A removal cut removes a branch or limb entirely, back to either a major scaffold limb or the trunk of the tree. Removal cuts are effective for lifting the canopy of a sagging tree through the removal of lower limbs, or for removing a crossing or rubbing branch. A few judicious branch removals can open up a crowded canopy. This is done carefully to avoid removing more than 25% of live material in one season. To prevent a loss of historic character at Fort Ross, removal cuts should not remove the major scaffold limbs unless they are dead or in severe decline.

An experienced pruner can identify the branch collar and its function to make a removal cut that does not damage the tree. The branch collar is a visible ridge or line where a branch joins with the trunk or a main scaffold limb. It is very important for tree health to not cut into this ridge of tissue. This is where wound closure will initiate once a branch is removed. Rapid wound closure is crucial for tree health since open or slowly-closing wounds are opportunities for invasion by pathogens and pests.



Figure 6.21: *(left)*
A removal cut that has removed a branch entirely.



Figure 6.22: *(right)*
Branch removal cuts and wound closure: a recent cut on left, an older cut on right.

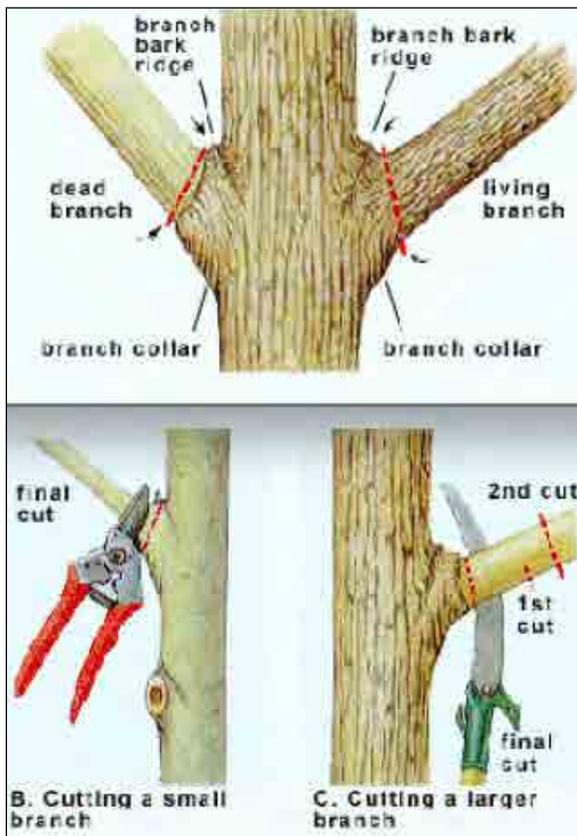
Target Pruning

Target pruning, also known as the 3-saw cut, is the method for safely removing large or heavy limbs from a tree without tearing bark below the branch. Target pruning must be used for all branch removals on fruit trees at Fort Ross.

Target pruning involves first making an undercut on the branch to be removed, near but not at the target (Cut 1). Then a cut is made from the top of the branch (Cut 2). As the limb's fibers are cut and it begins to sag, the undercut closes and 'snaps' the branch off cleanly rather than tearing away bark underneath the branch. Cuts one and two can be repeated more than once on the same branch to remove it in small pieces. The final 'target' cut (Cut 3) is done just outside of the branch collar at an angle perpendicular to the removed branch – not parallel to the tree trunk. A target cut retains the branch collar for quick wound closure and also creates a smaller wound with less surface area than an improper 'flush cut.'

Figure 6.23: (left) Target pruning: how and where to make good cuts on a branch (USDA).

Figure 6.24: (right) A good removal cut with a callus forming.



When to Prune

Some types of pruning can be conducted at any time of year while others should be only conducted in the dormant season. For the species of fruit tree present in the Fort Ross orchards, the following guidelines apply:

- Anytime: root suckers; watersprouts; dead, damaged or diseased material
- Dormant season: structural cuts; rubbing and crossing branches; canopy thinning, reduction or raising cuts

Refer to the Preservation Maintenance Task Calendar (Appendix V) for further guidance on when to prune fruit trees.

What to Prune

Pruning the Fort Ross fruit trees requires many careful decisions about what to cut and why, as discussed previously in Chapter 5 in the Pruning to Stabilize section.

Dead, Diseased & Damaged Wood (the Three D's)

Several types of plant material should be universally and automatically removed: dead, diseased & damaged material. Dead, damaged & diseased branches can be carefully removed at any time of the year. Dead branches serve no purpose and may fall off and strike an object or people below. Damaged branches may still be alive and photosynthesizing, but when they are cracked, split or structurally unsound they cannot support a fruit crop and may break off and tear bark, causing further damage. Damaged branches can be pruned by making heading or thinning cuts beyond the damaged section or they may be removed entirely. Diseased branches should be cut well below the point of infection and disposed off-site or burned, to rid the orchard of disease inoculum. Pruning tools should be sterilized between diseased material cuts to avoid the spread of pathogens within and between trees.



Figure 6.25: *Rootstock suckers on a young grafted pear tree (note thorns on sucker growth).*

Root Suckers

Suckers are vigorous tree growth that arises from roots below ground or below the graft union. Suckers draw energy and nutrients away from the tree canopy and should be removed as soon as they appear with pruners or loppers. Some species and rootstocks sucker more than others and require more frequent sucker removal.

Watersprouts

Watersprouts arise from scaffold branches and trunks above the graft union or above the ground on ungrafted fruit trees. Watersprouts can crowd a tree canopy and create crossing or rubbing branch situations. Remove by pruning or lopping back to the branch or trunk. Young watersprouts are often weakly attached and can be easily removed by simply bending them downward and snapping them off cleanly. Selected watersprouts can be trained to form new branches or limbs if the tree canopy is too thin. In this case, remove all but the desired watersprout and structurally prune the shoot until it becomes a new, stout branch.

Rubbing and Crossing Branches

Rubbing branches abrade each other and cause wounds that allow disease pathogens to enter the tree, or if left too long can fuse the branches together. Crossing branches may become rubbing branches in time and should be selectively removed by retaining the one with the better structure and orientation and removing the other. Target pruning should be used when branches are long or heavy.

Structural Pruning

Structural pruning is distinguishable from the types of pruning mentioned above in several ways. Whereas the three “D’s”, watersprouts, root suckers and rubbing branches are automatically removed any time of year, structural pruning entails a more thoughtful and conscientious approach to shaping, re-shaping or altering the form of a fruit tree over many years. Structural pruning requires a vision for the historic form and character of the tree and typically takes at least three years of gradual pruning to achieve a final result. Other reasons for structural pruning may include tree health, equipment access under the tree or worker access to the canopy.

Excessive Interior Growth (Canopy Cleaning)

Fruit trees without preservation maintenance develop dense, crowded canopies with crossing, rubbing, dead, damaged and disease material. This is the case with many fruit trees from the Russian and Ranch Eras at Fort Ross: congested canopies reduce air movement and light penetration which can increase disease, threatening tree longevity as well as fruit quality.

The preservation maintenance techniques described above should be used to gradually clean the canopies of older trees while retaining their characteristic scaffold form. For the Contemporary Era fruit trees the same pruning and maintenance principles apply, however, as these trees have an open bowl form, here the objective is to maintain the styled open center.



Figure 6.26: (left) Canopy cleaning & thinning indicated by limbs in blue (USDA).

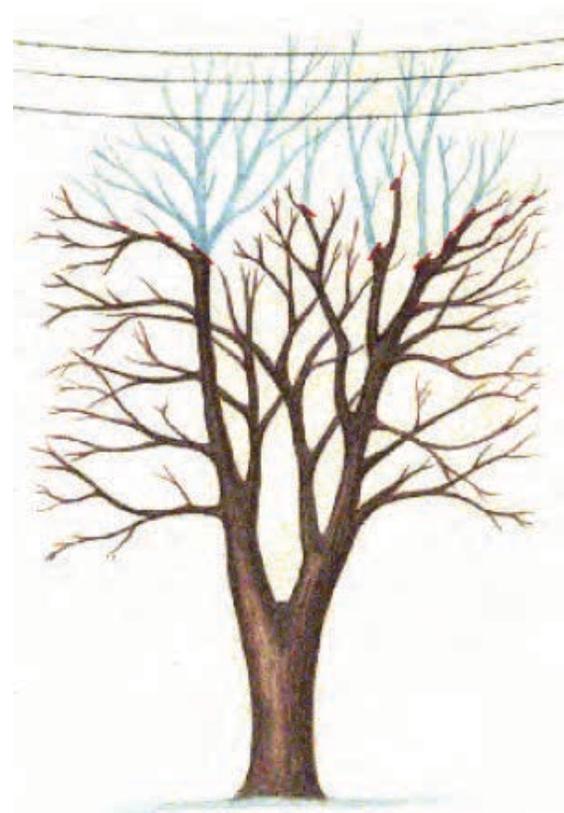
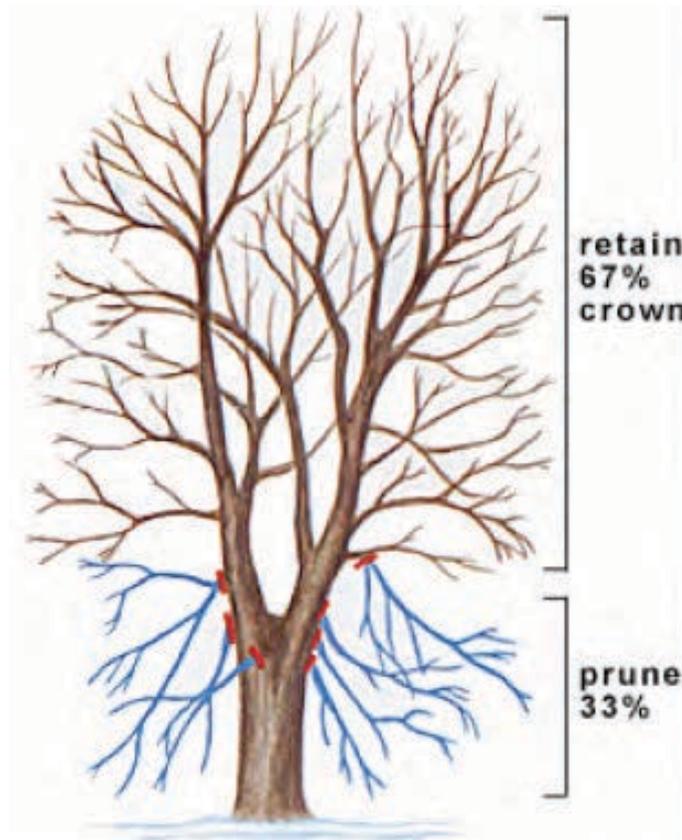


Figure 6.27: (right) Canopy reduction pruning indicated by limbs in blue (USDA).

Tall or Wide-Spreading Branches (Canopy Reduction)

Older fruit trees that have reached their mature size produce only incremental new growth at the tips. This often causes branches in the upper canopy to slowly droop down and rest on underlying branches. Canopy reduction can be used to lighten the end weight of a branch to reduce the likelihood of breakage, to reduce mutual shading and encroachment between adjacent trees; or to make it easier to harvest fruit.

The Russian and Ranch Era trees have reached their mature size. Only reduce large branches when there is a need to lighten end weight and make the tree more structurally stable. The apple tree to the south of the Capulin cherry trees (*D-MdR-13*) received moderate crown reduction and crown cleaning in 2014 to lighten long branches and bring the center of gravity closer to the trunk. More gradual work on this tree may be necessary in the future.



Low or Hanging Branches (Canopy Raising)

Raising the canopy of a fruit tree involves removal of the lower branches. This may be necessary to allow greater access to the trunk, to prevent fruit-laden branches from touching the ground, or to permit equipment access between trees. Canopy raising for equipment access should be a consideration only when the risk of branch breakage by equipment strike outweighs the importance of retaining a healthy branch.

Historically, the fruit trees at Fort Ross had their canopies browsed and their trunks cleaned to a four or five foot height. This character can be perpetuated by removing low new growth. Contemporary Era trees in the Russian Orchard that could particularly benefit from greater understory access by canopy raising include the Rhode Island Greening apple trees *A-MdC-4* through *A-MdC-13*.

Figure 6.28: *Canopy raising indicated by limbs in blue (USDA).*

Training Replacement Limbs on Mature Trees

Individual limbs and branches on a mature tree occasionally die, break or need to be removed to improve the health and structure of the tree. When there is a vacancy in the tree canopy, it is possible to train a replacement branch into the space by selectively training a watersprout if one exists. The process takes many seasons to achieve but will eventually improve the tree by balancing the weight of the canopy and increasing photosynthetic capacity. This will also increase fruit yield.

Training New Trees

Replacement tree plantings or new fruit tree installations in the Fort Ross orchards should be trained to reflect the characteristic form of the historic fruit trees, in order to render them compatible additions to the historic property. New trees should be trained without a stylized scaffold form (e.g., not a regular central leader or open bowl style), but should be high-headed with a tall trunk, four to five feet tall. The clear trunk can be formed by rubbing off auxiliary buds or pruning off lower shoots. Historically, the fruit trees at Fort Ross gained tall trunks through the browsing activities of livestock and wildlife.

Figure 6.29: (left)
Weed eaters.

Figure 6.30: (right)
*Close-up of different
blade/head styles:
blades and string.*



Mowing

Grass and vegetation management on the orchard floor is important for tree health, mobility through the orchard, and worker health and safety. Vegetation growing under or near fruit tree canopies competes for water and nutrients and can impose stress on the historic trees. Mowing reduces the biomass of grass and vegetation that consumes resources and transpires moisture out of the soil. Mowing the orchard floor also makes moving around within the orchard far easier and safer for workers: rough terrain is easier to see and avoid; ticks are less likely to attach to workers clothing; dew and moisture is kept underfoot and does not soak clothing.

Mowing vegetation adds organic matter to the soil and increases soil health as microbial action breaks down plant trimmings. Mowing and trimming can also be detrimental to trees if equipment is allowed to contact trunks or exposed roots. Mowers and weed eaters must be used with extreme caution around the fruit trees at Fort Ross. Methods for controlling orchard floor vegetation in the Fort Ross orchards are described below:

Weed Eaters (weed whacker)

Gas powered weed eaters are commonly used to cut down grass and brush in orchards. They must be used with care and correct PPE must be worn: eye and ear protection, gloves, long pants and sturdy shoes.

Avoid allowing weed eater blades to come closer than 3' from a tree trunk to prevent nicking the bark, causing wounds or girdling the tree. Weed eaters have the advantage over mowers of being effective on steeper slopes and in rough terrain. However, weed eaters cut grass long, rather than finely chopping it up like a mower. The longer clippings are slower to break down and create a matted appearance. They also tend to throw debris at high speed and can cause damage or injury. Avoid using weed eaters close to other workers or visitors. Weed eaters are recommended for hard to reach or steep areas of the Russian, Call and Benitz Orchards. They are not recommended for the Rotchev House or Call House and Picnic Area.



Figure 6.31: A weed eater with operator wearing full PPE.

Walk-Behind Field and Brush Mower

Walk-behind field and brush mowers are powerful and efficient, capable of cutting down medium-sized shrubs with ease. Walk-behind field and brush mowers can traverse moderate slopes, but are not designed for steep slopes. Placement of the single or double-blades allows the operator to cut brush in densely vegetated areas while maintaining a physical distance from the vegetation. The blades will also cut vegetation into fine pieces. Walk-behind brush and field mowers are best used for the first early season mowing when grass and brush are thick, or for orchard stabilization when encroaching brush requires heavier equipment.

Walk-behind mowers are recommended for densely vegetated areas such as the upper fence line of the Russian Orchard and around the overgrown apple trees in the Call Picnic Area. The Call and Benitz Orchards are too far away and inaccessible to make this type of machine feasible.

Riding Mower

Riding mowers are convenient and allow the operator to sit while operating the machine. These mowers are typically used for light-duty or secondary mowing operations, such as late spring or early summer mowing when grass growth is not so dense. The single or double-blades are typically located in the middle of the machine, making it difficult and unsafe to drive into thick overhanging brush areas.

Figure 6.32: DR® brand rough-cut mower is an effective tool to cut thick underbrush.



They are not recommended for slopes due to the risk of tipping. Riding mowers are usually less powerful than walk-behind brush mowers and will bog down and die in thickly vegetated areas. Avoid soggy soil or swale areas to avoid getting the machine stuck.

Use of a riding mower is recommended for easily accessible areas such as in the flatter portions of the Russian Orchard and around the Call House and Picnic Area trees.

Tractor with Flail Mower Implement

A flail mower is an implement that attaches to the rear power take off (PTO) of a tractor and is pulled behind to mow vegetation. This is the most effective orchard-mowing tool with sufficient power and width to mow 6' – 8' swaths. Unlike mowers with a single rotating blade, flail mowers have numerous small blades attached along the length of



Figure 6.33: (top)
Riding lawn mower.



Figure 6.34: (below)
Zero-turn riding mower.

a rotating cylinder that ‘flail’ around at high speed. The cutting action is effective for moderate to thick vegetation.

Power and width are a flail mower’s advantages and large areas can be cut quickly and effectively. The disadvantage of a flail mower is the overall size of the machine, which limits its access to open orchard areas or widely spaced rows. In addition, while debris is chopped up reasonably well, a single-blade machine creates finer mulch.

Tractors should not be operated on slopes or when soils are wet. The weight of a tractor can cause severe soil compaction even if soils are merely moist. Due to their relatively large size and power, tractors can also do severe damage to fruit trees by catching and breaking limbs. Situational awareness is critical to avoid damaging trees or other resources. Only experienced tractor operators should mow within the Fort Ross orchard areas. Tractors with flail mower attachments are recommended only for the flatter areas of the Russian Orchard. Swales and wet areas should be avoided.

Grazing

As an alternative to mechanized equipment, controlled grazing activities can be used to manage orchard floor vegetation. Grazing must be done by animals such as sheep that will not damage orchard trees and should be limited to two months a year. In addition, the animals should not be permanently housed at the park. Grazing activities must remain consistent with other recommended orchard management practices.

Figure 6.35: (left)
Orchard tractor.

Figure 6.36: (right)
*Tractor with a 8’ wide
flail mower implement.*



Brushing

Brushing entails the manual or mechanical removal of shrubs, vines and small trees that encroach upon an orchard space. Areas of some orchards such as the Benitz, Call and Russian Orchards are inaccessible to wheeled equipment and vegetation management must be accomplished by hand. The following section describes effective tools and techniques for removing brush within the orchard areas of Fort Ross.

Pulaski

Many tools are capable of removing brush, but few excel at this task like a Pulaski. The tool is a combined axe and adze head and was originally used for wildland firefighting. A Pulaski is able to chop down stout brush material with the axe and then dig out the stump with the adze. A Pulaski can be used carefully to leave soil undisturbed, but it is also capable of digging and cutting quite deeply if necessary.

Recommended use of the Pulaski at Fort Ross includes for the removal of Coyote brush, blackberry vine, plum seedlings and small volunteer trees.



Figure 6.37: (left) Pulaski digging & chopping tool.

Figure 6.38: (right) Weed wrench tool for woody plant removal.

Weed Wrench

A weed wrench is a unique tool that grips small trees and shrubs by the base and uses a long levered handle to pull them up and out of the soil. This is a very useful and ergonomic tool when minimal soil disturbance is important.¹³

Recommended uses for a weed wrench at Fort Ross include the removal of plum seedlings in the Russian Orchard, Call Orchard and Call House and Picnic Area. Coyote brush and other small volunteer trees should also be removed.

Stump Herbicidal Treatment

Unwanted trees larger than 4"-6" can be difficult to remove by digging or pulling out. One option is to cut trees flush with the ground and apply herbicide with a brush to the freshly cut stump. This method does not disturb the soil or the roots of other trees. Use a systemic herbicide such as Glyphosate (Roundup) that will be translocated to the roots. Correct PPE and caution must be exercised when herbicides are used. Read the product label and material safety data sheet (MSDS) before use and apply the product according to its specification.

Herbicides are toxins that can injure the applicator or the environment and should be used sparingly. The above technique should be reserved for unwanted trees that are likely to re-sprout from the stump and cannot easily be removed by digging or pulling, such as those in the Russian Orchard behind the fault-line ridge.

Aerating

Aerating the orchard floor improves soil condition by loosening hard soil structure, improving water penetration and increasing oxygen availability to feeder roots. This is especially important in areas that have been compacted by foot or equipment traffic, such as the pathway leading from the Russian Orchard gate, the Call House and Picnic Area orchards and the Rotchev House apple trees. Aeration opens small holes in the soil to a depth of 2"-4" by coring out plugs of soil and laying them on the soil surface. The

13 The Weed Wrench® brand has been discontinued, but several other companies offer similar tools.



Figure 6.39: *Aerator commonly used for turf can be adapted to orchard use.*

holes immediately increase oxygen concentrations at the feeder root level and help stimulate new growth. Aerating allows air, fertilizers, mulches and water to fall into the holes, bringing these compounds closer to the heart of the soil food web and allowing the processes of decomposition and nutrient cycling to take place more efficiently.

Aeration is achieved by powered walk-behind aerators or by larger tow-behind aerators pulled by a tractor. It is important to only use aerators with hollow-core tines (which extract plugs of soil) rather than solid spike aerators, which can increase soil compaction at the sides of the hole. Do not aerate within 3 feet of tree trunks to avoid damaging larger anchor roots and do not attempt to run aerators over large exposed roots on the soil surface.

Aerate the orchard floor once every two to three years. Time aeration operations for spring when soils are moist but not waterlogged. This will avoid damaging equipment and allow for easy tine penetration. If seasonal moisture is inadequate for aerating, deeply water the area with soaker hoses for several days and let drain prior to aeration.

Walk-Behind, Riding or Pull-Behind Aerators

A standard aerator consists of a rotating shaft with hollow metal tubes that pierce the soil and extract a plug that is left on the soil surface. In a larger grassy space such as the Russian Orchard, plugs can be left on the surface to break down slowly and backfill into the holes. To improve the

aesthetics of higher visitor use areas such as the Call House and Picnic Area or the Rotchev House, the plugs can be removed and nutritional mulch can be applied, or the plugs can be broken up through raking. A motorized device called a de-thatcher (normally used on turf grass) can also quickly break plugs up with blunt, spinning blades. Specialized equipment like aerators are expensive, but they can be rented or a landscape professional can be hired to perform aerating work.

