UNIVERSITY OF MASSACHUSETTS

DEPARTMENT OF ENTOMOLOGY

MEMORANDUM

DATE: February 2, 1993

TO: Nora Mitchell

FROM: Bill Coli

SUBJECT: Final Report

Here, at last, is the current draft of the final report. I am still calling it a draft as I expect you will suggest editorial or other more substantive changes after you read it.

I am still not completely satisfied, but am resisting the temptation to continue to refine it until I have your comments. I would specifically ask you to consider:

1. Does the executive summary "work", that is, does it sufficiently convey a summary of activities performed and results highlights ? For example, while the ES contains excerpts from several sections within the body of the report, there are no examples of interpretive opportunities.
2. Is the Results and Discussion section complete enough in your view ? I could easily expand on information contained in the site visit reports for some sites to help make the case for the recommendations stronger. For example, we still have several unresolved questions, including: the large trees in DEWA which have never fruited but could be the oldest in the system; and the plum at Nez Perce which we still have not been able to confirm. In addition, the historic apples at Hubbell Trading post, the fig at Fort Davis, the Canyon de Chelly peaches, etc., all could be mentioned in R&S (as well as in the ES for that matter) if you think it would improve the report. This should not take more than a couple of days.
3. More generally, is the report well organized and does it fully convey the scope of what we did, and the significance of the work to NPS ?
4. Are the recommendations reasonable ?
5. Regarding the Appendices: Some of the material therein is germane to the final report, while some is earlier reports I decided to include "for the record". Should I use a different (smaller) font for the previously-submitted stuff ?

Perhaps we can meet or talk on the phone after you've had a chance to review it. In the meantime. I will continue to work on the database, to complete the "tree level" data. Thanks again for your patience and support.

NOT FOR PUBLICATION WITHOUT AUTHOR'S PERMISSION

FINAL REPORT

INVENTORY AND CONSERVATION OF GENETIC RESOURCES IN THE FORM OF HISTORICALLY SIGNIFICANT FRUIT AND NUT TREES IN THE NATIONAL PARK SYSTEM

DECEMBER, 1992

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THIS PROJECT WAS CONDUCTED UNDER A COOPERATIVE AGREEMENT BETWEEN THE UNIVERSITY OF MASSACHUSETTS, AMHERST, AND THE UNITED STATES DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE

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I. EXECUTIVE SUMMARY

A survey instrument was designed and administered to 341 NPS sites in order to indentify those containing historic fruit or nut plantings. Survey results revealed a much larger number of historic orchards than had been anticipated. The culture of tree fruits and nuts is a common factor to sites as diverse culturally as Canyon de Chelly NM, Booker T. Washington NHS, and St. Gaudens NHS. Some areas, such as the Great Smokey Mountains National Park and Shenandoah National Park, contain many abandoned home sites, some with hundreds of trees.

Data from the survey were confirmed from 337 units, with 210 responding negatively, and 127 positively. Historic plantings were identified in each of the NPS regions, with the Southeast having the largest number (22), and the National Capitol having the fewest (7). Virtually every temperate, and several tropical or semi tropical, cultivated fruit or nut were reported in the NPS system, including: apple, apricot, avocado, cherry, coconut, fig, grapefruit, lime, olive, orange, noni, paw paw, peach, pear, pecan, persimmon, pomegranate, and walnut. At the project outset, most sites had little or no information on the varieties, ages, and in some cases, the locations of existing trees. Although not all positive sites reported original trees, site dates ranged from as early as 1752 (Wick Farm Orchard at Morristown NHP) to as recent as 1963 (Lyndon B Johnson NHS), and span the complete period during which fruit trees were introduced and spread throughout the North American Continent.

The survey indicated that many sites had not conducted a complete tree inventory, or were not sure which varieties were present or if trees dated to the historic period for the site. Site management of trees also varied widely, from active removal of trees, to no management, to commercial operation or lease.

The survey also demonstrated the urgency of this research, since some unidentified fruit and nut trees had already been lost, and some were currently threatened. In many sites, maturing second growth forest had overgrown old, abandoned orchards and homesite trees. In other areas, park practices, such as using old orchards as sites for parking lots or other park facilities, had resulted in removal of unidentified trees. Finally, many trees were dying due simply to old age, accelerated by disease and other pest infestations in unmanaged orchards.

In general, fruit trees in the NPS system receive little or no maintenance, the exceptions being sites such as Adams NHS, Morristown NHP, Oxon Hill Farm, and Fort Vancouver, where trees are an important component of site interpretation. As a consequence of low maintenance, condition of trees in the majority of sites visited is poor to fair. Commonly seen pests attacking the tree are: Vertebrates, wood rotting fungi, apple scab, black rot, cedar apple rust, internal borers, white apple leafhopper, apple leafminers, and aphids. Commonly seen pests attacking fruit were: apple scab, codling moth, apple maggot, leafrollers, fruitworms and plum curculio.

A total of 139 sites in 44 parks were visited by investigators during the conduct of the study. As of this report, we have classified 33.8% of these sites as Historic, 13.7% as Cultural, and 52.5% as Other. Budget and time limitations made it impossible to visit a significant number

of parks reporting historic fruit and nut trees on the original survey. Based on site documents we have obtained, a number of sites not visited clearly have trees which date to the primary period. An example is olive grove remnants dating from the plantation period at Dungeness, Cumberland Island National Seashore (Zeichner, 1988).

Other sites which submitted positive replies whose status has not yet been confirmed by site visits include: Biscayne NP (only lime grove in the NPS system); Fort Frederica (fruits and nuts of unkown cultivar and age); Canaveral NS (Oranges, grapefruit of unknown cultivar and age); Pea Ridge NMP (large potentially historic pecan); Glacier NP (remnant orchards at a number of sites); Grand Canyon NP (remnant fruit trees at historic ranch in canyon); Hawaii volcanoes NP (6 pre-1940's apples); Eugene O'Neill NHS (historic orchard, oranges, limes, almonds); and Great Basin NP (historic orchard remnants), to name a few. In addition, sites such as great Smokey Mountains (Remnant orchards, Cherokee orchards, 'Shockley' apple), which was not visited, and Shenandoah NP, only part of which was inventoried, require additional effort to completely identify tress with genetic or historic significance.

In most cases, attempts to quantify tree age by collecting increment cores from NPS trees was not possible; the largest, presumably the oldest, trees typically yielded very small intact cores. Due to twisting and breaking of some cores, and presence of dry rot in others, many readings could not be considered reliable.

Based on dendrochronometer readings of tree cores, the oldest confirmed trees in the NPS system were the 23" caliper pear (115 years), and a second pear (83 years) at San Juan Island, Hoffmeister site. The age of the larger tree puts it and several other comparable trees at the same location within the primary period for the park. The surviving pear at Hampton NHS was also estimated as 83 years old, although the specimen was noted as being of "very poor" quality, with "low reliability because of extensive breakage and twisting." Hence, its age could be substantially greater than determined by the dendrochromometer reading.

Based on their large caliper, the potentially oldest trees identified to date on NPS land are in Delaware Water Gap NRA, on the Roberts Farm site in New Jersey. The largest tree at this site is in excess of 40 inch caliper, and could approach 200 years of age. Several other large trees can also be found at Roberts Farm, and other comparably large specimens have been located and measured in the Minisink District of DEWA. The Noah Brooks Tavern and the Hartwell Tavern in Minuteman NHS also had relatively large trees, up to 30.25" caliper, which could not be cored due to internal rot. I estimate that these trees date at least to the early to mid 19th century.

The positive identification to cultivar of fruit trees in the national park system proved to be a daunting problem for a number of reasons. Principal among these was the lack of fruit, or poor fruit condition due to lack of tree maintenance and/or pest management. In addition, although budding and grafting of fruit trees pre-date settlement of North America, many NPS trees are likely to be reproductively produced "own-rooted" seedlings.

Nonetheless, with the assistance of experts at the New York Agricultural Experiement

Station, Geneva, NY, and elsewhere, a number of tentative or conclusive identifications were made of specimens collected from the study. An example is the apple collected from the Ransom site on Isle Royale which, due to its distinctive shape, is likely related to the old cultivar 'Black Gilliflower'. In this case, the apple shape is so distinctive, as to be diagnostic, a relatively unique occurence.

A potentially important contribution to genetic diversity is the location at the Moses Cone Estate in Blue Ridge Parkway NHP of the cultivar 'Gragg'. The successful identification by Dr. Elwood Fisher of an apple which is not in the USDA Clonal Germplasm Repository or in personal collections, was largely possible due to the extensive orchard maps done for the site early in this century.

NPS should continue to make available to interested staff, the educational information needed to pursue improved management strategies, and to carry out enhanced management for significant sites or trees (e.g. Moses Cone Estate, Saint-Gaudens NHS, Hampton NHS, John Day Fossil Beds NM, etc.). NPS staff training in cultural practices relevant to fruit and nut trees, in Integrated Pest Management, and in proper tree pruning and training are critical if existing or newly planted trees are to survive.