Irrigating

Lack of adequate soil moisture is a major health stressor in fruit trees, especially for young and old trees. Preserve orchard fruit trees by watering them if they show signs of drought stress. Some fruit tree species such as olives are better able to tolerate dry conditions than others, but all fruit trees benefit from supplemental irrigation during the dry season. Different systems and approaches can be used to provide fruit trees with supplemental water. A portable, truck-mounted water tank or collapsible bladder and a gas-powered water pump could effectively be used to irrigate the orchards at Fort Ross.

Creating berms of soil around fruit trees at the drip line is an effective method of ensuring that water is delivered to tree roots efficiently and not wasted as runoff. Berms can be created by hand-digging trenches and piling up the loose soil or by bringing in compost, mulch or soil and applying it on top of the native soil.

Applying a layer of mulch around fruit trees will also utilize irrigation water efficiently and maximize water infiltration. Mulch prevents evaporation of soil moisture by shielding the soil from the sun and discouraging grass and vegetation growth.

Monitoring Soil Moisture

Soil Probe or Shovel

A standard round pointed shovel is an effective tool to test soil moisture in orchard areas in order to determine if irrigation is necessary. This test should be conducted in an area away from fruit tree roots. Digging is disruptive to the



Figure 6.40: *A soil probe is used to test for soil moisture content.*

soil but allows a clear view of the depth of soil moisture.

A soil probe is a specialized tool for investigating soil moisture levels up to 18” deep, depending upon the penetrability of the soil. A soil probe is best used when and where soils are relatively moist. It is very difficult to use on dry, compacted or rocky soils.

Indications of Drought Stress

During periods of drought or below average rainfall monitor fruit tree leaves for the first visual signs of drought stress. Drought stress trees reduce solar exposure and evapotranspiration by curling their leaves or drooping them downwards. In long period of drought, a permanent wilting point is reached where leaf cells loose turgidity and cannot recover. As a result, particularly drought stressed trees will drop their leaves to prevent moisture loss through evapotranspiration.

Irrigation Frequency

Newly planted trees require regular water for at least the first three years until their roots are well established. A newly planted tree must be watered at least every other day during the dry season, and weekly the following year. Construct a soil basin at the drip line of the young tree to capture water and allow it to soak downwards to the roots.

As young tree roots develop and spread out in search of water, extend the diameter of the soil basin or remove it entirely and soak the area beyond the drip line of the tree. This will encourage roots to extend farther from the base of the tree. Irrigate deeply to encourage deep rooting and allow a period of drying out to force roots to grow deeper. These practices will encourage strong root establishment that will make the tree more resilient during times of drought.

Most of the fruit trees in the Fort Ross orchards appear to have adapted to their environmental conditions and are able to sustain themselves on seasonal rainfall, groundwater and moisture from fog. Supplemental watering for mature trees may not be necessary except under extreme drought conditions. However, sometimes the difference between a fruit tree that survives and one that thrives is the application of just one or two deep irrigations during the dry season. Any additional water delivered during the summer, especially to older trees, may extend the life and vigor of trees such as the Capulin cherries and the oldest apples. Species such as olive and pear are more resilient to drought and are unlikely to require any supplemental water.

Watering Systems for Orchards

Truck-Mounted Collapsible Water Bag

Supplying irrigation water to remote fruit trees such as those in the Russian, Call and Benitz Orchards is a difficult

Figure 6.41: 250 gallon collapsible water bag, pump and suction hose on Ford F250.





challenge. The most flexible and portable system is a truck-mounted water bag coupled with a pump and a long hose. This system is cost-effective, portable and easy to dismantle and store when not in use. The downside to this approach is the time and labor involved in the process as well as the limited capacity of a small tank relative to the number of trees that may need to be irrigated. Water weighs 8.3 pounds per gallon, so weight carrying capacity and safety must be considered before purchasing a water bag.

A water bag system has been successfully used to irrigate fruit trees in remote orchards and would be suitable for the orchards at Fort Ross. Burch Manufacturing produces one model of water bag called Kolaps-a-Tank.¹⁴ The water bag is composed of vinyl with a fill hole at the top and a threaded outlet in the front. It holds up to 250 gallons of water. The weight of a full bag is 2,075 pounds, or just over one ton. A gas-powered portable water pump connected to the water bag by a suction hose can create up to 30 psi at the end of a 100' garden hose, enough to quickly empty the water bag and supply fruit trees with supplemental irrigation. A truck capable of carrying one ton is required to safely transport the full bag.

A portable gas-powered water pump will pressurize the water adequately for spraying or hand watering trees. Be mindful of the engine exhaust port and aim it away from the

Figure 6.42: (left) Top filling a water bag. (Filling the bag can be accomplished through the top fill tube or by a hose hooked up to hose bib or fire hydrant. Fire hydrant pressure fills the bag in just over one minute.)

Figure 6.43: (right) Filling through a hose connection.

14 See Burch Manufacturing website for additional specifications: <http://burchheathouser-kabking.com/index.html>.



Figure 6.44: *A pressurized water stream with pump running, at approximately 30 psi.*

vinyl bag or any other heat-sensitive materials. Secure the pump to the truck so it does not vibrate off of the tailgate of the truck.

A standard suction hose is required between the bag and the pump. A suction hose has a rigid wall structure that will not collapse under suction pressure. Using a series of reduction fittings, a regular $\frac{3}{4}$ " garden hose can be attached to the pump and any type of nozzle or sprayer can be used to water the fruit trees. It is recommended that a hose shutoff valve be used after watering each tree to avoid wasting water. A full 250 gallon bag takes approximately 45 minutes to empty when hand watering. Monitor the amount of water in the tank and the number of trees needing water to ensure that all trees with irrigation needs receive water.

Fertilizing

Tree health is intimately tied to the health and fertility of the soil, which is tied to a host of factors including soil parent material and geology, composition and texture, average annual rainfall, pH and past agricultural practices. The five orchard areas at Fort Ross span a long history and diversity of uses, but generally they have been cultivated, logged, grazed since the early 19th century. The subject of fertilizing in the Fort Ross orchards is also discussed in Chapter 5 – Fertilizing, including specific recommendations based on soil testing.

Typically, fertilizing is best done when temperatures are warm and the soil is moist. This facilitates breakdown and release of nutrients into the soil to be made available to plant roots. Schedule fertilizer applications after mowing has occurred in the spring but before the last rains. Actively growing tall grass may consume nutrients intended for the fruit trees, and rain is necessary to dissolve the fertilizer and naturally incorporate it into the soil where it is available to tree roots.

Laboratory soil tests are a good diagnostic tool for understanding the quantities of macro and micronutrients in an orchard soil. Four soil samples taken in the Russian and Call Orchards in summer, 2014 were analyzed by a laboratory in Watsonville, California (see Appendix IV). The results indicate a long history of cropping due to low quantities of Nitrogen, Phosphorous and Sulfate. Very high levels of the micronutrients Magnesium, Manganese and Iron are probably due to the underlying geology and seismic activity of the land. Soil pH was within the acceptable limits.

Common Deficiencies

The macronutrients that plants require in greater quantities are Nitrogen (N), Phosphorous (P) and Potassium (K). These nutrients are commonly listed on fertilizer bags as numbers in the order N-P-K, also called the “fertilizer analysis.” Deficiencies of any one of these three nutrients usually appear in the leaves first as chlorosis or discoloration. Micronutrient deficiencies can occur but is less likely due to the minute quantities utilized by plants compared to N, P and K.

Formulations (Simple vs. Complete / Synthetic vs. Organic)

Fertilizer addition is necessary to correct deficiencies and maintain fruit tree health, especially on soils with a long history of agricultural use, such as at Fort Ross. Organic fertilizers derived from plant and animal byproducts are highly recommended over synthetically manufactured fertilizers. Synthetic fertilizers are designed to be immediately available to plants in the form of readily soluble nutrients. However, this solubility contributes high levels of salts to the soil once the nutrient has been absorbed by the plant,

or causes leaching below the root zone by rain or irrigation water. Organic fertilizers by contrast are not readily soluble to plants and must be acted upon by soil microorganisms. Microbes break down the more complex forms of organic nutrients into plant soluble form, a process that does not contribute salt residue to the soil. Organic fertilizers also contribute moisture-retentive organic matter to the soil and improve soil health by promoting strong microbiological activity.

The fertilizer analysis indicates whether that fertilizer is simple (only one single nutrient) or complete (a range of nutrients). For example, analysis of the simple synthetic fertilizer Ammonium Nitrate shows that it supplies a single nutrient (Nitrogen) at the rate of 30-0-0. The product is 30% Nitrogen by volume, with no other nutrients present. This relatively high concentration of readily soluble nitrogen can actually damage sensitive plant roots if applied incorrectly. A complete organic source of Nitrogen is guano (bat excrement) with an analysis 10-3-1 (10% Nitrogen, 3% Phosphorous and 1% Potassium). The lower analysis of guano is less likely to burn or damage plant roots and contributes a wider range of macro and micronutrients to the soil.

Calculating Fertilizer Application Rate (pounds of fertilizer vs. actual fertilizer)

The Russian and Call Orchard soil test result recommends that Nitrogen is applied at a rate of 2.0 lbs. of actual Nitrogen per 1000 square feet. Actual Nitrogen refers to the amount of Nitrogen within a fertilizer mixture. For example organic guano has a NPK ratio of 10-3-1 and contains 10% or 0.1 lb of actual Nitrogen per pound of fertilizer. To meet the recommended rate of 2 lbs. of actual Nitrogen per 1000 square feet, divide the recommended rate (2 lbs.) by the amount of actual Nitrogen in one lb. of bat guano (0.1lbs). This calculation gives a bat guano fertilizer rate of 20 lbs. of fertilizer per 1000 square feet:

2 lbs. actual Nitrogen per lb. of fertilizer / 0.1 actual Nitrogen
= 20 lbs. fertilizer per 1000 sq. ft.



Fertilizing Equipment

The application of fertilizer is made much more accurate and efficient with the right equipment. A quality scale with a large platform is essential for accurately measuring fertilizer, and five-gallon buckets make convenient containers for fertilizer at the scale and in the field. Be sure to tare the scale or calibrate it to discount the weight of the bucket itself when measuring fertilizer.

Two types of fertilizer spreaders are useful in an orchard setting: a hand spreader and a push spreader. A hand spreader allows more precise distribution of fertilizer but the hopper is limited to about seven pounds of fertilizer, requiring frequent refilling. Push spreaders hold up to 40 pounds and cover a much broader swath, but are less accurate. In the Russian, Call, and Call House Picnic Area orchards, accuracy is less of a concern than in front of the Rotchev House. Carefully operate the equipment to avoid spilling fertilizer and possibly burning tree roots.

Figure 6.45: (top) Fertilizer spreaders, scale, bucket and product. (Note: wear PPE including dust mask, glasses and gloves when measuring and distributing fertilizers.)

Figure 6.46: (below, left) Hand-held fertilizer spreader.

Figure 6.47: (below, right) Push-type fertilizer spreader.

Compost

Compost is woody and vegetative plant material broken down by microbial action within a pile or a windrow. Compost is a cultivated version of the material created by biotic ecosystems under tree canopies. Trees cycle nutrients from the soil and create leaves and twigs that eventually fall back to the soil and are broken down by microbes, ready for uptake again by the tree. Compost amends the soil by providing organic matter and improving soil structure, water retention, fertility and microbial action. Compost is highly beneficial to soils and trees when applied regularly

Compost production on an orchard scale requires some effort and space, as well as enough biomass from trimmings and clippings. An on-site composting operation may not be feasible at Fort Ross due to budget and personnel constraints. However compost should still be regularly applied to the Fort Ross fruit trees to improve soil health. Compost is typically incorporated into the soil by forking, digging or rototilling, but it can also be left on the soil surface as a top dressing or nutritional mulch. Compost should be weed-free and distributed evenly around the drip line of the tree but not against the trunk of the tree. A layer 1” - 2” is adequate as a top dressing. Avoid adding a very thick a layer of compost that could smother roots.

Mulching

“Mulch” is a term that captures a broad range of organic and synthetic products. The essence of mulch is that it covers the soil, suppresses weed growth and retains soil moisture. The most common form of mulch for orchards is wood chips created by a wood chipper.

Mulch is highly recommended in the Fort Ross orchards, particularly in the Russian Orchard, Call House and Picnic Area and Rotchev House trees. Mulching around the trunks of fruit trees to a depth of 4” greatly reduces annual grass growth and the subsequent need to risk injuring the tree with grass-trimming equipment. To reduce the visual impact of mulch create an irregular margin of the mulch circle.

Covering soil with mulch reduces the evaporation of

ambient soil moisture by the sun and cools the root zone. Wood chip mulch has minor nutritive value for trees but does contribute organic matter to the soil as it breaks down. Mulched trees have a net increase in growth over non-mulched trees.

The Russian and Ranch Era fruit trees do not require mulch as urgently as the Contemporary Era fruit trees or any newly planted fruit trees. However, all trees benefit from reduced weed competition and increased soil moisture content. Mulching one tree to a depth of 4" and four feet from the trunk requires 0.6 cubic yards of mulch per tree, or 16 cubic feet. An average wheelbarrow holds 6 cubic feet, so each tree would require about three wheelbarrow loads of mulch.

Integrated Pest Management

A healthy orchard ecosystem supports a vast range of insects, fungi and bacteria that are mostly not detrimental to fruit trees. The goal of integrated pest management (IPM) is to establish an environmentally sound balance between pest and beneficial organisms where pest damage below an established threshold is acceptable. Some orchard pests adversely affect fruit trees only during certain growth stages, or when their populations are high. Other pests such as Codling moth only affect fruit quality without harming the tree itself. For the historic fruit trees at Fort Ross, fruit damage alone may be below an action threshold, since tree health is not affected. For historic preservation, the primary resource is the fruit trees, rather than the fruit.

Figure 6.48: (left) Sticky traps for insect monitoring.

Figure 6.49: (right) *Diabrotica* beetle, a common landscape pest.



Pest identification and population monitoring is critical to developing an IPM plan and determining whether action is necessary. To identify insect use tools such as sticky cards and pheromone traps to capture insect pests and a loupe or hand lens to view them more closely. The University of California's integrated pest management website <http://www.ipm.ucdavis.edu/> is a good online resource for pest identification and control recommendations specific to California.

IPM recommends an approach that integrates cultural practices, biological control agents, and chemicals agents. Chemical pesticides are seen as a useful tool but a last resort. The following control practices and agents can be utilized at Fort Ross State Historic Park:

Cultural Controls

- Raking up fallen fruit in the fall to prevent overwintering of pests;
- Pruning out diseased material and burning or disposing of the material off-site;
- Applying tanglefoot to tree trunks to prevent crawling insects from reaching the canopy;
- Using insecticidal soaps and horticultural oils to suffocate scale and soft-bodied insects;
- Trapping of vertebrate pests such as gophers.

Biological Controls

- Use of *Bacillus thuringiensis* (BT) to combat larval pests;
- Use of lacewing, lady beetle and other natural enemies of harmful insects;
- Use of beneficial nematodes to attack soil pests such as weevils or harmful nematodes.

Chemical Controls

- Use of systemic fungicides that are translocated through the infecting fungus;

- Use of selective insecticides that poison specific insects and stages of the lifecycle;
- Use of systemic herbicides that are translocated through the invading plant.

Pests & Diseases of the Fort Ross Fruit Trees

The following orchard pests were positively identified by the project team.

Pear Sawfly Larva

A “Pear slug” is the larva of the Pear sawfly (*Caliroa cerasi*). It has a slimy, grey-green appearance. Mature larvae are about ½” long. Larvae skeletonize pear leaves by chewing, leaving the fine leaf veins intact and giving the leaf surface a brown, mottled appearance. In the Fort Ross Orchard areas, natural biological controls are keeping the pest in check and pear slug thresholds do not appear to warrant control at this time. If populations increase, directing a stiff stream of water at the pear canopy is effective means of larvae removal.

California Pear Sawfly Larva

The California pear sawfly (*Pristiphora abbreviata*) is a bright-green caterpillar (larva) about ½” in length with a darker green or black head. Sawfly larvae chew circular holes giving leaves a ‘hole-punched’ appearance. Pear trees can tolerate large numbers of sawfly larvae without becoming weakened.



Figure 6.50: (left) Pear slug (Pear sawfly larva) and leaf chewing damage (Washington State University, Orchard Pest Management).

Figure 6.51: (right) California pear sawfly larva and leaf chewing damage (Washington State University, Orchard Pest Management).



Figure 6.52: *A Fire blight diseased branch on a Contemporary Era ‘Vicar of Winkfield’ pear.*

Fire Blight

Fire blight (*Erwinia amylovora*) is a bacterium that affects pome fruits such as apple, pear and quince. This disease agent is a serious pest in California orchards and has been observed in the Russian Orchard at Fort Ross. Fire blight commonly enters plants through blossoms in the spring. Infected flowers and stems turn a characteristic black color and droop as though scorched by fire. The bacterium proceeds down stems and into branches and trunks creating cankers that are a source of inoculum for subsequent infection. Fire blight is more prevalent during periods of warm, wet weather. Temperatures of 75-85 degrees coupled with rain or moisture allow the bacterium to spread to flower buds.

Fire blight is difficult to prevent, but it must be controlled. It becomes life-threatening when allowed to progress through the tree. The most effective method of control is to prune out diseased and cankerous material in summer or winter and dispose of it away from the orchard. Burning diseased material in a pile is another option. Copper sprays such as Bordeaux applied directly to flower blossoms have limited effectiveness.



Figure 6.53: (top left)
Typical gopher mounds.

Figure 6.54: (bottom
left) *Macabee Old
Reliable gopher trap.*

Figure 6.55: (right)
*Two five-year-old
apple trees killed by a
gopher chewing roots.*

Pocket Gophers

California pocket gophers (*Thomomys sp.*) spend their lives in burrows underground. They have brown fur, black eyes and grow between 6" – 10" long. They leave telltale crescent shaped mounds of dirt in a roughly linear pattern throughout the orchard. A few gopher mounds have been observed in the Russian Orchard.

Pocket gophers are herbivorous and feed on fruit tree roots and above ground plant parts such as grasses and forbs. They are particularly damaging to young fruit trees and can chew an entire root system back to the trunk flare, killing the tree.

Trapping is the recommended method of controlling gophers in an orchard. This requires digging, setting and checking traps regularly. This method is laborious, but has the advantage over poisons of not harming non-target species. Many gopher traps exist; the preferred type is the Macabee Old Reliable brand or a similar style.

Meadow Voles

Meadow voles (*Microtus californicus*) live underground in burrows but are active day and night above and below ground. They have brown fur, are about 5” long and look very similar to house mice. Their burrows appear as open holes on the ground with no loose soil outside the entrance. Trodden-down runs are evident leading to and from the entrance holes.

Voles are herbivorous and chew on fruit tree trunks above and below the ground. Characteristic gnaw marks located several inches up the trunk from the ground indicate vole chewing. If gnawing girdles the tree trunk it restricts the flow of sap and may kill the tree. Tall grass surrounding the tree trunk offers shelter for voles and may encourage their presence around tree trunks. Young trees with thin bark are particularly vulnerable.

Trim grass down around the tree trunk as soon as possible in spring. Voles are very difficult to trap and all efforts at this usually fall short. The best control is a physical barrier around the trunk of the tree to a height of 8”. Plastic guards are commercially available or can be made in-house by using corrugated plastic drainpipe, cut lengthwise.

Figure 6.56: (left)
Meadow vole.

Figure 6.57: (center)
Plastic tree trunk guard for vole protection.

Figure 6.58: (right)
Corrugated plastic pipe tree trunk guard .



Spraying

If it is necessary to spray trees or vegetation in the Fort Ross orchards, ensure that safety precautions are taken and that the work is performed under the guidance of a qualified applicator. Rinse sprayers thoroughly to remove all residues before refilling with new product. It is not recommended to spray tree insecticide in canopies with a sprayer that is also used for herbicides. Residues may be present that can injure the tree.

Choose the right time of day and conditions to spray. Do not spray when wind is above ten miles per hour to avoid drift and avoid spraying in the heat of day when plants are actively transpiring. Move around the entire tree for good coverage but do not overspray to the point of runoff. Use the appropriate nozzle and pressure to avoid misting and off-target drift. Rinse sprayers thoroughly after use and allow to air dry.

The types of products that might be sprayed at Fort Ross include:

- Biological control agents
- Horticultural oils
- Insecticidal soaps
- Compost tea
- Selective herbicides
- Selective pesticides

PPE for any spraying operation should include:

- Eye protection
- Filtering face piece (dust mask) or respirator
- Gloves (chemical resistant latex, nitrile, PVC or neoprene)
- Long sleeves
- Long pants

- Rubber boots
- Tyvek suit

Hand-held pump sprayers are convenient for small batches of spray and also easy to clean. They hold up to three gallons of mix and are portable but may not be suitable for carrying long distances.

Backpack pump sprayers accommodate up to four gallons of mix and are very portable. They are worn on the back and can weigh up to 35 pounds when full. They have a limited vertical range and are not suitable for spraying tree canopies taller than ten feet. Backpack sprayers should not be used from ladders as the weight of the backpack may cause loss of balance.

Spraying large volumes in an orchard requires a larger tank sprayer operated by a small engine. This apparatus can be pulled through the orchard by hand or by ATV, or mounted on the bed of a truck. A tank sprayer can propel larger volumes of product much higher into tree canopies than a hand operated pump sprayer, and is suitable for spraying trees of the stature of the Ranch Era Vicar of Winkfield pears or the Capulin cherries in the Russian Orchard.

Figure 6.59: *(left)*
Personal Protective
Equipment for spraying.

Figure 6.60: *(right)*
Backpack sprayer
over Tyvek suit.





FRUIT MANAGEMENT

Fruit Thinning

Thinning a percentage of young fruit from a tree early in the season benefits the tree and the quality of the fruit that is allowed to ripen. Some trees bear such heavy crops that branches break under the weight of maturing fruit, damaging the tree in the process. In the Fort Ross orchards, all the apple and pear trees are candidates for fruit thinning. Removing about 50% of the young fruit when they are marble-sized will lighten the load on branches and allow trees to direct energy into developing the remaining fruit, resulting in larger and better quality fruit. A good rule of thumb is to space fruit about 6” apart.

After thinning, the remaining apples may also exhibit fewer moth larvae holes. Fruit pests such as the Codling moth prefer to lay their eggs where fruits are closely touching or pressed together. Thinning fruit greatly reduces the number of preferred laying sites for the moth.