NPS administration should consider the establishment of regional sites within the NPS system where unusual (or unknown) fruit or nut specimens could be propagated, screened, and maintained or discarded. Maintaining potentially valuable specimens off site would serve the twin goals of conservation and removal of exotics from wilderness parks, and would consolidate resource management needs at fewer sites.

Known rare cultivars or otherwise unusual germplasm (e.g. Canyon de Chelly peaches, Moses Cone Estate apples, etc.) should be made available to USDA for inclusion in the appropriate repository.

Exclusive of any contribution NPS fruit or nut trees may make to genetic diversity at this time, a strong case can be made for conservation of NPS fruit and nut tree resources due to their cultural or interpretive value. We strongly concur with arguments offerred by others (Melnick, 1984; Firth, 1989) that rural cultural landscapes are an often overlooked factor in evaluating and registering "historic districts" in the National Register, and believe that many of the cultural landscapes we have visited, with their associated fruit and nut trees, are suitable candidates for inclusion in submissions to the National Register. Consequently, we believe that NPS sites should retain all original trees for propagation as replacements where appropriate, or until NPS addresses issues and recommendations made in this report.

NPS should provide special project funds to appropriate sites (e.g. John Day Fossil Beds, Buckner homestead, Bandelier, Zion, etc.) to rehabilitate historic irrigation systems or arrange for other mechanisms to provide adequate water to trees. Funding for nutrient analyses, and required fertilization should also be provided to sites which intend to enhance maintenance of historic or culturally-significant fruit or nut trees.

Prime among the NPS policy issues which should be addressed at the regional or national level is to resolve whether fruit trees are undesirable exotics, or important contributors to site interpretation and/or wildlife. NPS should address this question on a servicewide basis, taking into consideration both natural resource and cultural resource management factors.

From the survey and from site visits, we noted a variety of past and present dispersal practices of potentially rare and/or commercially valuable germplasm. NPS administration should develop a clear servicewide policy regarding collections and propagation of fruit and nut germplasm from national park lands.

The authors believe that fruit and trees are a significant resource in the NPS system, justifying at least one full time position to complete the servicewide inventory, coordinate staff training, plan enhanced amanagement, develop regional repositories, and add to USDA germplasm repositories when approporiate.

II. INTRODUCTION

Human beings have been utilizing or cultivating fruit and nut trees for millenia. The first known reference to oranges, reported to have originated near the South China Sea, was in the second book of the *Five Classics*, a text which appeared in China around 550 B.C. and is generally attributed to Confucius (McPhee, 1967). McPhee describes how the spread of this fruit "closely and sometimes exactly kept pace with the major journeys of (European) civilization".

From their point of origin in Asia (modern Afganistan), seeds of apple (originally *Pyrus malus L.*, now *Malus domestica* (Borkhauser)), have also been spread by humans throughout the worlds' temperate growing regions (Childers, 1973). Over time, due to chance mutations or cross pollination, a certain number of trees grown from these seeds would be superior in appearance or quality compared to their wild ancestors. While many named apple cultivars experienced only local favor and limited longevity, others were of sufficiently high quality that they have been continually maintained and propagated. After generations of selection and propagation it has been estimated that 6,000 and 8,000 *cultivars* of apple have been described (Fogle and Winters, 1981; Crasweller, 1991). The precise number of once-named apple cultivars will likely never be known inasmuch as about 22,000 pseudonyms have also been used (E. Fisher, personal communication; McGann, 1987).

Like the apple, the pear is original to Eurasia, and it too has been cultivated for over 3,000 years (Postman, 1992). In Great Britain, 64 varieties were cultivated in 1640, and more than 700 were grown in 1842 (Jabs, 1984). There currently exist over 250 cultivars which are over 100 years old, and approximately 15 which are in excess of 400 years old. Some of the oldest known named apple cultivars, 'Lady', 'Fameuse', 'Calville Blanc d'hiver', 'Costard', 'Haute-Bonté', and 'Pearmaine', have been grown in France for between 400 to 500 years (Jabs, 1984; McGann, 1987).

As the number of apple cultivars increased over time, so did the culturalists' knowledge of orchard management techniques such as budding, grafting, and pruning, all of which were well developed in Europe by the 1500's (McGann, 1987).

Prior to European settlement of North America, 3 native wild apples of the genus *Pyrus*, *P. coronaria* L., *P. angustifolia* Ait., and *P. rivularis* Doug. occurred on the continent (Beach, 1905). Old European cultivars of *P. malus* were introduced to North America by European colonists, occasionally as grafted trees imported by individuals such as Governor Endicott of Massachusetts, and Governor Peter Styvesant of New Amsterdam (McGann, 1987). In 1700, French settlers planted the first grafted 'Fameuse' apples in Vermont, at Chimney Point on Lake Champlain (Heleba, 1991). Most often, however, seeds collected from trees growing in the home country were the preferred method of transport (Anderson, personal communication).

Allthough much of the emphasis in colonial America was on clearing trees, fruit such as apples, pears, peaches and cherries were frequently planted to provide much needed delicacies fresh or baked, and essentials such as animal food, vinegar, and especially, hard cider (Pierpont,

1976). Favretti and Favretti (1978) note that "Fruit trees were a very major part of the American landscape throughout the seventeenth and eighteenth centuries."

As fruit tree seeds were spread by pioneers and inevitable cross-pollination occurred, a large number of American cultivars were developed, including 'Roxbury Russet'(one of the oldest), 'Newton Pippin' (also known as 'Yellow Newton'), 'Hunt Harvest', 'William's Favorite', 'Early Strawberry', 'Early Harvest', 'Pumpkin Sweet', and 'Baldwin'. By 1869, Downing listed 1,271 native cultivars (Beach, 1905). In 1911, Bradford listed over 625 apple varieties growing in the state of Maine alone, many of which were native to North America.

Periodic severe freezes in the early part of the 20th century resulted in the death of thousands of fruit trees in various parts of the U.S., undoubtedly including many specimens of old cultivars. Also at that time, advances in refrigerated storage allowed commercial farmers to grow apples based on ease of culture and taste rather than keeping characteristics, so that many less common apples went out of cultivation. In addition, over the past several decades the trend in commercial fruit tree propagation has continued towards specializing in a very limited number of fruit varieties. Therefore, the older historical varieties and the genetic diversity they represent, are in danger of being lost, or are already irretrievable (Fogle and Winters, 1981). In response, Federal governments and a number of private organizations and individuals have attempted to conserve as many of the older cultivars as possible in living collections.

The United States Clonal Germplasm Repository System (NCGR), now incorporated into the National Plant Germplasm System (NPGS), is the most comprehensive of these collections. The objectives of the NCGR are to collect, establish, maintain, evaluate, and distribute clonal fruit and nut genetic resources. At eight repositories in seven states, collections span 37 genera from *Actinidia* to *Zizyphus* (Forsline, 1988). Germplasm collections consist largely of field, screenhouse, or greenhouse plants, although dormant buds, tissue cultures, seed, and pollen are also used as alternative preservation methods.

In Great Britain, a similarly large scale repository, the National Fruit Collections, dates to the early 1800's. In 1990, maintainence of the National Fruit Collections became the responsibility of Wye College, University of London. Over the next 8 to 10 years, Wye College plans to propagate and move to Wye each of the over 4,000 fruit varieties (2,350 apple, 500 pear, 350 plum, 220 cherry, 320 bush fruits) growing at the previous repository location, the Brogdale Orchards, Faversham, Kent.

The Bybee-Howell Pioneer Orchard on Sauvie Island, Oregon near Portland, contains over 115 major varietes of apples, as well as pears, plums and grapes, collected from throughout the Pacific Northwest. The orchard was planted in 1970, and is maintained cooperatively by the Oregon Historical Society, Multnomah County Regional Parks and the Home Orchard Society.

Operated by the Worcester (Mass.) Horticultural Society, the Stearns Lathrop Davenport Memorial Orchard has preserved about 116 old apple cultivars. The orchard is the result of the recognition by a young S.L. Davenport in the 1930's, that the destruction by WPA crews of

abandoned apple orchards might be eliminating the last examples of many of the older varieties (Pierpont, 1976).

Probably the largest private collection in the U.S., about 1,200 apples, 300 pears, 30 pums, 15 peaches, 19 grapes, 14 gooseberries, 9 currants, and 9 raspberries, is maintained by Elwood Fisher in Harrisonburg, Virginia (Sagon, 1991). Over the years, Fisher has collected examples of old fruit from the Mid Atlantic states and elsewhere, and has provided acquisitions such as 'Virginia Beauty' to the National Clonal Germplasm Repository. Certain specimens in his collection, such as the 'Bower's Nonpareil', are reportedly the only examples in existence.