Propping Fruit-Laden Branches

A technique for preventing heavily laden fruit tree branches from snapping is to prop them with 2” x 4” until harvest time. It is a good idea to cut a notch in one end of the 2” x 4” to cradle the branch and prevent it from falling down. When there are not enough props for the number of laden branches, prioritize propping scaffold limbs first. A small outer limb that breaks will be more easily replaced and do less damage to the tree than an entire scaffold limb that breaks or splits near the trunk.

Figure 6.61: (left)
Apples before thinning.

Figure 6.62: (right)
Apples after thinning.



Figure 6.63: (top, left)
Installing a prop.

Figure 6.64: (top, right)
2" x 4" lumber makes an effective temporary prop for heavy branches.

Figure 6.65: *Shoulder-worn picking bags are the safest and securest method for harvesting fruit, especially when on a ladder.*



Fruit Harvest

Every year in mid-October a Harvest Festival is held in the Russian Orchard. Care should be taken during this public harvest event to ensure that historic apple and pear trees are not damaged by overzealous harvesting. Monitor the use of long-handled fruit picking tools so the branches are not pulled to the breaking point. For safety reasons, orchard ladder use is not recommended for the general public. Reserve ladder use for staff members and those who are familiar with proper orchard ladder use.

Ripeness Indicators

It is important to teach visitors how to determine when fruit is ripe and right for picking in order to protect the historic trees during harvesting. Trees can be damaged by pulling too hard and breaking spurs or branches.

Vicar of Winkfield pears are ripe when the flesh near the stem yields slightly when pressed. The surest test of ripeness in pears is to grasp the fruit and bend it upwards slowly. If it snaps off at the stem easily then it is nearing ripeness.

Apples are judged for ripeness visually by subtle lightening of the flesh and the appearance of small lenticels against the background flesh color. Ripe apples also release from the branch more easily than unripe apples. When fruits of any species begin to fall to the ground it is a sure sign that the ripening period has begun (see Appendix VI, Fruit Ripening Chart).

Harvesting Equipment

Specialized fruit harvesting bags expedite the process of gathering large quantities of fruit. They are also safer when working from a ladder as both hands are free. Orchard bags are carried over one shoulder and have an open bottom that is rolled up securely during harvesting and unrolled when offloading fruit into a sorting bin. The bottom design eliminates the need to repeatedly lift a heavy bag of fruit.

Figure 6.66: (left) A fruit picking bag.

Figure 6.67: (center) Crates and liners for sorting and storing.

Figure 6.68: (right) Liners for pears prevent bruising and are available in different sizes.



CHAPTER 7

TREATMENT

Orchard treatment consists of the larger-scale actions proposed to enhance the ability of the Fort Ross Orchards to support visitor use and to express the scale and diversity of trees in the historic period. The treatment plan is primarily focused on the Russian Orchard area, but also provides limited recommendations related to the other orchard areas. The recommended actions are based on findings of the historical research, existing conditions, and analysis and evaluation of historic integrity. In addition to the specific treatment recommendations, this chapter offers guidance on interpretation of the Russian Orchard and project implementation.

MANAGEMENT OBJECTIVES

The management objectives for the project are the drivers of all proposed actions. The broad-spectrum management objectives for the Fort Ross Orchard treatment are as follows:

- Follow the *Secretary of the Interior's Standards for the Treatment of Historic Properties*,
- Enhance the historic character of the Russian Orchard, and
- Enhance the capacity to interpret the history of the Russian and Ranch Eras.

The direction for treatment was informed by the outcomes of a half-day webinar workshop, involving CDPR, FRC, NPS staff, and project advisors. Participants in the planning webinar reviewed the treatment tasks and expressed additional treatment objectives. Project participants emphasized the importance of the National Historic Landmark (NHL) and

proposed that the features with the national level of significance (the Capulin cherries and the historic Russian Orchard area) be given priority within the landscape. In addition, the long-term maintenance of the orchard was a concern for project planning participants and they expressed the need to scale the treatment alternatives to reflect maintenance concerns. Finally, participants articulated a desire to increase the visitation at the park by providing additional fruit harvest opportunities. As a result of the webinar, the treatment alternatives were refined to include the following management objectives:

- Avoid a negative impact to the character of the Russian Orchard and NHL property due to the introduction of new trees representing the Ranch Era, by locating new Ranch Era trees outside of the revised NHL boundary.
- Limit the scale of new plantings, to avoid creating unmanageable maintenance responsibilities.
- Provide opportunities for visitors to harvest heirloom variety fruit from non-historic trees.

Together these objectives provide a clear framework for the coalescence of treatment options that satisfy multiple goals.

APPLYING THE SECRETARY OF THE INTERIOR'S STANDARDS

The Secretary of the Interior's Standards for the Treatment of Historic Properties is the nationally recognized guidance for promoting best practices in historic preservation work. Federal, state, and local government agencies and non-governmental organizations use this framework for historic preservation planning. In the 1990s, the State of California officially adopted the Secretary of Interior's Standards as a guide for managing historic resources across departments.

The Secretary of the Interior's Standards divide treatment into four categories: preservation, rehabilitation, restoration, and reconstruction.

Preservation is the most limited treatment and

consists of protecting and stabilizing historic resources.

Restoration consists of repair and reconstruction of features to the period of significance and removing features from outside of the period of significance.

Rehabilitation preserves historic features while at the same time allowing for compatible use through sensitive alterations and additions.

Reconstruction is the re-creation of non-surviving features that were present during the period of significance.

Treatment recommendations for the Fort Ross orchards align with two types of treatment: preservation and rehabilitation. The preservation guidance focuses on improving the health and longevity of the living resources in the orchard areas. The rehabilitation alternatives promote the additional use of the site for fruit harvest and interpretation through the creation of representative site elements.

TREATMENT RECOMMENDATIONS

Russian Orchard

Three alternatives were developed for the Russian Orchard combining varying levels of intervention. *Alternative A: Preservation* focuses on protecting the most important historic trees from the Russian and Ranch Eras. *Alternative B: Russian Era Rehabilitation* includes the actions of Alternative A and proposes constructing an interpretive orchard fence based on the Russian Era orchard fence and planting historic tree varieties indicative of the Russian Era orchard. *Alternative C: Russian and Ranch Era Rehabilitation*, the preferred alternative, includes the actions of Alternative A and B and proposes planting trees indicative of the Ranch Era in the northern section of the Russian Orchard.

Alternative A: Preservation

Alternative A is the most limited in scope of the alternatives and its central goal is to preserve the historic fruit trees from the Russian and Ranch Eras (see Map 7.1). In order to maintain the visual character of the landscape, this alternative does not include additions of new fruit trees. The primary steps for implementing preservation are outlined in the Stabilization and Preservation Maintenance Chapters of this document. Stabilization and Preservation Maintenance actions, such as, propping branches, removing dead and diseased material, regular pruning and mulching can significantly prolong the life of the historic trees at Fort Ross. In addition to these actions, Alternative A proposes removing encroaching vegetation and expanding the orchard fence.

Vegetation Removal

Since the inclusion of the land in the California State Parks system and the reduction of ranch activities on the site, both deciduous and coniferous trees have extended into the open areas of land. Second growth redwood trees are reaching maturity and shading historic fruit trees. In order to protect the historic fruit trees, encroaching vegetation should be removed. Redwood trees that are significantly shading historic fruit trees should be limbed up and their canopy should be thinned. Areas of vegetation encroachment to be addressed are located in the following areas: 1) the northern section of the orchard near the Gravenstein apple tree, 2) the southwest corner of the orchard, 3) south of the sag pond within the orchard, 4) near the pear trees in the southeast corner of the orchard, and 5) outside of the orchard fence around the Ranch Era Sweet cherry trees.

Orchard Fence

Historic trees outside of the current Russian Orchard fence are subject to animal damage and encroachment by the redwood forest. This project proposes extending the orchard fence to include the oldest historic trees located to the southeast of the current orchard. In addition to protecting the trees outside the orchard fence, the expanded fence would provide a buffer for the trees in the current orchard area and diminish the further encroachment of vegetation

into the orchard. The fence extension will cross the San Andreas fault and run north of the sag pond that is outside the fence. The fence should be made of a flexible material, such as woven wire with tension springs. In addition, it will have an irregular alignment in order to adjust to the terrain, sag pond, and redwood trees. A gate should be constructed within the new section of fence that would allow access to the Call Orchard Road.

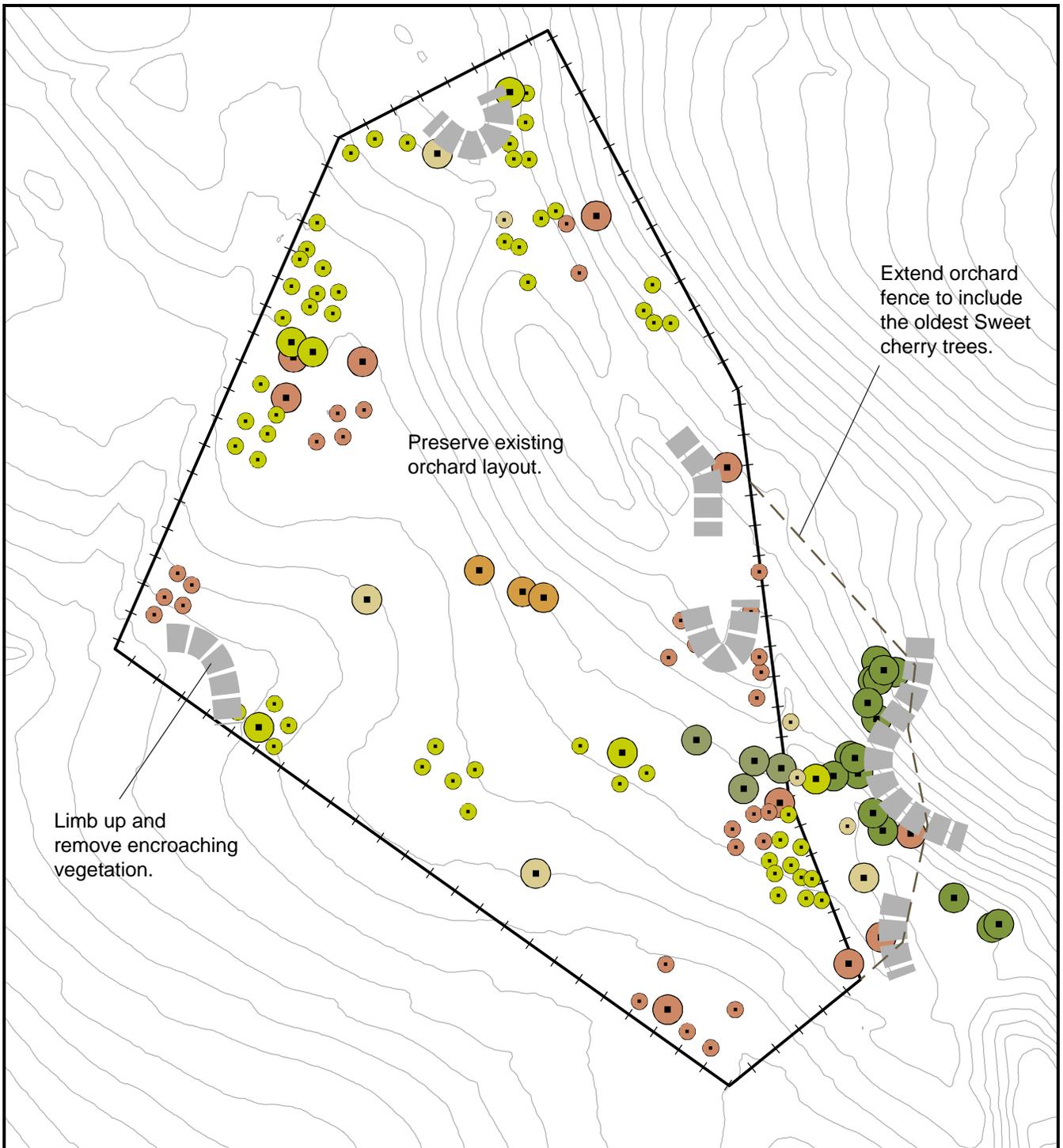
Replace Historic Trees In-Kind

As the historic Russian and Ranch Era trees die within the orchard, they should be replaced in-kind. A compatible replacement of a historic tree would be either a seedling or a full-size grafted tree that was propagated from historic plant material. In cases where the historic tree dies before a plant could be propagated, a tree of the same variety and rootstock (for grafted trees) or a tree of the same species (for seedling trees) would be a suitable alternative.

Contemporary Era trees should not be replaced when they die. As mentioned earlier, the Contemporary Era trees are incompatible with the historic character of the orchard. Although they have a historically accurate genotype to the Ranch Era trees, they are of semi-dwarf rootstock and do not reflect the historic form of the full-size variety and seedling trees. Despite this, the Contemporary Era trees represent many years of work by volunteers in the orchard and provide additional fruit for harvest activities. Thus, this document does not call for wholesale removal the Contemporary Era trees, but rather their attrition through natural mortality.

Alternative A Recommendations:

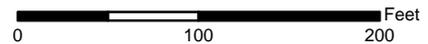
1. Maintain present orchard layout.
2. Perform stabilization and preservation activities to improve the condition of historic trees.
3. Conserve genetic material of historic trees.
4. Remove encroaching vegetation, including pruning redwood trees.
5. Extend the orchard fence around the majority of Sweet cherry trees located to the southeast of the current fence and include a gate to the Call Orchard Road.
6. Replace in-kind Russian and Ranch Era trees when they die.
7. Do not replace Contemporary Era trees when they die.



FRUIT TREE ERA AND TYPE

- | | |
|---|--|
|  Ranch Apple (6) |  Russian Capulin Cherry (3) |
|  Ranch Pear (10) |  Contemporary Apple (56) |
|  Ranch Plum (4) |  Contemporary Pear (29) |
|  Ranch Olive (4) |  Contemporary Plum (4) |
|  Ranch Sweet Cherry (18) | |

Alternative A: Russian Orchard Preservation
Fort Ross Orchard Management Plan



Alternative B: Russian Era Rehabilitation

Alternative B includes the scope of work described in Alternative A. In addition, Alternative B provides opportunities for interpretation of the Russian Era orchard practices through the construction of features representative of the Russian time period (see Map 7.2). While there are insufficient physical remains on the site to implement an orchard restoration, this proposal supports the introduction of interpretive site elements based on the character of the orchard in 1841. The proposed elements are compatible additions that do not alter the historic fabric of the site. The two main components of Alternative B are constructing an L-shaped fence representative of the location, length, and width of the Russian Orchard and planting historic fruit trees and grape vines characteristic of those present in the Russian Era.

This proposal is based on the evidence provided by the physical remains of the original Russian Orchard and the historic site descriptions detailed earlier in this document and summarized below. The physical remnants of the Russian Orchard consist of the three Capulin cherry trees and the probable remnants of the orchard house oven. The most detailed written site description is the 1841 property inventory. This inventory provides the historic site dimensions (385 feet by 168 feet) and tree quantity and ratio (260 fruit trees - 207 apple, 29 peach, 10 pear, 10 quince, 8 cherry trees, and some vines). The inventory also states the orchard was surrounded by a palisade fence. The remnants of the original orchard fence, however, have not been located.

The probable location of the historic Russian Orchard described in the inventory can be extrapolated based on the location of the surviving Capulin cherry trees. In 1822, Khlebnikov wrote that the fruit planted in 1820 (apple, pear, peach, cherry, and Bergamot pear cuttings from Santa Cruz) were planted “in one line next to the fence in a disorderly fashion” (Khlebnikov 1990, 102). There is no other documentation of cherries being planted at the site, and this document is likely referring to the Capulin cherries. Thus, the row of three existing Capulin cherry trees likely

runs adjacent to the location of one edge of the historic orchard fence. In addition, the Russian Era archaeological site indicates the probable location of the orchard house mentioned in the inventory. Based on this information and the current topography of the site, the 385 foot long northern side of the orchard fence likely ran from the northwest to the southeast parallel to the row of Capulin cherries and the majority of the Russian Orchard was located in the gently sloping area to the south of the Capulin cherry trees.

Orchard Fence

Alternative B proposes conducting additional archaeological investigations to attempt to locate Russian Era orchard fence remnants and constructing an L-shaped fence in the approximate location of the historic fence, based on the above evidence. In 1880 the orchard fence was described as an eight foot high redwood slab fence made of slabs two inches thick that were “driven into the ground, while the tops were nailed firmly to girders extending from post to post, set about ten feet apart” (Munro-Fraser 1880, 370). The shorter segment of the proposed L-shaped fence will represent the historic palisade fence that surrounded the orchard. The redwood slab fence would run 168 feet from northeast to southwest. The longer segment of the L-shaped fence will serve to indicate that the fence is an interpretive design. The proposed open rail three foot high fence constructed to support grape vines will run northwest to southwest. The fence should be visibly-permeable and not alter the view from the orchard to the fort and the water. The fence would express the length of the historic Russian Orchard, but not the character of the historic fence. The non-historic style of the fence clearly will indicate that the entire L-shape fence is a representative example rather than a historic site element.

Russian Era Fruit Trees and Vines

Twenty-five to thirty-seven fruit trees and 30 grape vines are proposed for the site in Alternative B. The recommended plantings of Russian Era trees in Alternative B represent the minimum amount of trees that could effectively depict the historic qualities of the Russian Orchard. The proposed

trees reflect the type of trees grown in the Russian Era in terms of species and tree form, rather than the historic quantity or ratio of plant species.

During the Russian Era, plants were propagated from seeds and cuttings. Based on the documented plantings from 1814-1820, grapes, pear, Capulin cherry, and Bergamot pear were planted from cuttings and peach and apple were planted from both cuttings and seeds (see Table 2.2). The quince propagation method is undocumented, although they were likely grown from cuttings. All of the plant material came from the California Missions, except for the grapes which came from Lima, Peru.¹⁵ The proposed plantings should reflect this pattern.

The proposed plants are as follows:

- 5 Capulin Cherry Trees,
- 5-8 Apple Trees,
- 5-8 Pear Trees,
- 5-8 Quince Multi-Trunked Trees,
- 5-8 Peach Trees, and
- 30 Grape Vines.

The five Capulin cherry trees should be planted in a row in line with the three historic trees in order to reflect the eight cherry trees documented in the 1841 orchard inventory. One propagated Capulin cherry tree should be planted between the Capulin cherries D-PsP-1 and D-PsP-2 and two trees should be planted on either side of the existing row from 16-20 feet apart. The planting should be conducted carefully to not disrupt the root system of the historic trees. The groups of five to eight apple, pear, quince, and peach trees should be planted in irregular groupings with each tree 16-20 feet apart. The groups should be placed within the area defined by the L-shaped fence. Grape vines should be planted 10 or more feet apart along the 385 foot length of the lower fence segment.

¹⁵ It is probable that some of the grapes planted after 1820 at Fort Ross came from California Mission cuttings.

Plant Propagation

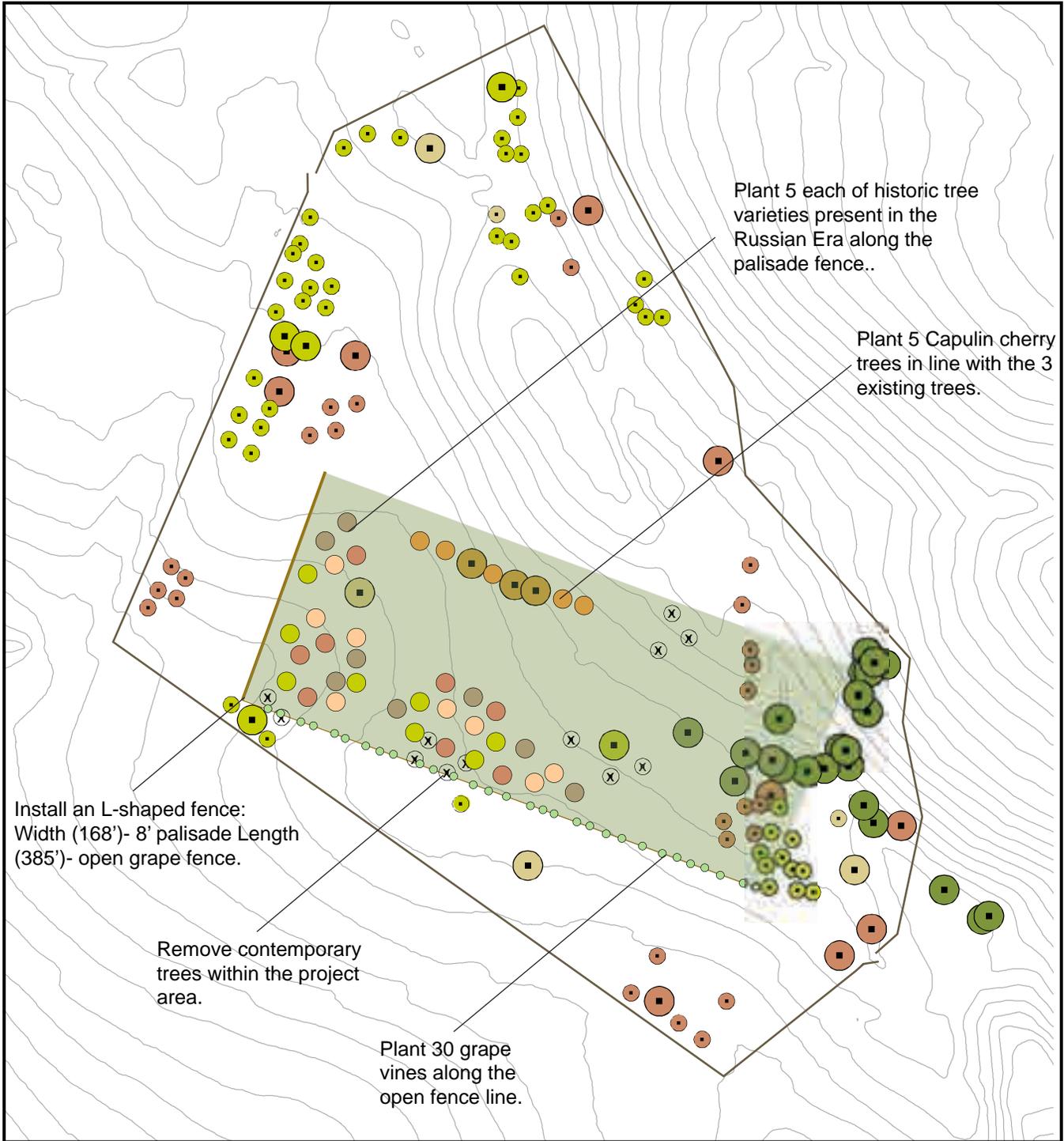
The plant material for the propagation of each species will need to be individually sourced. The plant propagation can be conducted through a contract with a local Sonoma County nursery. The Capulin cherry can be propagated from cuttings of the remaining Capulin cherry trees within the orchard or from volunteer Capulin cherry trees taken from the orchard floor. The remaining fruit trees need to be sourced from outside of the park. The most accurate source of plant material would be propagation from surviving Mission Era fruit trees. If a surviving tree of a particular species cannot be found, Mission Era varieties would be acceptable. La Purisima Mission State Park and Santa Barbara Mission La Huerta Project are both working to preserve Mission Era plants and would be a potential source of plant material. In addition, the USDA National Clonal Germplasm Repository in Corvallis, Oregon is a source for pear, Bergamot pear, and quince species. If plant material with a direct genetic lineage to the California Mission orchard tree cannot be obtained, a seedling fruit tree would be an acceptable alternative, or a tree matching the known Mission Era varieties. The grape vines could be grown from cuttings of Listan Prieto or Muscat of Alexandria varieties of grape, which were grown by Spanish Missions in South America and Peru.