A. PROJECT BACKGROUND

The loss of historic fruit cultivars and the lack of system-wide and park-specific knowledge of orchards and fruit varieties in the NPS sytem were identified as genetic resource preservation issues at the February, 1987 Historic Orchard Workshop conducted at the University of Massachusetts, Amherst, and sponsored by the North Atlantic Region (NAR) in cooperation with Natural Resources, Washington Office. A servicewide project was initiated in June, 1987 to determine the number of National Park Service units which have historically or genetically-significant fruit or nut trees, and to determine the uniqueness of those trees. This project was conducted under a Cooperative Agreement with the University of Massachusetts, Amherst. Both University and NPS staff assumed responsibilities for specific project tasks.

NPS sites known at the time of the historic orchard workshop to contain orchards or remnant fruit or nut plantings date from as early as 1752 (Wick Orchard at Morristown NHP) to as late as 1963 (Lyndon B. Johnson NHS). Because apples were not native to North American Continent, NPS sites span the complete period during which fruit trees were introduced and spread throughout the North American Continent. Many NPS historic sites date from the mid-nineteenth to the early twentieth century, a time when a wide variety of now rare cultivars were being grown (Beach, 1905; Bradford, 1911). Orchards which were planted prior to 1940 also may contain significant cultivars. At the initiation of this project, it was postulated that fruit or nut trees present on some of the NPS historical sites could represent the last remaining examples of certain domesticated cultivars, potentially presenting NPS with a unique opportunity to conserve genetic diversity of fruits and nuts. The potential for identifying historically significant trees, which could be used to enhance site cultural interpretation, was also seen to be high.

B. OBJECTIVES

The objectives of this project were:

I. To conduct a servicewide inventory and develop a computerized data base of National Park Service sites that have historic fruit or nut trees, including remnant trees at old homesites.

II. To identify and determine the uniqueness of the cultivars present, using site visits and other means.

III. To make management recommendations for conservation and propagation of unique genetic and historical resources.

C. OVERVIEW OF PROCEDURES

i. Survey

Investigators met initially to plan operational procedures and an assistant was hired by the North Atlantic Regional Office (NARO). A survey instrument (See: Appendix F. of this report) was developed in the summer of 1987. The survey was sent by the NPS Director to all Superintendents and Regional Directors on November 3, 1987. Follow-up phone calls were made to sites which did not reply by the due date of December 15, 1987. Several meetings were held at NARO and at the University of Massachusetts, Amherst (UMASS) to review survey returns and identify those requiring clarification or additional information. Early in the conduct of this study, it became apparent that confusion over the word "orchard" in the original survey may have caused inaccurate survey replies in some cases, and follow-up telephone calls were used to resolve resulting questions.

ii. Site visit planning

Based on survey responses, a tentative prioritized list of sites requiring visits was developed using criteria such as: presence of historic trees; unique or unknown cultivars; level of present management; and danger of the resource being lost. We gave careful consideration to whether NPS site staff could carry out a detailed tree inventory and sample collection, and report on tree condition beyond that requested in the survey. It was decided that an individual with extensive pomological training and experience (the principal investigator) should conduct the majority of site visits in order to reduce variability of data collection and for other technical reasons. Given project resources, it was not possible for project investigators to visit all sites. Sites with endangered historically significant trees were given the first priority for identification. Parks with unidentified historic trees and ones where the resource was in danger of being lost were also given priority. Where cost-effective and feasible, investigators visited lower-priority sites near higher-priority locations.

Although available funding and time constraints limited the number of visits which could be made by the investigators to parks submitting a positive survey reply (n=127), a series of site visits was decided upon to complete the inventory and collect other appropriate data. After considering available resources, number, distribution and potential importance of positive replies, imminent danger to the resource, and importance of the resource to genetic divesity or to the site, we decided to initially concentrate on collecting samples and data from as many priority sites as possible in 5 NPS regions: Pacific Northwest, Midwest, North Atlantic, Mid Atlantic, and

National Capitol, with additional site visits to the Southeast, Southwest and Western regions to come later. Separate reports with management and conservation recommendations for all sites visited are found later in this report.

iii. Site visit protocol

For parks likely to require visits, a site visit protocol was designed. Due to the large number of sites, the diversity of fruit and nut types, and the potential for finding unusual varieties, a much more extensive and complex identification process was needed than was originally planned. Sites with unknown cultivars demanded a variety of strategies, as described in the following pages.

The optimal time for a site visit coincides with the presence of fruits on the tree of good quality and at physiological maturity. The large number of priority site visits, and other time demands of the investigators, made optimal timing of site visits impossible for all sites. It was possible , however, to collect useful data on tree age, tree condition, management status, and, in some cases, cultivar.

All sites to be visited were contacted in advance to make arrangements. On site, investigators cleared up any remaining uncertainties in the survey. When varieties or tree age were unknown, corings were taken with a 3/8 inch increment borer (when possible) to determine tree age, tree caliper was measured, and fruit samples were taken (where available). Notes were made concerning tree growth habit, leaf and bark characteristics, tree condition, any visible pests or pest injury, and other pertinent information, were noted.

As a follow-up to site visits, NPS staff were asked to collect and mail additional fruit samples to the University or cooperating experts for identification on several occasions thoughout the conduct of the project. Samples were shown to a number of expert sources, and compared to reference texts, specimen collections and other resources. If fruit were not present, or were in poor condition, and if survey or site research indicated the potential for rare or unique cultivars, a program of limited pest management was developed for a few parks. In a few instances, scion wood from NPS trees was collected and propagated at a commercial nursery, then grown under a full IPM program, until fruiting.

If trees were managed, the management plan was copied for reference. Any historic documents (diaries, articles, site staff research, etc.) pertaining to the orchard were examined for information useful to the project. Emphasis was placed on archival information discussing the significance of the planting in site history.

iii. Tree age determination or estimation

Fruit trees are relatively slow growing plants, and they can live to a great age. For example, a grafted Dutch apple, 'Summer Bonchretien' planted in 1647 by Governor Peter Styvesant in New Amsterdam, later New York, is reported to have survived until 1866, when it

was knocked down by a delivery wagon (Sokolov, 1988).

For the most part, NPS site staff have access to little or no information about age of fruit or nut trees found in the park, however, some parks have sufficient resource information, including oral histories, maps or photographs, to enable approximate dating of trees. For example, Hampton NHS has a 19th century map showing an orchard at the location of 2 large remnant pears. Where no such documentation existed, an attempt to determine tree age was seen as an important component of the site visit protocol.

Where possible, investigators attempted to estimate tree age by taking a core with a 3/8 inch increment borer. Although fruit and foliage samples are temporal, increment cores were mounted on wood blocks to be examined with a dendrochronometer, and hence are more permanent. A working relationship was established with The US Forest Service Lab. in Durham, New Hampshire, for assistance with reading tree cores. Mounted cores are maintained by the principal investigator at the University of Massachusetts, Amherst.

v. Cultivar identification

Investigators contacted or met with representatives of the USDA Apple, Peach, and Nut Germplasm Repositories to determine which cultivars are currently in the collection, and the extent of USDA interest in acquisitions from NPS. No molecular techniques for determining fruit parentage currently exist, because clonal material and other aspects of DNA fingerprinting of fruits are not currently available. However, a number of sophisticated labs, including the USDA Clonal Germplasm Repository, Geneva, NY, are working on the problem (Kresovich,1989). A number of old cultivars in the USDA collection have been screened by isozyme analysis (Weeden and Lamb 1985) as a way to determine similarities in composition of important enzyme systems. However, this approach is still not well enough developed to be used as a means to screen large numbers of samples for positive cultivar identification.

Very few "keys" to old fruit cultivars exist, and these are limited in size and utility. Most existing information about old fruits is in the form of botanical descriptions, such as those of Beach (Apples of New York, 1905), and of F.C. Bradford (Apple Varieties in Maine, 1911). Such sources often include fruit descriptors which are genetically-based, such as stem length, lenticel size and distribution, and flesh color, which can be used in identification. However, other important characteristics such as fruit size, shape, color, and skin appearance, which can be influenced by level of care and pest injury, are also used. Because of this, fruit from non-managed trees are often very difficult to positively identify from visual characteristics.

To consult on identification of unknown specimens collected by us or sent by cooperating NPS staff, we elicited the cooperation and assistance of Professor James Anderson (Ret.), University of Massachusetts, Drs. Robert Lamb and Roger Way, Professors Emeritus and Mr. Ken Livermore, Dr. Way's Technical Assistant, at the Cornell University Agricultural Experiment Station, Geneva, NY. In 1989, we screened a total of 46 samples collected from the Midwest Region.

We also contacted Dr. Elwood Fisher of James Madison University, a nationally-recognized expert in the identification of old fruit cultivars. Unfortunately, due to other committments, Dr. Fisher declined to collaborate at great length with this study. Project investigators were able to participate in one joint site visit to the Moses Cone Estate orchards with Dr. Fisher, and Dr. Ian Firth, who has conducted a cultural landscape inventory at the site.