Maintenance Considerations

Ten Contemporary Era trees should be removed from the project area to create space for the fence and the new plantings. Thus, the Russian Rehabilitation will result in a net increase of only 15 to 27 trees. The most significant maintenance required by the new trees will be in the establishment period (2-3 years). After the trees are established, they should possess more vigor than the contemporary grafted trees within the orchard. The peach trees will require routine monitoring as they are the most disease-sensitive of the proposed species. The fruit species are not known to be invasive and will not spread into surrounding ecosystem. In order to represent the young trees present during the Russian Era, the proposed trees could be replaced on a 30 to 50 year cycle depending on their growth rate.

Alternative B Recommendations:

1. Complete projects for Alternative A.
2. Remove Contemporary Era trees within the project area.
3. Conduct archaeological investigations to search for remnants of the historic Russian Orchard fence.
4. Construct an L-shaped fence representing the size of the original Russian Orchard (the short side an 8 foot tall redwood palisade fence and the long side an open rail grape fence).
5. Plant 25-37 new trees (5-8 apple, 5-8 peach, 5-8 pear, 5-8 quince, and 5 Capulin cherry) utilizing seedling or mission variety trees.
6. Plant 30 grape vines of historically accurate varieties (Listan Prieto or Muscat of Alexandria) along the long side of the L-shaped fence.



RUSSIAN-TYPE FRUIT TREES AND VINES

- Capulin Cherry (5)
- Pear (5-8)
- Apple (5-8)
- Quince (5-8)
- Peach (5-8)
- Grape (30)
- X Contemporary Trees to Remove (3 Pears and 9 Apples)
- Original Russian Orchard size and approximate location

Alternative B: Russian Era Rehabilitation
Fort Ross Orchard Management Plan



Alternative C: Russian and Ranch Era Rehabilitation

Alternative C includes the treatment recommendations of Alternatives A and B, but also provides additional scope. Alternative C provides the largest vision and is the preferred alternative (see map 7.3). It celebrates the continuum of the orchard history associated with the site by perpetuating the use of the landscape as an orchard. This alternative recommends planting apple and pear trees representing Ranch Era varieties and tree form within the current Russian Orchard fence. The proposed plantings are located to the north of the probable historic Russian Orchard, outside of the proposed National Historic Landmark boundary expansion.

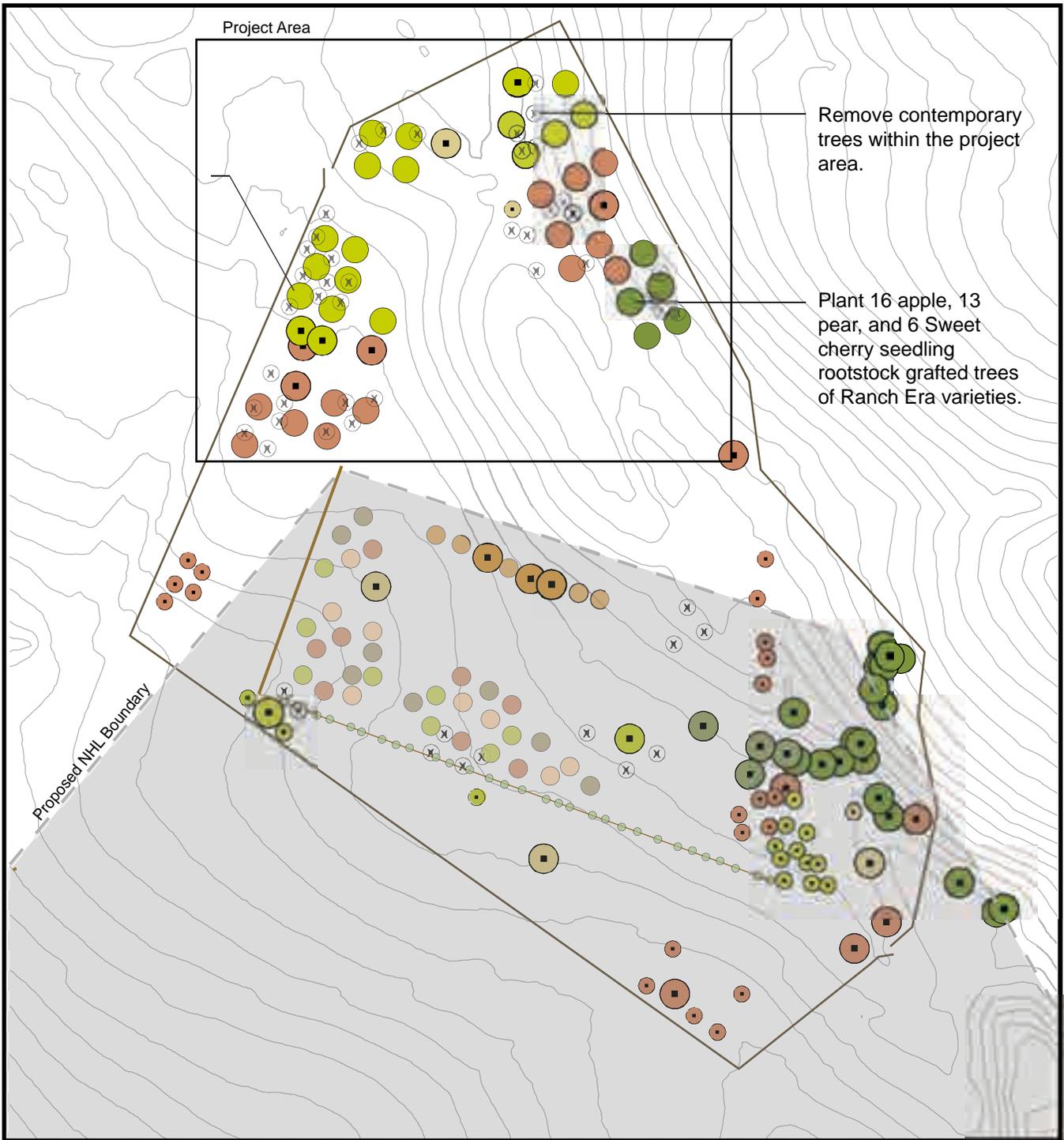
Fifteen apple trees, twelve pear trees, and five Sweet cherry trees are recommended to be planted near the entrance area and in the northeast region of the orchard. The new trees will be spaced 20 feet apart and at least 20 feet from historic Ranch Era trees. The trees will be grafted with scionwood cutting taken from the orchard on seedling rootstock. The trees can be grown through a local Sonoma County nursery.

Maintenance Considerations

In order to plant the Ranch-type trees, 41 Contemporary Era trees will be removed from the project area. This will result in a net loss of nine trees. The highest level of maintenance will be required during the first 2-3 years after planting. Once the trees are established the seedling rootstocks will provide the trees with vigor and they should be more resilient than the existing Contemporary Era trees.

Alternative C Recommendations:

1. Complete the recommendations from Alternative A and Alternative B.
2. Remove Contemporary Era trees from the project area.
3. Plant 15 apple, 12 pear, and 5 Sweet cherry trees of Ranch Era varieties and form in the northern section of the current Russian Orchard.



RANCH-TYPE FRUIT TREES

- Apple (16)
- Pear (13)
- Sweet Cherry (5)

- X Contemporary Trees to Remove (6 Pears and 33 Apples)

Alternative C: Russian and Ranch Era Rehabilitation
Fort Ross Orchard Management Plan



Map 7.3

Benitz Orchard Rehabilitation

The area to the west side of the Fort Ross Road includes large open grasslands surrounded by forest leading to the one remaining apple tree from the Benitz Orchard (see Map 7.4). The main priority for this area is preserving the remaining historic tree. In order to prevent vegetation encroachment, woody vegetation over 2 feet tall should be cleared within a 60 foot radius around the tree and all woody vegetation should be cleared from under the tree's drip line. In addition to the tree preservation measures, a loop trail could be created in order to bring visitors to the remaining tree. Finally, if the Ranch Era trees in the Russian Orchard do not provide enough fruit for harvest activities, it is proposed that a Demonstration Orchard is created in an open area near the road between the Russian Orchard and the remaining Benitz tree.

Benitz Orchard Loop Trail

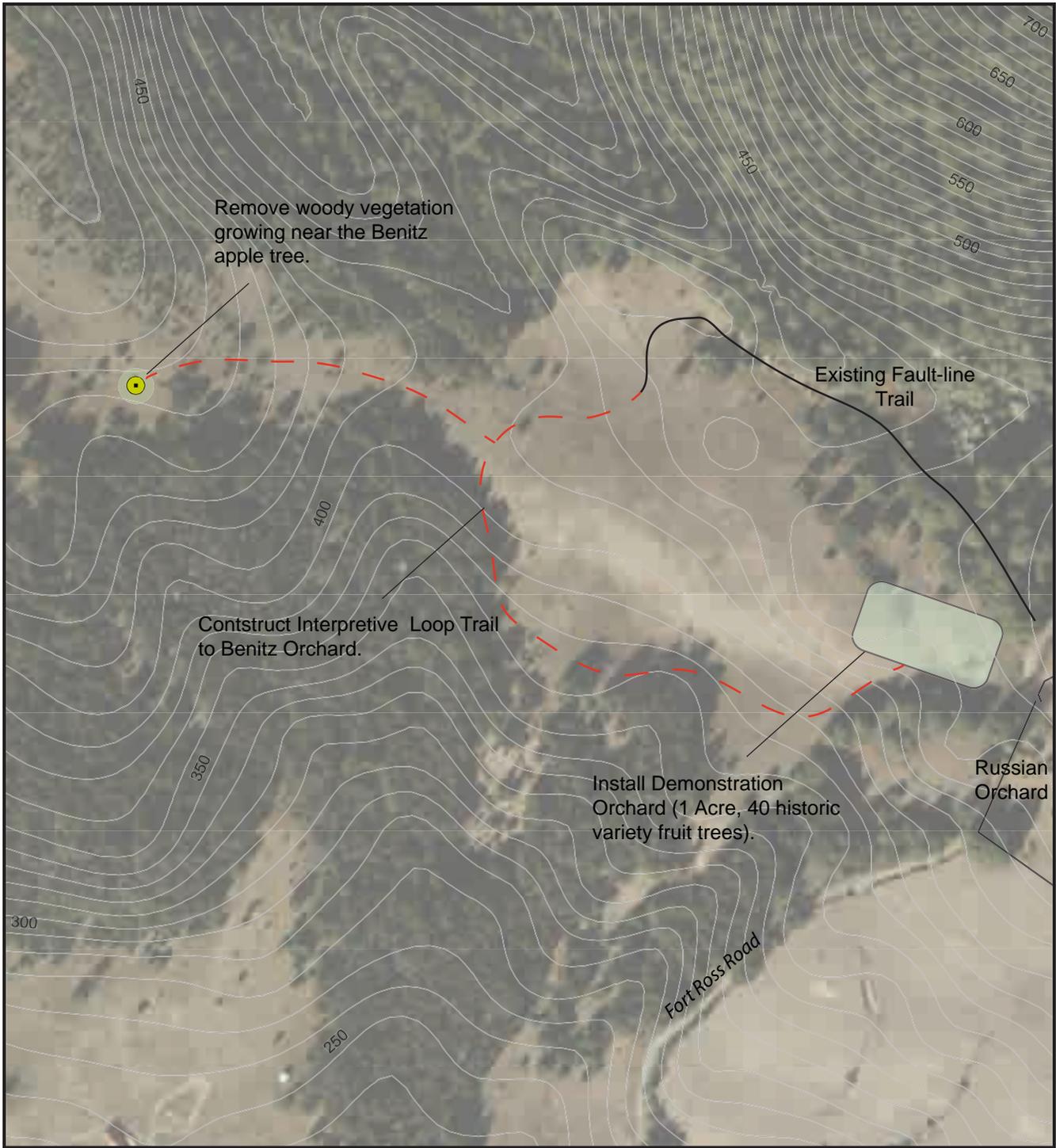
The proposed Benitz Orchard Loop interpretive trail would follow the existing trail along the fault line through the forest west of the road and then extend across the open field east of the Benitz Orchard. From there a spur trail would lead to the Benitz tree. The loop trail would continue past the spur along the southern edge of the open field back to the road. The trail would provide opportunities to interpret the Ranch Era agricultural activities and view the historic Benitz apple tree.

Demonstration Orchard

A Demonstration Orchard would provide more opportunities for visitor engagement with fruit trees and heirloom varieties. The proposed orchard would be approximately one acre and would contain around 40 trees of historic varieties. The varieties would represent the varieties present in the Benitz Apple Orchard and pear, plum, and sweet cherry trees grown in the Russian Orchard during the Ranch Era. A deer fence, similar to the present-day Russian Orchard fence, should be built around the Demonstration Orchard.

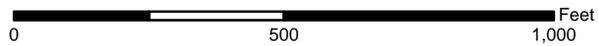
Benitz Orchard Recommendations:

1. Routinely clear woody vegetation over 2 feet tall from the within a 60 foot radius around the Benitz tree and clear all woody vegetation from underneath its drip line.
2. Construct a Demonstration Orchard across the road from the Russian Orchard with 40 fruit trees representing the available Benitz apple varieties.
3. Create an interpretive loop trail from the existing fault-line trail with a spur to the historic Benitz apple tree.



Benitz Orchard Area Treatment Fort Ross Orchard Management Plan

 Benitz Apple Tree



Map 7.4

Call Orchard Preservation

The Call Orchard is presently in stable condition (see Map 7.5). The grazing cattle help to control encroaching vegetation in this area. In addition, the dead branches on the ground surrounding many of the trees armor the trees against animal damage, thus a fence would likely not preserve the condition of the trees. In addition to general stabilization and preservation maintenance measures, the deadwood surrounding the fruit trees should not be removed so that the branches will continue to serve as a barrier to animals. If a gate was created in the southeast corner of the Russian Orchard fence and the old logging road to the orchard was enhanced as a trail, the orchard area would likely receive more visitors.

Call Orchard Recommendations:

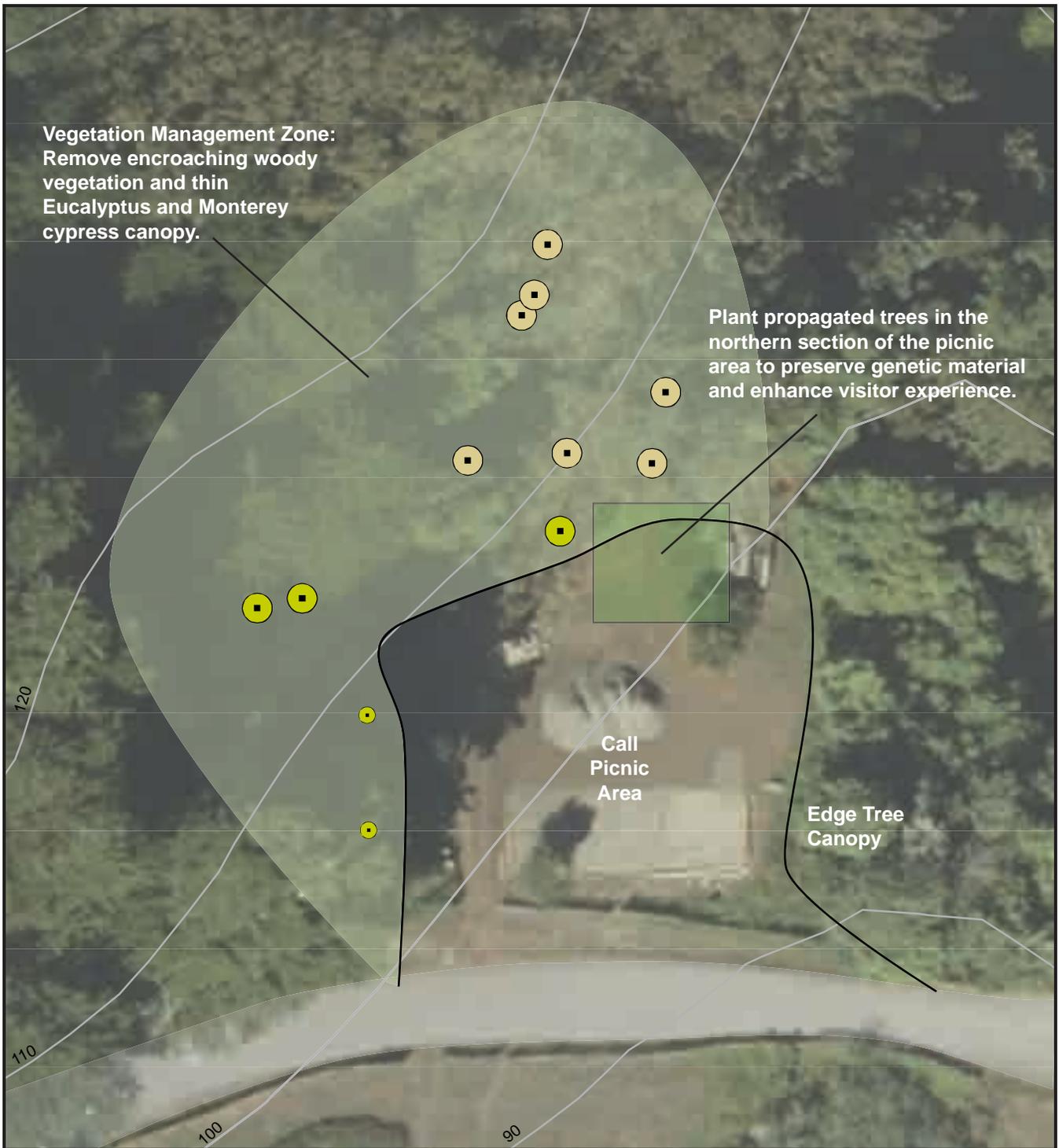
1. Do not remove the deadwood from the orchard area so that it will serve as armoring against cattle.
2. Enhance access to the site through a gate in the Russian Orchard fence and trail improvements.

Call House and Picnic Area Preservation

The majority of trees around the Call Picnic Area are in poor condition. This is largely due to a lack of maintenance and encroaching vegetation. In order to improve the condition of the trees, the woody vegetation over two feet tall within a 60 foot radius of the trees should be controlled. Following the recommendations in the Stabilization section, the overhanging Eucalyptus and Monterey cypress branches should be pruned by a certified arborist to allow more light to reach the fruit trees. In addition, the genetic material of the Ranch Era trees in this area should be preserved through the propagation of “daughter” trees. These trees can be planted at the northern edge of the open area and near the shed in order to enhance the site. The two Call House trees are in fair and good condition and do not require any additional treatment than the general recommendation provided in the Stabilization and Preservation Maintenance Chapters.

Call Picnic Area Recommendations:

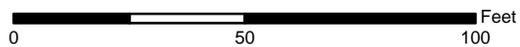
1. Remove encroaching woody vegetation over two feet tall within a 60 foot radius of fruit trees.
2. Prune encroaching Eucalyptus and Monterey cypress that are shading the fruit trees.
3. Preserve the genetic material of the Ranch Era trees.
4. Plant propagated trees in the northern portion of the picnic area and near the shed.



FRUIT TREE ERA AND TYPE

-  Ranch Apple
-  Ranch Plum
-  Contemporary Apple

Call Picnic Area Treatment
Fort Ross Orchard Management Plan



Map 7.5

Rotchev House Trees Preservation

Although the Rotchev House trees are not historic, they provide shade for visitors and are emblematic of the use of the property for fruit production. The trees should be preserved following the recommendations in the Stabilization and Preservation Maintenance Chapters. Particularly, the trees should be mulched in order to reduce the compaction caused by visitors. When the trees are die, they should be replaced by full size fruit trees.

INTERPRETATION

Interpretation is a valuable tool that can help visitors understand the layered story of the historic orchard landscape. Interpretative elements are relatively low cost to install and can be included in any of the treatment alternatives. Signage can provide overall orientation to the site. It can also focus visitor attention on specific details such as the name of a tree, or on broad themes such as the connection between the Spanish Missions and Fort Ross. Four specific types of signage are recommended to interpret the Fort Ross orchards: tree labels, low-profile wayside signs, an upright directional sign, and trailside signs.

Tree Labels

As part of this project, individual identification tags were applied to the orchard trees during the orchard inventory. However, these tags are not permanent and only contain the unique tree identification label. New tree labels will provide information to visitors and facilitate long-term tree monitoring.

Recommendations: Install tree labels on all historic fruit trees within Fort Ross State Historic Park. Inscribe the label with the Common Name of the Tree, the Species and Variety (if pertinent), the Era the tree was planted (Russian or Ranch), and, in smaller print, the unique tree ID developed for this project. Utilize a tree label with a spring so that the label can move as the tree grows.

Low-profile Wayside Sign

A low-profile wayside sign is a site-specific sign that provides a caption on the landscape. Low-profile wayside signs are placed overlooking an important panorama or site feature. Low-profile wayside signs should be carefully placed and used sparingly so that they do not intrude on the historic landscape.

Recommendations: Install one medium-sized low-profile wayside sign near the picnic area in the orchard overlooking the Capulin cherry trees to express the history of the cherry trees and Russian Era fruit production. A 36 by 24 inch panel would allow for a large graphic, informative text, and



Figure 7.1: Tree label and tack (Gardenmarkers.com).



Figure 7.2: *Low-profile wayside sign overlooking a historic landscape (National Park Service).*

smaller inset graphics. Install a smaller 24 by 24 inch low-profile wayside sign along the proposed Benitz Loop Trail overlooking the Benitz apple tree to express information about the Benitz Orchard and early Ranch Era fruit production.

Upright Directional Sign

An upright directional sign provides general orientation to the site. An upright sign can include a site map, site rules, and explain potential visitor activities. A bulletin case attached to the sign can be used to post information about specific events and volunteer opportunities.

Recommendations: Install a new upright directional sign outside of the orchard fence near the entrance gate. Include a site map of the Russian Orchard and a contextual map depicting the Call Orchard and Benitz tree. Construct a bulletin case on one side of the sign to allow the park and Fort Ross Conservancy to post timely information for visitors.

Trailside Walking Tour Signage

Trailside signs are small markers along the trail that offer information about individual features such as a single



Figure 7.3: (left)
Upright directional sign
with a bulletin case.

Figure 7.4: (right)
Trailside sign.

tree. Trailside signs can also provide a reference number as part of a walking tour. A walking tour can be a way for visitors to learn more about the landscape without the intrusion of larger low-profile wayside signs. In the 1980s, local volunteers developed a walking tour of the Russian Orchard with numbered wooden stakes, however many of these stakes are no longer present.

Recommendations: Redevelop a numbered walking tour for the orchard areas. Install small numbered trailside markers adjacent to features in the Russian Orchard, the Call Orchard, and the Benitz Orchard. Provide reusable laminated guides at the entrance sign with text pertaining to each numbered feature.

TREATMENT IMPLEMENTATION AND COMPLIANCE

The implementation of the recommendations of the Orchard Management Plan will be a multiple year effort of California Department of Parks and Recreation, Fort Ross Conservancy, and local volunteers. Volunteer groups led by Susan Rudy have already implemented many of the Preservation Maintenance and Stabilization measures. Stabilization activities should be accomplished before further work in the orchard is undertaken. California

Department of Parks and Recreation, the National Park Service, and their partners have implemented rehabilitation projects at Jack London State Historic Park, Manzanar National Historic Site and John Muir National Historic Site that can serve as a model and inspiration for the orchard rehabilitation at Fort Ross State Historic Park. The treatment recommendations can be implemented at a variety of scales, as all of the recommendations have been vetted by the planning team. Project implementation could include an entire alternative, or individual elements related to different orchard areas.

The Treatment Implementation Process chart at the end of this chapter (Figure 7.5) describes the basic process of project implementation that can be used as rough guide to move forward through the rehabilitation planning process. Beginning with Project Start-up, the main project team should be selected and the treatment alternative finalized. Design and Compliance, the next project phases, happen simultaneously to ensure that the design reflects the information obtained through compliance work. During Design, the construction details can be developed and finalized.

Compliance must address the cultural components of the site as well as the surrounding natural resources. A project within the Russian Orchard will require initial California Environmental Quality Act (CEQA) review. CEQA pertains to both historic and natural resources. However, projects that follow the Secretary of Interior Standards generally have no significant impact and are often determined categorically exempt from CEQA (California Office of Historic Preservation n.d., 6). The National Historic Landmark Coordinator and the State Historic Preservation Officer should also review the project. In addition, archaeological work is required to investigate the orchard for additional remains. Finally, the project is within a recorded Traditional Cultural Property, the Metini village site. Cultural consultation will allow for the Kashaya Pomo people to participate in the project planning process. Consultation should be initiated in Project Start-up phase.

After Design and Compliance, the plant material will need

to be grown specifically for the rehabilitation project. Plant material can be obtained on site and from sources of Mission Era plants. A local nursery can be contracted to propagate the trees and vines using historically accurate plant material (see Chapter 5 - Germplasm Conservation and Propagation).

Once the plant material is obtained, installation can proceed. The contemporary trees within the project area should be removed in the same season that the new trees are planted. Fall is the best time to plant trees, but they can also be planted in winter and early spring. Project work in previously undisturbed areas will require additional archaeological monitoring.

After the plants and fences are installed, the rehabilitation project is not complete. The new trees will require watering for 2-3 years during the dry season. After the trees are established, the orchard can be maintained through Preservation Maintenance tasks driven by routine monitoring.

Treatment Implementation Process

Project Start-Up	Design	Compliance/Consultation
<p>Establish a project team including Cultural and Natural Resource Staff and a Landscape Architect.</p> <p>Review the findings of the Orchard Management Plan and select main elements from treatment alternatives.</p> <p>Develop a rough cost estimate and options for phasing the project to work with funding sources. Seek funding.</p> <p>Initiate consultation with Kashaya Pomo.</p>	<p>Conduct additional site analysis.</p> <p>Draft detailed design drawings and project specifications.</p> <p>Review project design with interested parties including Kashaya Pomo to finalize the design.</p> <p>Develop a phased project budget and secure funding. Include within budget funding for three years of plant establishment.</p> <p>Design interpretive signage.</p>	<p>Identify and complete necessary archaeological investigations in the project area.</p> <p>Conduct continued consultation with Kashaya Pomo.</p> <p>Complete California Environmental Quality Act review.</p> <p>Review project with National Historic Landmark Coordinator and California State Historic Preservation Officer.</p>
Secure Plant Material	Installation	Maintenance
<p>Locate a source of all historic fruit varieties.</p> <p>Identify a Sonoma County fruit tree nursery that has experience propagating rare fruit varieties and conducts contract work.</p> <p>Work with the contract nursery to take cuttings of all historic variety trees and collect seeds for propagation. Take scion wood cutting in the winter and graft in the spring, take budding cuttings in August.</p> <p>Grow trees in a nursery for 6 months to a year.</p> <p>Fabricate interpretive signage.</p>	<p>Remove Contemporary Era trees within the project area.</p> <p>Construct fence, minimizing the area of impact and using archaeological monitors.</p> <p>Plant trees in the fall, using soil amended with organic fertilizer and compost. Mulch newly planted trees.</p> <p>Utilize archaeological monitors in sensitive areas.</p>	<p>Water trees through the dry season weekly for the first two years of establishment.</p> <p>Prune trees to establish a high scaffold, but allow trees to grow into a natural uneven form.</p> <p>Perform Preservation Maintenance activities.</p> <p>Monitor trees for signs of stress and address the cause.</p>

Figure 7.5: Treatment Implementation Process (Adapted from *Wayside Exhibit Development Process, Harper’s Ferry Center, NPS*).

A P P E N D I X

APPENDIX

APPENDIX I. E.O. ESSIG, 1933

E.O. ESSIG. 1933. (*Excerpt*)

The Russian settlement at Ross. In *The Russians in California*. Special publications ; no. 7. San Francisco: California Historical Society. (Essig provides an excellent description of the Ranch Era orchard, but he incorrectly identified many trees planted by Benitz as Russian Era trees.)

“I have found the orchard to be a most interesting place. The old Russian fence has completely disappeared. A few bricks in the southeast portion indicate the location of the two powder magazines which Mrs. Call stated once stood there [according to later archaeological investigations likely the location of the orchard house]. A number of picket fences enclosed most of the original area which is also used as a sheep pasture. The orchard occupies a considerable area of the rolling hills some five hundred feet above and three-fourths of a mile behind the fort at the edge of the native shrubbery and timber. Started in 1820 [actually 1814] by the Russians with one hundred trees of peach, apple, pear and cherry, brought from Monterey by Lieut. Kiryll Khlebnikof, it has since been added to by William Benitz, and later by G.W. Call. It has had indifferent care, but when well cultivated yielded large crops of excellent fruit. There are now trees showing all stages of decay and in many places sprouts show where others once stood. A low spot near the road, which holds water in winter, has a heavy growth of niggerhead grass, *Juncus effusus* Linn. Var. *brunneus* Engelm, which has warded off the plow for years, Below it are some of the very largest pear trees in the orchard. They appear to be of the Vicar of Winkfield variety. Some large apple trees also stand nearby. They were probably planted by Benitz. In the upper northwest corner are the original Gravenstein apple trees planted by the Russians. Only the two which were in fruit could be definitely identified. They are large, vigorous trees, covered with moss and well laden with delicious juicy fruit. Just below and boarding the road is a veritable thicket of prune seedlings which is almost impenetrable. Nearby is a huge redwood which has apparently grown up since the Russians departed. Near the middle of the orchard is a row of six seedling cherry trees 12 feet apart, also planted by the Russians. These did not look like cherry trees. Their general appearance and the size, shape and texture of the leaves

much more resembled almond. However, Mrs. Call assured me that they were a sort of small seedling cherry [Capulin cherries]. Returning again to the orchard I was able to find characteristic cherry seeds in the dry grass beneath the trees. Another thicket composed of apple, cherry, pear, and prune trees and native brush occurs on either side of a small spring or creek bed near the middle of the east side. One of the four remaining pear trees planted by the Russians is on the upper side of this mass or shrubbery- the three others are some distance below the spring. Two of these pear trees are decidedly different from any other varieties in the orchard. They are tall, open trees, bearing small leaves and small, very scabby fruit. The tree above the thicket and another below, the two already referred to, are much more compact in habit. No fruit could be procured from the first, but that of the later, although small, was much better looking than that of the other two. On October 6 the fruit of the two typical trees was ripe, while that of the later was still green. It is possible that only the two openly-framed trees were actually planted by the Russians, but those set out by Call are much smaller especially in trunk diameter. The three are tall and slender and do not possess the wide, weeping effect of the same variety grown elsewhere in the state. The fruit at this date was small, very slender in shape and highly colored where exposed to the sun.

Summarizing, it will be noted that there remain but fifteen of the original fruit trees planted by the Russians; two Gravenstein apple and three Bellflower apple, four Russian pear and six seedling cherry trees. A census of the entire orchard at this time showed the following number of trees present: apple 54, cherry 11, pear 43, plums, several dense thickets of seedling prunes and plums, prunes 2, olives 5. The apples are of many varieties and not a few of the trees laden with fruit of good quality, which was well colored and of fine appearance except for scab and the work of the codling moth. The pear trees are specially [sic] large—some being nearly fifty feet tall. The varieties noted were Vicar of Winkfield, Bartlett, and some very beautiful sand pears of which there are portions of two rows in the southeast corner which were planted by Call. The original trees planted by the Russians were set closely together as illustrated by the cherry trees. However, they were usually not set in rows as was later done in some instances by Benitz and Call.

All of the trees are brushy and covered with lichens which give them a truly aged appearance. Mrs. Call told me that the orchard had been plowed every year excepting last year, but there are certain which seem not to have felt the plow for many years.

The trees appear never to have been pruned and were never sprayed. At the present time scab is the most destructive pest in the orchard and the fruit of the apple and pear trees is covered and disfigured by it. Of the insects noted the codling moth is the most abundant and injurious. A large percentage of fruit was found to be infested. The rosy and green apple aphids were also present in considerable numbers and the

“aphis apples” gave evidence of early spring attacks. No signs of the woolly apple aphis were seen. The oyster-shell scale, *Lepidosaphes ulmi* (Linn.), and the greedy scale, *Aspidiotus camilliæ* Sign., were present on most of the apple trees but were nowhere abundant. Adults of the beneficial ladybird beetle, the margined scymnid, *Scymnus marginicollis* Mann. were also noted. Specimens of this beetle were taken by the early Russian collectors at Fort Ross and describe in 1843.

The preservation of the living trees planted by the Russians should be undertaken before it is too late. The speedy acquisition by the state of the entire Fort Ross Ranch would be a great investment for the future. It is nothing less than criminal to allow the present progress of decay and despoliation to continue!” (16-18).

APPENDIX II. FRUIT TREE CONDITION ASSESSMENT FIELD FORM

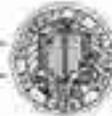
FRUIT TREE CONDITION ASSESSMENT FIELD FORM						
Park: _____			Date: _____			
Location: _____			Inspected by: _____			
Species: _____			Variety: _____			
Field ID #: _____			Diam.: _____			
Tree						
Significance:	Individual	Contributing feature	Non-contributing feature	Unknown	Insert Photo	
Condition Assessment:						
_____ Good:	Good growth with minor physical damage, defects, disease or insect damage, or minor dieback/deadwood					
_____ Fair:	Decreased growth with moderate physical damage, defects, disease or insect damage, or moderate dieback/deadwood					
_____ Poor:	General state of decline with little or no growth, major physical damage, defects, disease or insect damage, or major dieback/deadwood					
_____ Dead:	Greater than 90% of crown dieback with no growth					
Inspection:						
Zone	Description	Inspection factors				
Zone 0: Orchard Floor	Ground outside dripzone	overgrown groundcover/encroaching vegetation	rodent holes	gopher mounds	grade disturbances	
			accumulated debris	drainage issues		
Zone 1: Root System	Ground within dripzone	root damage	accumulated debris	loss of soil	root suckers	
		exposed roots	early leaf drop	early fruit drop	soil compaction	
Zone 2: Trunk Base	Intersection of roots with trunk	loss of bark	cavities	fruiting bodies	cracks or splits	
		girdling	cankers	root suckers	wildlife damage	
		soil accumulation	trunk flare buried			
Zone 3: Main Trunk	Trunk up to scaffold limbs	cracks or splits	hanging or attached deadwood	wildlife nests	decay or cankers	
		leaning trunk	cankers or fruiting bodies	loss of limbs	dense moss/lichen cover	
Zone 4: Canopy	Scaffold limbs, branches and foliage	deadwood	wildlife damage or nests	foliage discolored	foliage curled	
		% live canopy	cankers or fruiting bodies	foliage sparse or early leaf drop	dense moss/lichen cover	
		unbalanced canopy	unbalanced scaffolds	dieback of terminal shoots	water sprouts/epicormic growth	
Zone 5: Above/Around Canopy	Area above canopy	approaching vegetation	indirect over shading	encroaching objects/features		
Recommendations:						
_____ Prune/remove deadwood: _____						
_____ Install support system/cable/brace: _____						
_____ Monitor for change: _____						
_____ Potential future removal: _____						

APPENDIX III. DNA IDENTIFICATION

Apple and Plum DNA Analysis Results

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SANCTUARY & MUSEUM

August 19, 2014

Susan Rudy
Fort Ross Conservancy
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Jenner, CA 95450

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Dear Ms. Rudy,

We have the results from our DNA analysis of the 9 leaf samples you submitted on behalf of the Fort Ross Conservancy. We successfully extracted DNA and generated clear and reproducible DNA profiles from all 9 samples. According to information you provided, the samples were of two different crops: 7 apple and 2 plum. The samples were analyzed using DNA markers and protocols specific to each crop. The results below are presented according to crop.

Our markers and protocols are extremely effective at generating unique DNA profiles. It is a near certainty that the DNA profiles we generate are unique to the one original seedling that becomes the basis of a given variety. Our markers and protocols do not distinguish among somatic mutations (aka. mutations, bud-sports, clones) that may arise over generations of clonal propagation. Though these mutations may result in plants with phenotypic traits clearly different from the original seedling, the DNA profiles of the mutant and the original will be identical. This issue is particularly important in considering the apple results.

APPLE RESULTS AND COMMENTS

Clonal selection is a common feature of apple cultivation. Many bud-sports with desirable novel traits have been selected and developed as distinct varieties. The results below are presented with this fact in mind. The matches described are to entries in the database generated by the National Clonal Germplasm Repository in Geneva, New York (NCGR-G), which is based on accessions in their collection. The collection may contain identification errors. With these considerations, I cannot definitively identify a variety; I can only state which database entries are a match. Phenotypic observations are an essential compliment to these results. I have denoted the matching accessions by the Plant Introduction Number and by the "GMAL" number assigned by the NCGR-G. These numbers will facilitate further investigations using the GRIN website (http://www.ars-grin.gov/npgs/acc/acc_queries.html) and in discussions with NCGR-G staff.

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SANTA BARBARA • SANTA CRUZ

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WEB: www.europeanplant.com

The sample "B-MdR-4" is a Gravenstein.
Specifically, from the NCGR-G, it matches:

Gravenstein Washington Red (PI 58887, GMAL 152), Oratia Beauty (PI 199692, GMAL 1303) and Euzia (PI 137042, GMAL 1766).

'Oratia Beauty' is expected to be a 'Gravenstein' mutation.

The sample "G-MdR-1 Benitz/QG Apple" matches two accessions from the NCGR-G:

Yar Mohammadi (PI 437064, GMAL 1203) and **Crimson Gold** (PI 589215, GMAL 9)

It is unclear if these two varieties are synonyms or if this is a naming mistake at the NCGR-G.

The sample "B-MdC-15 Russian Orchard/OB Apple" is most likely a Baldwin.
Specifically, from the NCGR-G, it matches:

Colby Baldwin (PI 589103, GMAL 812), Loop Russet Baldwin (PI 589102, GMAL 811)
Antonovka Zbeltaia (PI 588800, GMAL 104) and Tohoku 4 (PI 255900, GMAL 354).

The NCGR-G's accession Baldwin (PI 589884, GMAL 277) does not match the above Baldwin mutations, nor any other accession in the database. I think it is misidentified. The two Baldwin mutations share an identical profile, suggesting that this is the valid reference profile for Baldwin. The other two accessions are likely also mislabeled. 'Tohoku 4' is a more recent variety reported to be 'Jonathan' x 'Worcester'. Further information from the NCGR-G and phenotype observations are necessary.

The sample "A-MdR-14 Russian Orchard/QH Apple" is most likely a Rhode Island Greening

Specifically, from the NCGR-G, it matches:

Rhode Island Greening (PI589520, GMAL2035) and Keukelaar Greening (PI589248, GMAL1318).

'Rhode Island Greening' is an extremely old variety with records apparently going back to Colonial times. 'Keukelaar Greening' is an expected mutation of 'Rhode Island Greening'.

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The three samples:

"D-MdC-33 Russian Orchard/QD Apple"

"C-MdR-8 Russian Orchard/QC Apple" and

"D-MdR-13 Russian Orchard/QD Apple" are different from one another and do not match any available reference DNA profile nor do they match any other sample within this set.

I am surprised to not find matches. The NCGR-G database of apple DNA profiles is rather comprehensive; it includes most accessions in their apple collection. The three unidentified trees at Fort Ross may not be represented in the Geneva collection or they may be among the few accessions that were not genotyped.

PLUM

We were also unable to identify the two plum samples:

"F-PceR-1 Call Orchard Plum" and

"H-PceR-2 Call Picnic Grounds/QH Plum", which are different from one another and do not match any available reference DNA profile.

The plum profiles were compared to the reference database developed in our lab based on FPS selections and to profiles provided by the National Clonal Germplasm Repository at Davis, California (NCGR-D) based on their collection. I am less surprised to find no matches for plum samples. Our plum databases are less robust than the apple database.

Enclosed, please find an invoice in the amount of \$2,385.00 for the services provided.

Thank you for using the FPS Plant DNA Identification Service.

Sincerely,

Jerry Dangl
 Plant Identification Lab Manager
 Phone: (530) 752-7540
 Email: gsdangl@ucdavis.edu

Pear DNA Analysis Results

Nahla V. Bassil
Plant Molecular Geneticist
USDA-ARS National Clonal Germplasm Repository
Corvallis, OR

Correspondence, Oct. 22, 2014:

“The result of our fingerprinting and comparison to pear DNA-based profiles we have in our database of ~400 pear trees indicated the following:

- Your # 42 [D-PcR-42] has the same DNA profile as ‘Vicar of Winkfield’
- Your # 23 [D-PcR-23] has the same profile as ‘Bartlett’ a.k.a ‘Williams Bon Chretien’
- # 6 [D-PcC-6] did not match anything in our database
- # 38 [D-PcR-38] did not match anything in our database but was closest to ‘Vermont Beauty’”

Fruit Identification Summary

Tree ID#	Species	Testing Agency	Determination
A-MdR-14	Apple	USDA ARS, Davis, CA	Rhode Island Greening
B-MdR-4	Apple	USDA ARS, Davis, CA	Gravenstein
B-MdC-9	Apple	Felix Gillet Institute*	Late Strawberry (same group as Baldwin below)
B-MdC-15	Apple	USDA ARS, Davis, CA	Baldwin
B-MdC-16	Apple	Felix Gillet Institute	Fameuse family
C-MdR-8	Apple	USDA ARS, Davis, CA	No Match
D-MdC-12	Apple	Felix Gillet Institute	Duchesse d'Oldenburg
D-MdR-13	Apple	USDA ARS, Davis, CA	No Match
"	Apple	Felix Gillet Institute	Meseau de Lievre Rouge/ Golden Spire
D-MdC-33	Apple	USDA ARS, Davis, CA	No Match
G-MdR-1 (Benitz)	Apple	USDA ARS, Davis, CA	Crimson Gold
A-PcR-17	Pear	Felix Gillet Institute	Conference Pear (same as Vicar of Winkfield below)
D-PcC-6	Pear	USDA ARS, Corvallis, OR	No Match
D-PcR-23	Pear	USDA ARS, Corvallis, OR	Bartlett
D-PcR-38	Pear	USDA ARS, Corvallis, OR	No Match- similar to Vermont Beauty
"	Pear	Felix Gilet	No Match
D-PcR-42	Pear	USDA ARS, Corvallis, OR	Vicar of Winkfield (A-PcR-16, A-PcR-17, A-PcR-18, E-PcR-19, and E-PcR-22 same variety)

* Visual Identification completed 1/19/2015 by Jenifer Bliss, Researcher for the Felix Gillet Institute:

The Felix Gillet Institute (The FGI)
 P.O. Box 942
 N. San Juan, CA 95960
 Phone: (530) 292-3619
 e-mail: thefgi@gmail.com
 Website: felixgillet.org

APPENDIX IV. SOIL FERTILITY ANALYSIS



PERRY LABORATORY
HORTICULTURAL ADVISING AND TESTING

Susan Rudy
22655 Highway 1
Jenner, CA 95450

424 AIRPORT BOULEVARD
WATSONVILLE, CA 95076
Telephone 831/722-7606
Fax 831/722-5053

July 11, 2014

Chemical analyses on samples received: July 8, 2014

Sample Identification	pH saturated paste	Electrical Conductivity dS/m	Nitrate Nitrogen (N)	Ammonium Nitrogen (N)	Phosphorus (P)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)	Sulfate (SO ₄)	Boron (B)	Zinc (Zn)	Copper (Cu)	Manganese (Mn)	Iron (Fe)
		Saturated paste extract	RESULTS REPORTED IN PARTS PER MILLION OF DRY SOIL											
Tree Crops- Normal Levels	5.0- 6.5	<2.0	25+	0-25	9+	100- 200	2000- 4000	100- 400	20- 50	0.5- 1.5	1.5- 2.5	0.8- 1.2	8- 12	10- 20
Fort Ross Orchard.														
1. Quad Gate Entrance	5.6	0.7	18	8	1	190	4000	835	18	0.3	4.4	2.2	84	221
2. Quad D Capulin Cherry	6.2	0.8	23	13	4	420	4000	895	10	0.3	6.0	1.5	97	109
3. Quad D Late Gravenstein	5.7	0.5	3	8	5	305	3900	570	14	0.3	6.8	1.6	49	206
4. Quad F Call Orchard	5.4	0.5	10	8	8	250	4200	485	14	0.3	9.1	1.7	62	225

S E R V I N G A G R I C U L T U R E S I N C E 1 9 3 8



PERRY LABORATORY

HORTICULTURAL ADVISING AND TESTING

Susan Rudy
 Fort Ross Orchard
 7/11/14
 Page 2

The pH values of these soils are moderately acid in reaction and are generally satisfactory for most fruit trees. The levels of soluble salt are safely low in these soils.