A number of sites visited were subsequently contacted by telephone and asked to collect additional specimens for positive identification. These included a small plum from Nez Perce NHP which may have been moved to the site by a missionary wife, an early-ripening pear from San Juan Island NHS, a ridged apple from Olympic NHP, and additional fruit and wood samples from 3 sites in the Midwest Region. A part time assistant was hired during summer 1990 to mount an intensive collecting effort via frequent mail and telephone contact with NPS staff.

vi. Database development

A part time DBASE programmer was hired to work on development of the computer database, which, when complete, will contain data on: Survey results, site visit results down to the tree level, lists of resource people knowledgeble about crop and pest management, sources of historic cultivars, and a bibliography. Information gained from the survey and additional site-specific information acquired during the course of the project was used to develop a DBASE III+ database (HISTORC) which is compatible with NPS computer systems and existing databases (LSCAPE) provided by NPS data management specialists. The nature of information collected required substantial programming to develop a menu-driven, data entry and edit capability. Various means to query and report information in the database are available.

vii. Micellaneous activities

After completion of the servicewide survey and submission of Interim Report #1, the NARO liaison (Mitchell) and the UMASS investigator (Coli) met periodically to review progress and problems and to plan future activities. Coli presented a seminar on the project to Director Mott and staff at the Interior Building, October 6, 1988. A verbal presentation on interim results and future plans was given by Coli to Mitchell and Mr. John Dennis (Natural Resources, WASO) in the Fall of 1989, at the NARO office in Boston. On a number of occasions, Coli responded to requests for information and management assistance from NPS Staff at sites including: Martin Van Buren NHS, Adams NHS, FDR Home NHS, Fort Vancouver NHS, John Day Fossil Beds, St. Gaudens NHS, and the Southwest Regional Office.

Networking with others interested in old fruit and nut cultivars continued throughout the study. This resulted in 2 requests for presentations on the Historic Orchard Project, one given to the Annual Meeting of the Northern Nut Growers Association, at Ste. Catharines, Ontario, and the other to the annual meeting of The Northeast Apple Society, at Stratton, Vermont.

Concurrently, a collection of reference materials (books, catalogs) and other relevant information was begun, including: Texts describing characteristics of old fruit cultivars, sources

of expertise in identification of old cultivars, locations of existing fruit and nut germplasm collections and repositories, addresses of nurseries selling old cultivars, etc. This information was used during the project to determine the commercial availability of varieties in the NPS system, the management or other needs required to identify, propagate and maintain possible unique varieties, and the feasibility of NPS commercial sale of plant material. In the future, this reference information should be useful to NPS staff investigating orchard rehabilitation, especially using historically-relevant germplasm.

III. RESOURCE INVENTORY

A. INITIAL SURVEY RESULTS

Of the 341 NPS units authorized at the time of the survey, 337 responses were initially confirmed. Four survey responses, 3 from Scenic Trail Parks and 1 from the Roosevelt-Campobello International Park, were later verified as negative responses. Of the 337 NPS units that survey information has been compiled from, 127 sites responded that there were fruit and/or nut trees present, while 210 sites responded that there were not.

NPS sites replying positively contain virtually every domesticated temperate (and several tropical) fruit or nut in existence : Apple, apricot, avocado, cherry, coconut, fig, grape, grapefruit, lime, mulberry, olive, orange, noni bushes, paw paw, peach, pear, pecan, persimmon, plum, pomegranate, and walnut. Table 1. shows the breakdown of survey replies by region. A complete listing of positive site replies is given in Appendix K. of this report

Table 1. Total responses to historic orchard survey by region, 1988.

	NA	MA	NC	SE	MW	SW	RM	W	PN	ARO	Total
POSITIVE	21	14	7	22	18	13	9	14	9	0	127
NEGATIVE	16	17	24	31	13	24	32	30	7	16	210
											337

Survey results revealed a much larger number of historic orchards than had been anticipated. The culture of tree fruits and nuts is a common factor to sites as culturally diverse as Canyon de Chelly NM, Booker T. Washington NHS, and St. Gaudens NHS. Some areas, such as the Great Smokey Mountains National Park and Shenandoah National Park, contain many abandoned home sites, some with hundreds of trees. Many sites had not conducted a complete tree inventory, or were not sure which varieties were present or if trees date to the historic period for the site.

We developed a status nomenclature to classify the positive responses. Of the 127 positive replies, 78 units reported trees which date from the site's historic period (HISTORIC TREES),

18 reported reconstructed orchards (RECONSTRUCTED), and 8 reported trees which did not relate to the history of the site (NON-HISTORIC TREES). More information was needed on 22 of the sites before the status of the trees could be determined (categorized as UNKNOWN). This information is shown by region in Table 2.

Table 2. Interim data on NPS orchard * status for parks submitting positive survey replies, by region, 1988.