The fertility analyses show low nitrogen, phosphorus and sulfate for all samples at this time. The potassium, calcium, boron, zinc, and copper concentrations are in satisfactory ranges. The manganese and iron levels are somewhat higher than necessary.

It is recommended that additional nitrogen, phosphorus and sulfate be applied to these trees at this time. The nitrogen can be applied at a rate of 2.0 lbs of actual nitrogen per 1000 square feet of drip zone area. The phosphorus can be supplied at a rate of 1.0 lbs of phosphate per 1000 square feet. The following fertilizer materials might be applied per 1000 square feet:

Ammonium sulfate (21-0-0)	8.5 lbs
Monoammonium phosphate (12-61-0)	1.5 lbs

In the fall, an application of the following is recommended per 1000 square feet:

6-24-24 mixed fertilizer	20.0 lbs
Oyster Shell Lime	25.0 lbs

If you have any questions, please feel free to contact me.

Respectfully submitted,

Clifford B. Low, M.S.

APPENDIX V. PRESERVATION MAINTENANCE TASK CALENDAR

	January	February	March	April	May	June	July	August	September	October	November	December
Prune dead, diseased & damaged material	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Gopher trapping	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Spray dormant oils for overwintering pests	Olive	Olive										Olive
Prune canopy for structure	Olive	Olive										Olive
Brush & vegetation removal	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
IPM monitoring for pests			Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink
Mulch around trees			Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
Spray invasive/unwanted vegetation			Olive	Olive	Olive							
Prune suckers & watersprouts				Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink	Pink
Fertilize				Pink	Pink							
Fruit thinning				Pink	Pink							
Mow orchard floor				Red		Red						
Aerate tree root zones			Olive	Olive								
Prop heavy fruiting branches					Pink	Pink						
Irrigate new trees						Red	Red	Red				
Fireblight removal						Pink	Pink	Pink				
Harvest fruit								Pink	Pink	Pink	Pink	Pink

Suggested qualified work personnel:	
California State Park Staff	Red
Fort Ross Conservancy Volunteers	Pink
Private Professional	Olive
Any of the Above	Blue

APPENDIX VI. FRUIT RIPENING CHART

Species	Variety	Ripening period
apple	Baldwin	Late-November
apple	Crimson Gold type (Benitz Tree)	Unknown
apple	Gravenstein	Mid-September
apple	Late Gravenstein	Late October
apple	Rhode Island Greening	Mid-November
apple	Russet Baldwin	Late-November
apple	Unknown or Rootstock (A-1)	October
apple	Unknown or Rootstock (C 6-10)	Late-November
cherry	Capulin Cherry	Flower- October rains. Fruit- January-February
cherry	Sweet Cherry trees outside Russian Orchard	Unknown
pear	Similar to Vermont Beauty	Late September
pear	Vicar of Winkfield	Mid-November

APPENDIX VII. FRUIT TREE CONDITION ASSESSMENT SUMMARY

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
A-MdC-1	Russian Orchard	5/9/2014	apple	Late Gravenstein	6.2"	good	overgrown groundcover	95	
A-MdC-2	Russian Orchard	5/9/2014	apple	Late Gravenstein	7.3"	good	overgrown groundcover, lichen, deer scars on scaffolds, root suckers	90	remove deadwood
A-MdC-3	Russian Orchard	5/9/2014	apple	Late Gravenstein	5.6"	poor	root suckers, moss/lichen, deadwood, limb loss, deer scars on scaffolds	30	remove deadwood
A-MdC-4	Russian Orchard	5/9/2014	apple	Rhode Island Greening	7.3"	good	overgrown groundcover, encroaching veg., loss of bark on trunk from mower, sapsucker holes	100	
A-MdC-5	Russian Orchard	5/9/2014	apple	Rhode Island Greening	9.8"	fair	basal cavities, moss/lichen, deadwood, trunk cavities	80	
A-MdC-6	Russian Orchard	5/9/2014	apple	Rhode Island Greening	6.1	poor	basal cavities, basal cankers, root suckers, trunk cavities, trunk cankers, deadwood	50	
A-MdC-7	Russian Orchard	5/9/2014	apple	Rhode Island Greening	7.1"	fair	trunk cankers, root suckers, moss/lichen, sapsucker holes, warty gall growth on trunk base, overshadowing	70	
A-MdC-8	Russian Orchard	5/9/2014	apple	Rhode Island Greening	6.2"	good	overgrown groundcover	80	
A-MdC-9	Russian Orchard	5/9/2014	apple	Rhode Island Greening	10.2"	good	root suckers, wildlife damage, moss/lichen	85	
A-MdC-10	Russian Orchard	5/9/2014	apple	Rhode Island Greening	10.6"	good	sapsucker holes, moss/lichen, deadwood, overshadowing	85	
A-MdC-11	Russian Orchard	5/9/2014	apple	Rhode Island Greening	4.7"	poor	root suckers, moss/lichen, unbalanced scaffolds, deadwood, watersprouts, deadwood, unbalanced canopy, terminal dieback, overshadowing	30	
A-MdC-12	Russian Orchard	4/15/2014	apple	Rhode Island Greening	11.5"	good	root suckers, sapsucker damage, moss/lichen, watersprouts	100	
A-MdC-13	Russian Orchard	4/15/2014	apple	Rhode Island Greening	9.8"	good	loss of trunk bark, girdling by weedeater, sapsucker holes	90	

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
A-MdR-14	Russian Orchard	4/15/2014	apple	Rhode Island Greening	12"	poor	drainage issues, rodent holes trunk base cavity, trunk flare buried, trunk cracks/splits, trunk cavity, leaning trunk, loss of limbs, deadwood, unbalanced scaffolds, encroaching veg., overshadowing	80	remove deadwood, brace trunk
A-MdR-15	Russian Orchard	4/15/2014	apple	Rhode Island Greening	9"	fair	Horizontal main trunk with cavity: drainage issues, accumulated debris, loss of bark, cavities, soil accumulation, trunk flare buried, trunk decay, leaning trunk, loss of limbs, deadwood, moss/lichen, encroaching vegetation, overshadowing	90	remove deadwood, brace trunk, lighten end weight
A-PcR-16	Russian Orchard	4/15/2014	pear	Vicar of Winkfield	20.5"	good	galls on trunk base, root suckers, sapsucker holes, deadwood, moss/lichen	85	remove lichen, deadwood, lighten end weight
A-PcR-17	Russian Orchard	5/9/2014	pear	Vicar of Winkfield	14.5	good	debris, drainage issues, soil accumulation, leaning trunk, limb loss, deadwood, pear sawfly larva, overshadowing		deadwood, prune to thin
A-PcR-18	Russian Orchard	5/9/2014	pear	Vicar of Winkfield	18"	fair	main trunk horizontal on ground: new leaders formed by watersprouts. Encroaching veg., drainage issues, root damage, exposed roots, root suckers, deadwood, fireblight, termites in dead wood, unbalanced canopy, unbalanced scaffolds, shoot dieback, moss/lichen	90	deadwood, prune to thin, raise lower limbs, desucker, select 1-3 new leaders
A-MdR-19	Russian Orchard	5/9/2014	apple		-	dead	Ranch-era tree, dead only remnants of trunk are extant	-	
A-MdC-20	Russian Orchard	5/9/2014	apple	Rhode Island Greening	10.9"	good	root suckers, sapsucker damage, deadwood, overshadowing	90	
A-MdC-21	Russian Orchard	5/9/2014	apple	Rhode Island Greening	8.1"	fair	root suckers, sapsucker holes, sparse foliage	65	
A-MdC-22	Russian Orchard	5/9/2014	apple	Rhode Island Greening		fair	rodent holes, sapsucker damage, unbalanced canopy	65	
A-MdC-23	Russian Orchard	5/9/2014	apple	Rhode Island Greening	7.2"	good	sapsucker holes, encroaching veg	80	
A-MdC-24	Russian Orchard	5/9/2014	apple	Late Gravenstein	9.5"	good	sapsucker holes, moss/lichen	90	
A-MdC-25	Russian Orchard	5/9/2014	apple	Rhode Island Greening	5.8"	fair	trunk flare buried, foliage sparse	70	
A-PcC-26	Russian Orchard	5/9/2014	pear	Vicar of Winkfield	7"	good	overgrown groundcover	80	

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
A-PcC-27	Russian Orchard	5/9/2014	pear	Vicar of Winkfield	10.5"	good	root suckers, watersprouts	95	
A-PcC-28	Russian Orchard	5/9/2014	pear	Vicar of Winkfield	8.4"	good	root suckers, watersprouts	95	
A-PcC-29	Russian Orchard	5/9/2014	pear	Vicar of Winkfield	8.9"	good	overgrown groundcover, moss/ lichen, pill bugs in canopy	100	
A-PceR-30	Russian Orchard	5/9/2014	plum		13"	poor	Multi-trunked tree, fallen over. Overgrown groundcover, encroaching veg., accumulated debris, grade disturbance, root damage, root suckers, cavities, cracks & splits, deadwood, overshading	30	Potentially remove
B-PceR-1	Russian Orchard	5/9/2014	plum		-	dead	Tree was cut down at base, root suckers are only surviving element	-	Potentially remove
B-PceR-2	Russian Orchard	5/9/2014	plum		-	dead	Tree was cut down at base, root suckers are only surviving element	-	Potentially remove
B-MdC-3	Russian Orchard	5/9/2014	apple	Gravenstein	10.8"	good	overgrown groundcover, rodent holes, sapsucker damage, deadwood, unbalanced canopy	80	
B-MdR-4	Russian Orchard	4/15/2014	apple	Gravenstein	17.5"	poor	overgrown groundcover, encroaching redwood grove, accumulated debris, fruiting bodies, cracks/splits, soil accumulation, trunk flare buried, trunk decay/cavities, loss of limbs, moss/lichen, deadwood, sapsucker holes, white rot, unbalanced scaffold limbs, encroaching bay tree & coyote brush	50	Brace trunk, clear encroaching veg., propagate
B-MdC-5	Russian Orchard	5/9/2014	apple	Gravenstein	6.7"	poor-dead	overgrown groundcover, encroaching vegetation, root suckers, loss of bark, deadwood, watersprouts	50	
B-MdC-6	Russian Orchard	5/9/2014	apple	Gravenstein	2.8"	poor	overgrown groundcover, loss of bark, leaning trunk, unbalanced canopy, watersprouts	5	possible seedling volunteer
B-MdC-7	Russian Orchard	5/9/2014	apple	Gravenstein	5.4"	fair	overgrown groundcover, encroaching veg., sapsucker holes in trunk, unbalanced canopy	80	
B-MdC-8	Russian Orchard	5/9/2014	apple	Gravenstein		fair	overgrown groundcover, encroaching vegetation, root suckers	50	
B-MdC-9	Russian Orchard	5/9/2014	apple	Baldwin	4.7"	good	overgrown groundcover, loss of bark, leaning trunk, unbalanced scaffolds, watersprouts, moss/lichen	95	
B-MdC-10	Russian Orchard	5/9/2014	apple	Baldwin	5.8"	poor	overgrown groundcover, encroaching veg., root suckers, moss/lichen, deadwood,	50	Remove mature sucker

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
B-MdC-11	Russian Orchard	5/9/2014	apple	Baldwin	7.7"	poor	loss of bark, cavities at base, root suckers, sapsucker damage, moss/lichen, leaning trunk, deadwood, waterspouts	50	prune deadwood
B-PcC-12	Russian Orchard	5/9/2014	pear		5.9"	good	overgrown groundcover, encroaching veg., deadwood	95	
B-PcR-13	Russian Orchard	5/9/2014	pear		6.5"	fair	encroaching veg., moss/lichen, deadwood	70	
B-MdC-14	Russian Orchard	5/9/2014	apple	Baldwin	7.4"	poor	overgrown groundcover, moss/lichen, leaning trunk, deadwood, unbalanced canopy	50	
B-MdC-15	Russian Orchard	5/9/2014	apple	Baldwin	9.3"	fair	unbalanced scaffolds, moss/lichen, deadwood	70	
B-MdC-16	Russian Orchard	5/9/2014	apple	Baldwin	10.8"	good	root suckers, soil accumulation, moss/lichen	95	
B-MdC-17	Russian Orchard	5/9/2014	apple	Baldwin	8.4"	fair	root suckers, deadwood, foliage sparse	70	Remove mature sucker
B-MdC-18	Russian Orchard	5/9/2014	apple	Baldwin	12.2"	good	deadwood	90	deadwood
Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
B-MdC-19	Russian Orchard	5/9/2014	apple	Baldwin	11.5"	good	sapsucker holes, moss/lichen, deadwood	90	deadwood
B-PcR-20	Russian Orchard	6/11/2014	pear		9.1"	fair	overgrown groundcover, encroaching veg., gall on base, watersprouts, loss of limbs, deadwood, unbalanced canopy, overshadowing	70	remove crossing branches, remove encroaching plum
B-PcC-21	Russian Orchard	NA	pear			TBD			
B-PceC-22	Russian Orchard	NA	plum			TBD			
C-PcC-1	Russian Orchard	5/9/2014	pear	Unknown	4.3"	good	loss of bark, mechanical girdling, unbalanced scaffolds, poison oak at base	90	remove poison oak
C-PcC-2	Russian Orchard	5/9/2014	pear	Unknown	4"	fair	moss/lichen, watersprouts	80	
C-PcC-3	Russian Orchard	5/9/2014	pear	Unknown	4.9"	good	overgrown groundcover, watersprouts	80	
C-PcC-4	Russian Orchard	5/9/2014	pear	Unknown	5.7"	good	overgrown groundcover	85	

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
C-PcC-5	Russian Orchard	5/9/2014	pear	Unknown	4.2"	fair	overgrown groundcover, watersprouts	65	
C-MdC-6	Russian Orchard	5/9/2014	apple		8.1"	fair	overgrown groundcover, encroaching veg., deadwood, moss/lichen, foliage sparse, dieback of tips	60	
C-MdC-7	Russian Orchard	5/9/2014	apple		8.9"	fair	overgrown groundcover, cavities at base, foliage sparse	50	
C-MdR-8	Russian Orchard	4/15/2014	apple	Seedling	15"	poor	Tree is horizontal and laying on ground: overgrown groundcover, vole holes, grade disturbance, root damage, accumulated debris, root suckers, loss of bark at base, cavities, fruiting bodies, soil accumulation at base, leaning trunk, moss/lichen, foliage discolored, unbalanced canopy & scaffolds, dieback of tips, leaf spots	60	thinning and structural pruning, select several watersprouts to form new scaffold.
C-MdC-9	Russian Orchard	5/9/2014	apple		5.3"	fair	overgrown groundcover, root suckers, deadwood, watersprouts	65	
C-MdC-10	Russian Orchard	5/9/2014	apple		7.5"	fair	root suckers, girdling at base, deadwood, foliage sparse	65	
C-PceR-11	Russian Orchard	4/15/2014	plum	red/yellow fruit	24"	poor	Multi-trunked clump with numerous suckers, largest leader is 24" dbh, overgrown sucker thicket growth, cavities in trunks, cracks splits, suckers, deadwood, moss/lichen, leaf spot	90	remove suckers, thin and clean clump to establish new main leaders.
C-MdC-12	Russian Orchard	5/9/2014	apple	Baldwin	10.9"	good	root suckers	90	prune to clean
C-MdC-13	Russian Orchard	5/9/2014	apple	Baldwin	8.7"	good	moss/lichen, large wound on trunk	90	prune to clean & shape
C-MdC-14	Russian Orchard	5/9/2014	apple	Baldwin	11"	fair	canker disease in canopy, deadwood, decay/cavities	80	prune to clean & shape
C-MdC-15	Russian Orchard	5/9/2014	apple	Baldwin	9.3"	fair	sapsucker holes, small wounds on trunk, graft union visible	70	prune to clean & shape
C-MdC-16	Russian Orchard	5/9/2014	apple	Baldwin	9.9"	fair	soil accumulation, trunk flare buried, moss/lichen, deadwood	70	prune to clean & shape
C-PceR-17	Russian Orchard	NA	plum		Multi-stem	Poor			

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
D-PsP-1	Russian Orchard	4/15/2014	cherry	Capulin Cherry	35"	fair	overgrown groundcover, encroaching veg., grade disturbance (seismic uplift of slope), loss of bark and cavities on base, soil accumulation upslope, cracks/splits in trunk base, decay/cavities on trunk, deadwood, unbalanced canopy & scaffolds, deiback of terminal shoots (fungal)	65	Brace large scaffold limb, propagate,
D-PsP-2	Russian Orchard	4/15/2014	cherry	Capulin Cherry	33.5"	fair	overgrown groundcover, encroaching veg., grade disturbance (seismic uplift of slope), loss of bark and cavities on base, soil accumulation upslope, cracks/splits in trunk base, decay/cavities on trunk, deadwood, unbalanced canopy & scaffolds, deiback of terminal shoots (fungal)	70	deadwood, brace large scaffold limb (currently propped by live plum tree), head back to balance tree, test soil for nutrient deficiencies
D-PsP-3	Russian Orchard	4/15/2014	cherry	Capulin Cherry	19.5"	poor	Tree is leaning and propped by adjacent Capulin Cherry. Trunk only has 1/3 living cambium tissue. Foliage sparse, fruiting bodies, overgrown groundcover, encroaching veg., grade disturbance (seismic uplift of slope), loss of bark and cavities on base, soil accumulation upslope, cracks/splits in trunk base, decay/cavities on trunk, deadwood, unbalanced canopy & scaffolds, deiback of terminal shoots (fungal)	25	deadwood, prop and try to remove from neighboring supporting tree.
D-PcC-4	Russian Orchard	6/12/2014	pear		5"	fair	overgrown groundcover, unbalanced scaffolds & canopy, deadwood, pests, foliage discolored, overshadowing	70	prune to clean
D-PcC-5	Russian Orchard	6/11/2014	pear		5.5"	fair	overgrown groundcover, encroaching veg, basal cavities, watersprouts, deadwood, foliage discolored, crossing branches, overshadowing	70	prune to clean, remove crossing branches
D-PcC-6	Russian Orchard	6/11/2014	pear		3.2"	poor	loss of bark/bark damage to trunk, deadwood, foliage discolored, not thriving and nearly dead	20	
D-PcC-7	Russian Orchard	6/11/2014	pear		1.1"	poor	deadwood, watersprouts, foliage discolored, unbalanced canopy	15	remove
D-PcC-8	Russian Orchard	6/11/2014	Pear		3"	poor	girdling, deadwood, foliage discolored, lichen/moss, not thriving	30	prune to clean, or remove
D-PcC-9	Russian Orchard	6/10/2014	pear		3"	fair	overgrown groundcover, accumulated debris, unbalanced scaffolds, watersprouts, foliage discolored, lichen	66	prune watersprouts

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
D-PcC-10	Russian Orchard	6/10/2014	pear		2.8"	poor	encroaching veg., moss/lichen, deadwood, watersprouts, foliage sparse, unbalanced canopy, not thriving	40	remove
D-PcC-11	Russian Orchard	6/11/2014	pear		2.8"	poor	overgrown groundcover, plum suckers encroaching, deadwood, foliage discolored & sparse, lichen	15	remove
D-MdC-12	Russian Orchard	6/11/2014	apple	Unknown variety or seedling	11"	good	moss/lichen, deadwood, sapsucker damage	95	prune to clean
D-MdR-13	Russian Orchard	4/15/2014	apple	seedling	25"	poor	a.k.a. the "Mother" tree, possible Russian-era. . .check origin of cultivar. Root suckers, cracks/splits, cavities, loss of bark, decay/cavities, moss/lichen, foliage discolored, unbalanced canopy, leaf spot, cupped leaves, webbing on leaf undersides	70	K.Park pruned to clean and reduce end weight in 2014. Also propped one lower limb. Continue thinning & heading back to establish structure and strength
D-OeR-14	Russian Orchard	4/15/2014	olive	seedling	-	fair	Multi-trunked seedling tree planted by Mrs. Call. Overgrown groundcover, exposed roots, root suckers, deadwood, trunk decay/cavities, unbalanced canopy, tip dieback, lichen/moss	90	deadwood, sucker removal, remove crossing branches.
D-OeR-15	Russian Orchard	4/15/2014	olive	seedling	24"	poor	Multi-trunked seedling tree planted by Mrs. Call. Severely overgrown and encroached upon by plum suckers, accumulated debris, trunk cracks/splits/decay/cavities, deadwood, major pack rat nest, tip dieback, overshadowing, encroaching vegetation	10	structural pruning to reestablish shape
D-MdC-16	Russian Orchard	6/11/2014	apple	Bellflower	8"	good	basal cavities, root suckers, sapsucker holes, moss/lichen, deadwood, watersprouts, loss of limbs, pests, foliage discolored, unbalanced canopy	90	prune to clean & shape
D-MdC-17	Russian Orchard	6/11/2014	apple	Bellflower	11"	good	root suckers, sapsucker holes, moss/lichen, deadwood, trunk decay/cavities, foliage curled & discolored, diseases	90	prune to thin, reduce end weight, remove lower scaffold limb to create modified central leader tree.

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
D-OeR-18	Russian Orchard	4/15/2014	olive	seedling	-	fair	Multi-trunked seedling tree planted by Mrs. Call. Overgrown groundcover, exposed roots, root suckers, deadwood, trunk decay/cavities, unbalanced canopy, tip dieback, lichen/moss, sapsucker holes	80	deadwood, prune to clean, reduce end weight, remove crossing branches, remove adjacent seedling olive, plum and pear trees
D-OeR-19	Russian Orchard	6/12/2014	olive	seedling	18.6"	poor	Multi-trunked seedling tree planted by Mrs. Call. Overgrown groundcover, encroaching veg, accumulated debris, trunk cavities, unbalanced scaffolds & canopy, moss/lichen, deadwood, watersprouts, foliage sparse	30	prune to clean
D-PcC-20	Russian Orchard	6/11/2014	pear	Bartlett	5.75"	fair	pear slug (sawfly larva), deadwood, watersprouts, limb loss, fruit drop, lichen	60	prune to clean & open canopy
D-PcC-21	Russian Orchard	6/11/2014	pear	Bartlett	6.1"	poor	unbalanced scaffolds, moss/lichen, deadwood, root suckers, pear slug, discolored & sparse foliage, overshadowing from olives	40	prune crossing branches
D-PcC-22	Russian Orchard	6/11/2014	pear	Bartlett	3.75"	poor	encroaching veg, deadwood, pear slug, sparse & discolored foliage, unbalanced canopy, lichen, overshadowing olive trees	25	deadwood, remove encroaching veg
D-PcR-23	Russian Orchard	4/15/2014	pear	Bartlett	11"	poor	overgrown groundcover, encroaching veg, root suckers, cracks/splits, limb loss, trunk cavity/decay, lichen/moss, watersprouts, unbalanced canopy, encroaching veg, overshadowing canopy	5	remove seedling olive & plum trees & suckers, deadwood, prune to clean, renovation pruning for vigor, remove adjacent suckering trees.
D-PcC-24	Russian Orchard	6/11/2014	pear	Bartlett	4.5"	poor	early fruit drop, root suckers, unbalanced scaffolds, watersprouts, limb loss, pear slug, fireblight, lichen	40	prune watersprouts
D-PcC-25	Russian Orchard	6/11/2014	pear	Bartlett	5.5"	poor	root suckers, moss/lichen, watersprouts, deadwood, fireblight, foliage discolored, canker disease in canopy, lichen, overshadowing	40	prune watersprouts
D-MdC-26	Russian Orchard	6/11/2014	apple	Bellflower	9.5"	Fair	sapsucker damage, deadwood, earwig & leafhopper, foliage curled & discolored, fireblight, lichen	50	prune to clean, lichen & deadwood

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
D-MdC-27	Russian Orchard	6/11/2014	apple	Bellflower	9"	poor	overgrown groundcover, encroaching veg, trunk cavities, root suckers, watersprouts, deadwood, pests, foliage discolored, curled & sparse, unbalanced canopy, tip dieback, overshadowing and encroaching veg overhead	35	Remove to protect neighboring healthy tree of same variety.
D-MdC-28	Russian Orchard	6/11/2014	apple	Bellflower	7.75"	fair	root suckers, deadwood, pests, diseases, foliage discolored & curled, tip dieback, lichen, overshadowing & encroaching veg	65	heading cuts to separate tree from neighboring tree.
D-MdC-29	Russian Orchard	6/11/2014	apple	Late Gravenstein	6.5"	poor	root suckers, loss of trunk bark, deadwood, foliage sparse & discolored, tip dieback, lichen	50	prune to lower crown
D-MdC-30	Russian Orchard	6/11/2014	apple	Late Gravenstein	5.75"	poor	root suckers, loss of trunk bark, trunk cavities, cankers, moss/lichen, unbalanced scaffolds, pests & disease, foliage discolored & sparse	40	remove to protect neighboring apple tree
D-MdC-31	Russian Orchard	6/11/2014	apple	Late Gravenstein	5.25"	poor	loss of trunk bark, root suckers, diseases, foliage sparse	30	prune & fertilize
D-MdC-32	Russian Orchard	6/11/2014	apple	Late Gravenstein	5"	poor	loss of trunk bark, girdling of trunk, wildlife damage, foliage discolored & sparse, lichen, weakly rooted	25	remove
D-MdC-33	Russian Orchard	6/11/2014	apple	Late Gravenstein	7"	poor	rootsuckers, loss of bark, deadwood, foliage sparse & discolored, lichen	50	prune
D-MdC-34	Russian Orchard	6/11/2014	apple	Late Gravenstein	-	poor	root suckers, loss of bark, deadwood, foliage sparse & discolored, lichen, canker disease	30	prune
D-MdC-35	Russian Orchard	6/11/2014	apple	Late Gravenstein	5"	poor	loss of trunk bark, deadwood, pest & disease, lichen, foliage sparse and discolored, old deer rub wound on trunk	20	remove
D-MdC-36	Russian Orchard	6/11/2014	apple	Late Gravenstein	4.75"	poor	sunburn on trunk bark, root suckers, deadwood, pests & disease, foliage discolored, lichen	60	prune to clean
D-PcC-37	Russian Orchard	6/12/2014	pear	Similar to Vermont Beauty	4.5"	fair	rodent holes at base, bark loss on trunk, watersprouts, pests, lichen, foliage discolored	80	prune for structure, heading cuts
D-PcR-38	Russian Orchard	4/15/2014	pear	Similar to Vermont Beauty	17"	poor	Leaning tree, cavity in trunk, much lichen. Overgrown groundcover, encroaching veg, accumulated debris, drainage issues, hanging deadwood, decay/cavities, leaning trunk, limb loss, deadwood	75	deadwood, heading cuts, crown reduction, brace lower limb
D-PcC-39	Russian Orchard	6/12/2014	pear	rootstock	2.3"	good	pests, foliage discolored, lichen	90	remove: roostock

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D-PcC-40	Russian Orchard	6/12/2014	pear	Similar to Vermont Beauty	3.5"	poor	unbalanced scaffolds, leaning trunk, watersprouts, pests & disease, lichen	70	crown reduction
D-PcC-41	Russian Orchard	6/12/2014	pear	Similar to Vermont Beauty	6.5"	good	drainage issues: boggy in wet season. Moss/lichen, pear slug & diabrotica beetle	85	prune to clean, remove crossing branches
D-PcR-42	Russian Orchard	4/15/2014	pear	Vicar of Winkfield	19"	fair	overgrown groundcover, encroaching trees outside fence line, limb loss, deadwood, moss/lichen, unbalanced canopy & scaffold limbs, indirect overshading, pear sawfly larva	90	deadwood, lichen removal
D-PcC-43	Russian Orchard	6/12/2014	pear	Similar to Vermont Beauty	4.5"	fair	encroaching vegetation, cracks/splits in trunk, limb loss, unbalanced canopy	60	heading cuts, prune for structure
E-PaR-1	Outside Fence	4/15/2014	cherry	Sweet Cherry	23"	poor	encroaching vegetation, rodent holes, grade disturbance, root damage, exposed roots, accumulated debris, loss of soil, trunk cavities, soil accumulation, trunk cracks/splits, deadwood, leaning trunk, cankers/fruitlet bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshading trees	60	remove broken & fallen limbs to rebalance canopy, brace trunk.
E-PaR-2	Outside Fence	4/15/2014	cherry	Sweet Cherry	17"	poor	encroaching vegetation, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruitlet bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshading trees,	40	prune to clean, support with brace or cable
E-PaR-3	Outside Fence	4/15/2014	cherry	Sweet Cherry	18"	poor	encroaching vegetation, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruitlet bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshading trees,	5	prune back to sprout at trunk to establish a new leader.

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
E-PaR-4	Outside Fence	4/15/2014	cherry	Sweet Cherry	27.5"	poor	encroaching vegetation, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees,	50	prune to clean
E-PaR-5	Outside Fence	4/15/2014	cherry	Sweet Cherry	19.5"	poor	overgrown groundcover, encroaching vegetation, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities (center rotted out, probably hollow), soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees,	30	prune back encroaching redwoods to provide increased light
E-PaR-6	Outside Fence	6/12/2014	cherry	Sweet Cherry	19"	poor	encroaching veg, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees,	20	Prune to clean, install supports, monitor for change
E-PaR-7	Outside Fence	6/12/2014	cherry	Sweet Cherry	17"	poor	overgrown groundcover, encroaching veg, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities (center rotted out, probably hollow), soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees,	15	Prune to clean, install supports, monitor for change
E-PaR-8	Outside Fence	4/15/2014	cherry	Sweet Cherry	21.5"	poor	encroaching vegetation, rodent holes, grade disturbance, root damage, exposed roots, accumulated debris, trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees,	20	Prune to clean, install supports, monitor for change, prune back encroaching redwoods to provide increased light

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
E-PceC-9	Outside Fence	6/12/2014	plum	Rootstock or seedling	5.8"	poor	overgrown groundcover, encroaching vegetation, accumulated debris, root suckers, loss of trunk bark, cracks/splits, unbalanced scaffolds, moss/lichen, trunk decay/cavities, limb loss, watersprouts, deadwood, leaning trunk, unbalanced canopy	20	fruit is elongated, likely different species than in Call orchard.
E-PceC-10	Outside Fence	6/12/2014	plum	Rootstock or seedling	7.1"	poor	grade disturbance, loss of soil at roots, exposed roots, trunk cavities, unbalanced scaffolds, moss/lichen, deadwood, loss of limbs, unbalanced canopy	15	prune to clean
E-MdR-11	Outside Fence	6/12/2014	apple		13.1"	poor	grade disturbance, loss of soil at roots, exposed roots, suckers, trunk cavities, cracks/splits, unbalanced scaffolds, moss/lichen, deadwood, loss of limbs, unbalanced canopy, leaning trunk, watersprouts, foliage sparse	20	prune
E-PaR-12	Outside Fence	6/12/2014	cherry	Sweet Cherry	8.3"	poor	encroaching vegetation, grade disturbance, root damage, exposed roots, foot path on roots, root damage, accumulated debris, , trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruitlet bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees, half of tree fell over	12	prune
E-PaR-13	Outside Fence	6/12/2014	cherry	Sweet Cherry	8.5"	poor	encroaching vegetation, accumulated debris, grade disturbance, loss of soil, loss of trunk bark, trunk cavities, trunk cracks/splits, unbalanced scaffolds, moss/lichen, deadwood, watersprouts, loss of limbs, foliage sparse, tip dieback, encroaching/overshading trees	12	prune
E-PaR-14	Outside Fence	6/12/2014	cherry	Sweet Cherry	11"	poor	overgrown groundcover, encroaching vegetation, accumulated debris, grade disturbance, root damage, loss of soil, exposed roots, accumulated debris, fruiting bodies, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruitlet bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees, grazing path over roots, top broken off on both sides	12	prune

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
E-PaR-15	Outside Fence	6/12/2014	cherry	Sweet Cherry	7"	dead	encroaching vegetation, grade disturbance, root damage, loss of soil, loss of bark, exposed roots, accumulated debris, trunk cavities (center rotted out, probably hollow), soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees,	3	remove
E-PceC-16	Outside Fence	6/12/2014	plum	seedling	6.6"	poor	encroaching vegetation, accumulated debris, root suckers, unbalanced scaffolds, moss/lichen, trunk decay/cavities, leaning trunk (horizontal), deadwood, watersprouts, limb loss, deadwood, unbalanced canopy. Tree is fallen over	15	remove
E-PaR-17	Outside Fence	6/12/2014	cherry	Sweet Cherry	8.5"	poor	multi trunked tree, falling over. Grade disturbance, path over roots, root damage, accumulated debris, loss of soil, exposed roots. Trunk bark loss, trunk cavities, trunk cracks/splits, soil accumulation. Unbalanced scaffolds, leaning trunk, moss/lichen, deadwood, trunk decay/cavities, limb loss, foliage sparse, unbalanced canopy. encroaching/overshading trees.	15	prune, brace
E-PaR-18	Outside Fence	6/12/2014	cherry	Sweet Cherry	12.2"	dead	encroaching vegetation, accumulated debris, grade disturbance, root damage, loss of soil, exposed roots, accumulated debris, fruiting bodies, trunk cavities, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds	3	remove
E-PcR-19	Outside Fence	6/12/2014	pear	Vicar of Winkfield?	16.8"	poor	encroaching vegetation, accumulated debris, grade disturbance, cattle path over roots, trunk cavities, moss/lichen, trunk decay/cavities (trunk hollow, rotted out), top of tree fallen off, leaning trunk, deadwood, unbalanced canopy, heavily fruiting, overshadowing/encroaching trees	40	remove encroaching veg,
E-PaR-20	Outside Fence	6/12/2014	cherry	Sweet Cherry	6.8"	poor	encroaching vegetation, overgrown groundcover, loss of bark, trunk cavities, fruiting bodies, trunk flare buried, trunk decay/cavities, deadwood, leaning trunk, limb loss, moss/lichen, unbalanced scaffolds, encroaching overshadowing trees	20	prune

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
E-PceR-21	Outside Fence	6/12/2014	plum	seedling	9.9"	poor	multi-stem tree, fallen over and scattered leaders. encroaching veg, accumulated debris, grade disturbance, root suckers, trunk cavities, trunk cracks/splits, unbalanced scaffolds, leaning trunk, deadwood, watersprouts, limb loss, trunk decay/cavities, unbalanced canopy, lichen. few fruit	30	prune
E-PcR-22	Outside Fence	6/12/2014	pear	Vicar of Winkfield	17.1"	good	encroaching veg, accumulated debris, exposed roots, unbalanced scaffolds, leaning trunk, deadwood, unbalanced canopy, overshadowing/encroaching trees	60	prune overshadowing redwoods
E-PaR-23	Outside Fence	6/12/2014	cherry	Sweet Cherry	7.7"	poor	multi stemmed tree, falling down slope into sag pond. Overgrown groundcover, encroaching veg, accumulated debris, trunk cavities, soil accumulation, trunk flare buried, trunk cracks/splits, deadwood, leaning trunk, cankers/fruiting bodies, limb loss, moss/lichen, unbalanced canopy, unbalanced scaffolds, encroaching overshadowing trees, half of tree fell over	15	prune
E-PaR-24	Outside Fence	6/12/2014	cherry	Sweet Cherry	9.8"	poor	Overgrown groundcover, encroaching vegetation, accumulated debris, limb loss, leaning trunk, moss/lichen, unbalanced canopy, unbalanced scaffolds, tip dieback, encroaching overshadowing trees	30	prune
E-PaR-25	Outside Fence	6/12/2014	cherry	Sweet Cherry	5.5"	poor	Overgrown groundcover, encroaching vegetation, accumulated debris, moss/lichen, unbalanced canopy, unbalanced scaffolds, leaning trunk, deadwood, foliage sparse, top broken off at 10' high	30	prune
F-Pce-R-1	Call Orchard	6/12/2014	plum	Rootstock or seedling, yellow fruit	-	poor	13 stem multi-stemmed tree, very broad with some horizontal stems growing upright at a distance from the center. yellow fruit, encroaching vegetation, root damage, accumulated debris, exposed roots, trunk cavities, fruiting bodies, trunk cracks/splits, root suckers, wildlife damage (cow & deer), unbalanced scaffolds, moss/lichen, leaning trunks, deadwood, watersprouts, limb loss, deadwood, pests, unbalanced canopy	70	possible rootstock with yellow fruit, prune deadwood, remove hangers, prop leaning limbs

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
F-Pce-R-2	Call Orchard	6/12/2014	plum	Rootstock or seedling	-	poor	multi-stemmed tree, broad dripline from fallen over main stems. Drainage issues, cattle browsing under/around canopy. Accumulated debris, root suckers, loss of bark, trunk cavities, gall(s) on trunk, unbalanced scaffolds, moss/lichen, trunk decay, deadwood	70	prune from within but leave outer deadwood as "armor" against cows and deer
F-PceR-3	Call Orchard	6/12/2014	plum	Rootstock or seedling	-	poor	multi stemmed tree, broad dripline from fallen over main stems. cattle browsing under/around canopy. Accumulated debris, cracks/splits on trunk, wildlife damage, loss of bark, trunk cavities, unbalanced scaffolds, moss/lichen, trunk decay, deadwood, leaning trunk, watersprouts, limb loss, foliage curled, unbalanced canopy	50	Deadwood but leave fallen large dead limbs as armor against grazing animals.
F-PceR-4	Call Orchard	6/12/2014	plum	Cultivar red fruit	12"	poor	Tree is small and nearly dead, with red fruit. cow trampling around dripline, root damage, accumulated debris, exposed roots, loss of trunk bark, trunk cavities, trunk cracks/splits, wildlife damage, unbalanced scaffolds, moss/lichen limb loss, deadwood, foliage sparse & discolored, diseases (potentially Eutypia), unbalanced canopy, tip tieback, possibly original tree, not root stock	10	prune, brace
F-PceR-5	Call Orchard	6/12/2014	plum	Cultivar or seedling, Red fruit	4.3"	poor	Tasty red fruit, possibly original tree not rootstock. Tree small and not multi-stemmed, one remaining stem fallen over & laying on ground. Encroaching vegetation, accumulated debris, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, deadwood, watersprouts, limb loss, foliage sparse, tip dieback, unbalanced canopy	15	Deadwood, leave fallen limbs as protection from animals. Possibly propagate
F-PceR-6	Call Orchard	6/12/2014	plum	Rootstock or seedling	-	poor	Broad multi-stemmed thicket. Encroaching veg, overgrown groundcover, accumulated debris, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, deadwood, watersprouts, limb loss, foliage sparse & discolored, tip dieback, unbalanced canopy, overshadowing from nearby trees.	40	Deadwood but leave fallen large dead limbs as armor against grazing animals.
F-PceR-7	Call Orchard	6/12/2014	plum	Rootstock or seedling Yellow/pink fruit	14.8"	poor	soil compaction from cattle, accumulated debris, exposed roots, trunk cavities, cracks or splits, unbalanced scaffolds, leaning trunk, moss/lichen, limb loss, deadwood, diseases, foliage sparse, tip dieback, lichen	25	prune

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
F-PceR-8	Call Orchard	6/12/2014	plum	Rootstock or seedling	-	poor	Encroaching vegetation, overgrown groundcover, accumulated debris, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, deadwood, watersprouts, limb loss, foliage sparse, early leaf drop, low fruit productivity	25	Deadwood, leave fallen limbs as protection from animals. Bracing for main stems.
F-PceR-9	Call Orchard	6/12/2014	plum	Rootstock or seedling	11.2"	poor	overgrown groundcover, accumulated debris, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss, foliage sparse, early leaf drop, low fruit productivity, red spots on leaves - leaf spot	25	Deadwood, leave fallen limbs as protection from animals
F-PaR-10	Call Orchard	6/12/2014	cherry	Sweet Cherry	20"	poor	3-stem tree, only one living. Accumulated debris, cattle compaction, root damage, exposed roots, loss of trunk bark, trunk cavities, cracks or splits, root suckers, wildlife damage, rodents, unbalanced scaffold & canopy, leaning trunk, deadwood, disease (bacterial ooze/gummosis on stem), limb loss, foliage discolored & curled	30	prop surviving stem, prune to clean
F-PceR-11	Call Orchard	6/12/2014	plum	Rootstock or seedling? Red fruit	31.6	poor	large multi stemmed broad thicket, red fruit and spikes. Overgrown groundcover, accumulated debris, loss of bark, trunk galls, unbalanced scaffolds & canopy, leaning trunks, moss/lichen, deadwood, watersprouts, limb loss, tip dieback	40	Deadwood, leave fallen limbs as protection from animals. Bracing for main stems.
F-PceR-12	Call Orchard	6/12/2014	plum	Rootstock or seedling yellow fruit	-	poor	large multi stemmed broad thicket, yellow fruit. Overgrown groundcover, encroaching vegetation, root damage, loss of soil, root suckers, exposed roots, loss of bark, trunk galls, unbalanced scaffolds & canopy, leaning trunks, moss/lichen, deadwood, watersprouts, limb loss, tip dieback. Possibly root stock growth on east side of tree, probably original variety on west side of tree	40	prune to clean, deadwood
F-JrR-13	Call Orchard	6/12/2014	walnut	English Walnut	22.5"	fair	Multi stem (3), exposed roots, unbalanced scaffolds, leaning trunk, trunk decay/cavities, foliage sparse	50	prune, brace

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
F-PceR-14	Call Orchard	6/12/2014	plum	Rootstock or seedling	14.5"	poor	main stem horizontal on ground. overgrown groundcover, accumulated debris, root damage, loss of soil, exposed roots, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss, foliage discolored & sparse, early leaf drop, no fruit, doing poorly	25	prune
F-PceR-15	Call Orchard	6/12/2014	plum	Rootstock or seedling	-	fair	large multi trunked thicket, new trees establishing from fallen, rooted branches. Sapsucker holes, vigorous new growth. Accumulated debris, root suckers, watersprouts, limb loss, exposed roots, loss of trunk bark, trunk cavities, cankers, unbalanced scaffold & canopy, deadwood	75	prune to clean, deadwood, leave fallen limbs as protection from animals.
F-PaR-16	Call Orchard	6/12/2014	cherry	Possible roostock	12.6"	poor	trunk cavities, unbalanced scaffolds, leaning trunk, deadwood, pests	40	prune & deadwood
F-MdR-17	Call Orchard	6/12/2014	apple		29"	dead	tree dead but new growth emerging from base - possible scion wood for propagation. Drainage issues, accumulated debris, trunk cavities, cracks or splits, deadwood, watersprouts	0	possibly propagate
F-MdR-18	Call Orchard	6/12/2014	apple		11.3"	poor	accumulated debris, trunk cavities, cracks or splits, leaning trunk, deadwood, unbalanced canopy	50	prune
G-MdR-1	Benitz Orchard	6/11/2014	apple	Similar to Crimson Gold	14"	fair	Encroaching vegetation, root suckers, loss of trunk bark, trunk cavities, cracks or splits, unbalanced scaffolds, deadwood, limb loss, diseases, lichen, high propagation potential - sole Benitz tree found so far	85	Propagate, Prune to clean and for structure.
H-PceR-1	Call Picnic area	6/13/2014	plum		6.4"	poor	overgrown groundcover, encroaching vegetation, accumulated debris, root suckers, soil accumulation, trunk flare buried, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss	12	remove encroaching veg and water sprouts, prune to clean
H-PceR-2	Call Picnic area	6/13/2014	plum	Red ffruit	6.5"	poor	accumulated debris, root suckers, soil accumulation, soil compaction, trunk flare buried, loss of trunk bark, leaning trunk, unbalanced scaffolds & canopy, leaning trunk, deadwood, watersprouts, limb loss, lichen, overshadowing/encroaching trees.	30	propagate, deadwood, prune to clean, remove crossing branches, prune back overhanging eucalyptus branches

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
H-PceR-3	Call Picnic area	6/13/2014	plum		7.3"	poor	multi trunked tree, 7.3" dbh largest stem. overgrown groundcover, encroaching vegetation, accumulated debris, root suckers, soil accumulation, trunk flare buried, loss of trunk bark, cavities, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss, overshadowing/encroaching trees.	40	clear debris from floor, remove overhanging limbs above canopy
H-PceR-4	Call Picnic area	6/13/2014	plum		21.2"	poor	multi trunked tree, 21.2" dbh at base. encroaching veg, accumulated debris, soil accumulation, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss,	30	clear debris from floor, remove watersprouts.
H-PceR-5	Call Picnic area	6/13/2014	plum		8.8"	poor	overgrown groundcover, encroaching veg, accumulated debris, root suckers, soil accumulation, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss, lichen, overshadowing/encroaching trees	20	remove water sprouts, remove overhanging tree limbs.
H-PceR-6	Call Picnic area	6/13/2014	plum	red, round fruit	12.3"	poor	overgrown groundcover, accumulated debris, root suckers, soil accumulation, leaning trunk, unbalanced scaffolds & canopy, deadwood, lichen, overshadowing/encroaching trees	60	deadwood, remove crossing branches, remove overhanging eucalyptus branches
H-PceR-7	Call Picnic area	6/13/2014	plum		12.4"	dead	Tree fallen over, still fruiting. Roots pulled out of ground. overgrown groundcover, encroaching vegetation, accumulated debris, leaning trunk	5	remove
H-MdR-8	Call Picnic area	6/13/2014	apple	Possible Bellflower	10.7"	poor	accumulated debris, loss of trunk bark, soil accumulation, trunk decay/cavities (hollow trunk), unbalanced scaffolds & canopy, leaning trunk, deadwood, watersprouts, limb loss, foliage discolored, disease, overshadowing	15	prune, brace
H-MdR-9	Call Picnic area	6/13/2014	apple		13"	poor	Tree fallen over but alive. overgrown groundcover, encroaching vegetation, accumulated debris, loss of trunk bark, cavities, cracks & splits on trunk, leaning trunk, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss, lichen, encroaching/overshading trees	10	Propagate, brace, prune to clean

Field ID	Location	Date Assessed	Species	Variety	DBH	Condition	Inspection Notes	% live canopy	Recommendations
H-MdR-10	Call Picnic area	6/13/2014	apple		14.7"	poor	overgrown groundcover, encroaching vegetation, accumulated debris, root damage, exposed roots, cavities, cracks & splits on trunk, leaning trunk, root suckers, unbalanced scaffolds & canopy, deadwood, watersprouts, limb loss, lichen, encroaching/overshading trees.	35	Propagate, brace, prune to clean
H-MdC-11	Call Picnic area	6/13/2014	apple		2"	poor	overgrown groundcover, encroaching vegetation (blackberries), accumulated debris, root suckers, lichen. Possibly grafted from tree in Benitz or Call Orchards. Planted by grandmother of Cress Cresswell about 20 years ago.	75	remove encroaching vegetation, prune to shape
H-MdC-12	Call Picnic area	6/13/2014	apple		4.2"	fair	overgrown groundcover, encroaching vegetation, accumulated debris, soil accumulation, unbalanced scaffolds & canopy, deadwood, watersprouts, lichen, encroaching/overshading trees	50	prune for structure, remove overshading tree limbs.
H-PceR-13	Call House	6/13/2014	plum	red fruit	20"	good	two vigorous leaders, measured largest. Unbalanced scaffolds, moss/lichen, fruiting body on one trunk, trunk decay or cavities, limb loss, watersprouts, leaning trunk, deadwood	90	prune to thin, deadwood, cable to prevent failure onto house
H-PceR-14	Call House	6/13/2014	plum	green fruit	9.5"	fair	encroaching vegetation, rodent holes, accumulated debris, root suckers, lichen, encroaching/overshading trees, unbalanced scaffolds & canopy, leaning trunk, deadwood, limb loss, watersprouts, lichen, encroaching/overshading trees	90	prune to thin, deadwood, remove encroaching veg and hammock from trunk.
I-MdC-1	Rotchev House	6/13/2014	apple		15"	good	soil compaction from foot traffic, root suckers, deadwood, lichen	90	mulch under canopy to mitigate compaction, prune to clean.
I-MdC-2	Rotchev House	6/13/2014	apple		10.5"	good	soil compaction from foot traffic, root suckers, deadwood, lichen	90	mulch under canopy to mitigate compaction, prune to clean.

APPENDIX VIII. RANCH ERA FRUIT CULTIVARS IN THE RUSSIAN ORCHARD

APPLE (*MALUS DOMESTICA*) CULTIVARS

Excerpted and adapted from *The Apples of New York, Volumes I and II* (Beach, Booth, and Taylor 1905).

Baldwin

Soon after 1740, the Baldwin came up as a chance seedling on the farm of Mr. John Ball, near Lowell, Massachusetts. The farm eventually came into the possession of a Mr. Butters, who gave the name Woodpecker to the apple because the tree was frequented by woodpeckers. The apple was long known locally as the Wookdpecker, Pecker, or Butters. A surveyor of Woburn, brought the cultivar to the attention of Col. Baldwin of the same town, by whom it was propagated and more widely introduced in Eastern Massachusetts as early as 1784. By the 1850s, the Baldwin was the most popular apple in New England and also a common export. By the early 20th century, the Baldwin was the leading variety in the commercial orchards in New York, New England, certain regions in Southern Canada, and parts of the Midwest. It was also grown in the West and continued to be widely exported.

The tree is a strong grower, long-lived and vigorous. It is somewhat slow in reaching bearing maturity, but when mature it bears very abundantly. The Baldwin is grown

Figure A8.1: *Baldwin* (Beach, Booth, and Taylor 1905, *The Apples of New York*).



successfully on various soils and under various climatic conditions. The fruit is uniform with a low percentage of culls, although susceptible to apple scab fungus. The Baldwin is a bright red winter apple, above medium in size or large, and very good in quality. The fruit form is roundish to conic, varying to roundish oblong.

Gravenstein

The exact origin of the Gravenstein is unknown. It has been attributed to the region of Schleswig-Holstein, Germany in the mid-1700s, and was historically common in Germany and Sweden. The tree is typical of German apples in its growth and foliage. The Gravenstein was probably imported to the United States prior to 1826. In Sonoma County, Sebastopol became a leading producer of the early ripening Gravenstein around the turn of the 20th century.

The tree is large and vigorous and has an upright spreading to roundish, open form. It is quite productive and a reliable cropper. The fruit ripens early but does not store well. The fruit is large to above medium with a fairly uniform size but has an irregular shape. The form is oblate to roundish, broad at the base, and slightly angular about the basin. The skin is thin and greenish-yellow to orange-yellow overlaid with broken stripes of light or dark red. The cultivar found in the orchard at Fort Ross, Gravenstein Washington Red, is an improved red strain of Gravenstein which is important in California. The flesh is yellowish and firm, moderately tender, juicy, and aromatic.



Figure A8.2: *Gravenstein* (Beach, Booth, and Taylor 1905, *The Apples of New York*).

Rhode Island Greening

The Rhode Island Greening likely originated near Newport, Rhode Island in the historic area of Green's End. A tavern owner named Mr. Green is said to have raised apples from seed. One of these apple trees bore a large green apple. The scions of this tree were in such demand that the tree died from excessive cuttings. Early on the apples grown from these cuttings were known as Green's Inn apple from Rhode Island. The tree was documented in the early to mid- 18th century. By the early 20th century Rhode Island Greening was common in the very oldest orchards and, at the same time, was an important and widespread commercial variety.

The tree is long-lived and eventually becomes large although it is not an exceptionally rapid grower. Generally it is a reliable cropper and productive. It is hardy, strong, vigorous, and usually healthy, although both the foliage and the fruit are prone to apple-scab fungus. In some locations the limbs are susceptible to canker. The apple, as the name indicates, is green in color. It is commonly deep grass-green in autumn. As it ripens, the fruit develops becomes more yellowish. It often has a dull blush and occasionally develops a rather bright red cheek but is never striped. It is a one of the best apples for cooking. While it ripens early, it is not a good keeper.

Figure A8.3: *Rhode Island Greening* (Beach, Booth, and Taylor 1905, *The Apples of New York*).



PEAR (*PYRUS COMMUNIS*) CULTIVARS

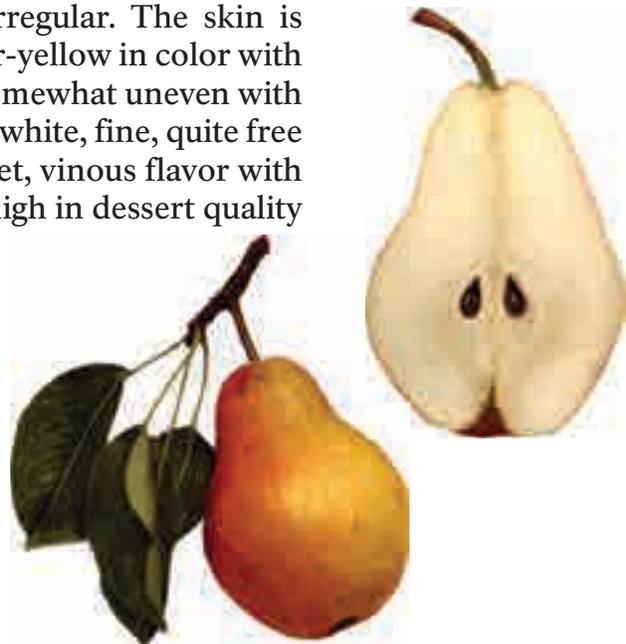
Excerpted and adapted from the National Germplasm Resources Laboratory Online Database (USDA, ARS, National Genetic Resources Program).

Bartlett

The Bartlett pear cultivar was found in Berkshire, England in 1770. Later it was acquired by a Mr. Williams, a nurseryman of Turham, Middlesex and distributed under the name of Williams Bon Chretien. It was brought to the United States under this name in 1797 or 1799 by James Carter for Thomas Brewer of Roxbury, Massachusetts. In 1817, Enoch Bartlett of Dorchester, Massachusetts acquired the Brewer property, and not knowing the variety's true identity, propagated it under his own name. Hence, it became known in America as Bartlett. It was added to the American Pomological Society catalog list in 1848 under the name Bartlett.

The tree is medium or less in vigor, not well formed as an orchard tree, productive, and fairly susceptible to fire blight. In spite of blight susceptibility, Bartlett is quite cosmopolitan in adaptability and is the most universally popular pear tree. The fruit is medium or larger in size, oblong-obtuse-pyriform in shape, and somewhat irregular. The skin is fairly thin, somewhat tender, and clear-yellow in color with occasional blushing. The surface is somewhat uneven with some inconspicuous dots. The flesh is white, fine, quite free of grit, melting, and juicy. It has a sweet, vinous flavor with a trace of muskiness. The fruit rates high in dessert quality and ripens fairly early in season.

Figure A8.4: *Bartlett* (Beach, Booth, and Taylor 1905, *The Apples of New York*).



Vermont Beauty

The Vermont Beauty originated as a chance seedling in the nursery of Benjamin Macomber, Grand Isle, Vermont, about 1885. It was added to the American Pomological Society catalog list in 1889.

The tree is moderately vigorous, sturdy, upright-spreading, not very productive, and fairly susceptible to fire blight. The fruit is small to medium in size and ovate-acute-pyriform. The skin is usually smooth, fairly free of blemish, greenish-yellow in color, and usually heavily blushed with bright crimson. The flesh is granular at the center, but fine grained at the outer periphery, moderately juicy, and firm but becoming somewhat buttery when fully ripe. The fruit is quite sweet, though inclined to be bitter in taste, lacking in flavor and texture characteristics.

Figure A8.5: *Vermont Beauty* (Hendrick et al. 1921, *The Pears of New York*).



Vicar of Winkfield

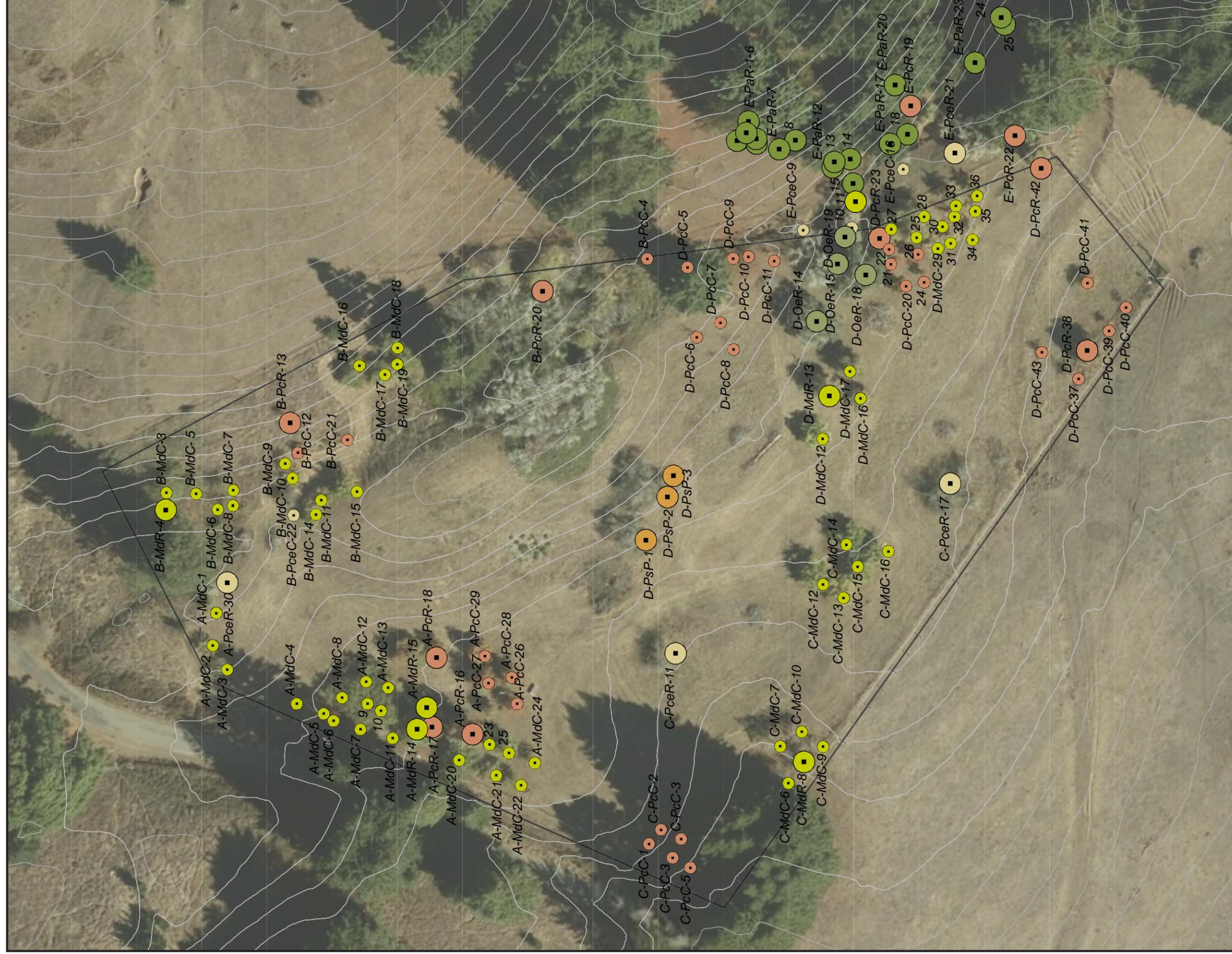
The Vicar of Winkfield pear cultivar was found as a seedling in 1760 near Vendome, France. The name Vicar of Winkfield was applied when it was introduced into England in honor of the Reverend W.L. Rahm, then Vicar of Winkfield in Berkshire, England. The variety was introduced into America during the early part of the nineteenth century, and was placed on the American Pomological Society catalog list in 1852.

The tree is vigorous, upright, stately, and fairly productive, though very susceptible to blight. The fruit is large in size, with an oblong-pyriform shape. The skin is fairly thick, somewhat tough, greenish-yellow in color, and often blushed. The flesh of the pear is firm, rarely buttery, granular, and moderately juicy. It tastes moderately sweet, often astringent, and lacks desirable flavor and texture characteristics. The fruit rates low as a dessert pear but is quite satisfactory for other culinary uses.



Figure A8.6: *Vicar of Winkfield* (Hendrick et al. 1921, *The Pears of New York*).

APPENDIX IX. RUSSIAN ORCHARD SITE MAP



FRUIT TREE ERA AND TYPE

- Ranch Apple (6)
- Ranch Pear (10)
- Ranch Plum (4)
- Ranch Olive (4)
- Ranch Sweet Cherry (18)
- Russian Capulin Cherry (3)
- Contemporary Apple (56)
- Contemporary Pear (29)
- Contemporary Plum (4)

Russian Orchard Site Map
Fort Ross Orchard Management Plan



SOURCE: Fieldwork June 2014

DATE: Dec. 2014

RESOURCES / CONTACTS

NATIONAL CLONAL GERmplasm REPOSITORIES:

USDA, Agricultural Research Service
630 West North Street
Geneva, NY 14456
Research Leader: 315-787-2244
Apple germplasm conservation.

USDA, Agricultural Research Service
33447 SE Peoria Road
Corvallis, OR 97333-2521
Supervisory Research Horticulturist: 541-738-4201
Pear germplasm conservation.

USDA, Agricultural Research Service
One Shields Avenue
Davis, CA 95616
Research Leader: 530-752-7009
Plum and cherry germplasm conservation.

ADDITIONAL RESOURCES:

La Huerta Historic Gardens
Old Mission Santa Barbara
2201 Laguna St.
Santa Barbara, CA 93105
805-682-4713
www.santabarbaramission.org
Source of Mission Era plant material.

Gardenmarkers.com
503 Falconer Drive Ste 9E
Charlottesville, VA 22903
FAX: 434-971-1868
www.Gardenmarkers.com
Source of tree labels with expanding spring.

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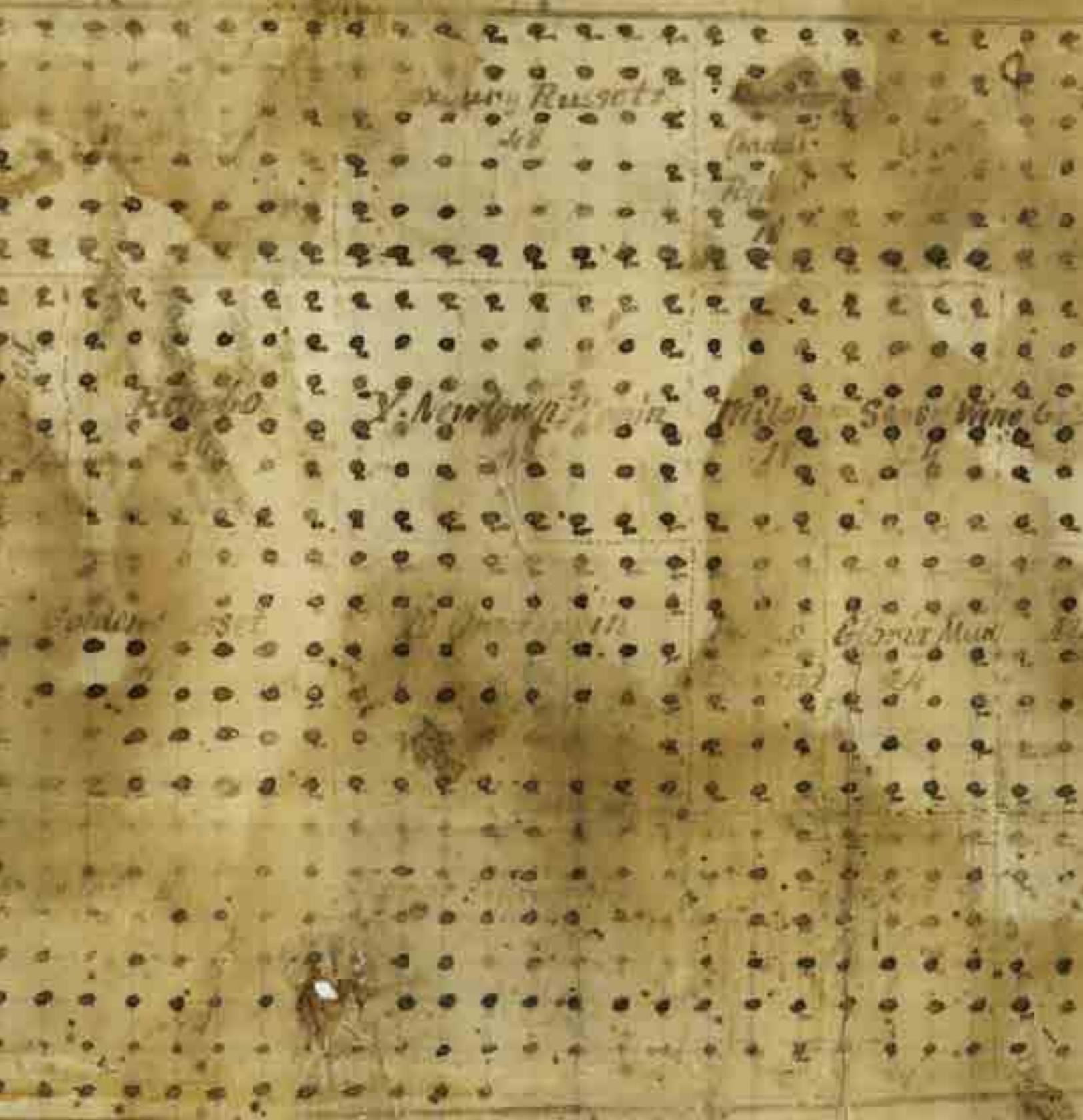
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