	NA	MA	NC	SE	MW	SW	RM	W	PN	Total
HISTORIC TREES	16	9	4	11	10	11	4	9	6	80
RECONSTRUCTED ORCHARD	2	0	1	1	0	1	1	1	0	7
NON-HISTORIC TREES	0	3	2	3	6	0	2	0	2	18
UNKNOWN TREE STATUS	3	2	0	7	2	1	2	4	1	22
TOTAL										127

* Some sites contain individual or scattered residual trees rather than orchards.

A wide range of present management practices was noted in the survey returns. A number of sites reported that trees were managed in some way. Some parks reported working with University Cooperative Extension professionals to develop or refine management plans, as at Hopewell Furnace NHS and Bruckner Homestead (Stehekin). Examples of orchard IPM plans or heightened management programs developed by project investigators and implemented by NPS staff are those at Adams NHS, Morristown NHP, and Franklin D. Roosevelt NHS. However, a large number of sites reported that they did not manage their trees at all.

The survey confirmed that some unidentified fruit and nut trees have already been lost, and some are currently threatened. In some sites, maturing second growth forest is threatening many old, abandoned orchards and homesite trees. In other areas, park practices, such as using old orchards as sites for parking lots or other park facilities, have resulted in removal of unidentified trees. Finally, many trees are dying due simply to old age, which can be accelerated by disease and other pest infestations in unmanaged orchards. Some parks which are managed as natural areas and which have as management objectives the restoration of native ecosystems, considered fruit trees to be undesirable "exotics" and have a policy to remove or allow them to die. Many of these decisions have been made without reference to the potential value or rarity of the unknown cultivars.

B. SITE VISITS CONDUCTED

The following is a concise summary of taped notes made at each site.

i. North Atlantic Region

a. Acadia NP

Site visits to Acadia were conducted from Sept. 5 to 7, 1989, on behalf of the project by Craig S. Hollingsworth, who met with and was assisted by Allen O'Connell, Mike Blaney, and Deb Wade. The park has a comprehensive inventory of exotic plants, including apples, done in 1986 and 1987 (Smith et al.), which noted 29 sites with apple trees on Mt. Desert Island, 1 site on Schoodic Peninsula, and 1 site on Isle au Haut.

Fruit injury seen was from apple scab, calyx end rot, codling moth, and apple maggot. Foliar injury was caused by apple scab, defoliators, skelitonizers, and whiteapple leafhopper. Trunk injury was from internal wood rots and borers.

Carroll Farm

The site was a homestead from 1830 to 1907. Five apple trees were found. The first was on the southwest side of the house, with a caliper of 19" (at 24") (Photo 89). To the east of the house were two more trees, caliper 17" and 18" (at 30") respectively (Photo 107, 87). Northwest of the house were 2 other trees, rotten in the center, each with a caliper of 16" (at 30"). All trees were in fair condition, with internal rot, leaf skeletonizers, foliar and fruit scab, leafhopper and codling moth injury.

Compass Harbour, Dorr property

The site was bought by the Dorr family in 1868 from a family named Conners. A local nursery has previously collected budwood from this site. Directly opposite the location of the old kitchen were 6 small, multiple trunk crabapple trees, likely seedlings (Photos 83, 86, 104, 106, 118), as well as magnolia, rhodedendron and other exotics.

At the Dorr nursery, we noted a crabapple with a caliper of 9.5" (at 36") (Photo 85).

Bar Island

At the gate was a 10.5" caliper apple with very small gnarled fruit and with foliage showing injury from scab and leafhopper (Photo 101). The site had several trees with multiple trunks of 5"-8" (at 30") caliper. About 30 yards up the path was an apple with a caliper of 11.5" bearing small green fruit (Photo 97), and several small apparent seedlings. Fruit were collected from a heavily-spurred 10" (at 6") caliper apple along the path (Photo 110), and a multiple trunk seedling with a caliper of 8" (at 18").

At the top of the path is a meadow of about 10 acres, with a planted orchard with 3 rows of 4 trees, the largest of which calipered at 20 1/8" (at 12") (Photo 105). Trees were barely hanging on, with

evident internal rot and bittersweet rampant, although some produced a few fruit (Photo 177, 199.

At the southwest end of Bar Island, on land which was not yet owned by the park, were four trees, all small caliper. Along the scenic path starting at the north end of the meadow was a 9" apple (Photo 88). Past the Jack Perkins residence was another 9" caliper (at 24") apple (Photo 99).

Seal Cove Rd.

The largest of 8-12 trees at Exotic Site #10 was about 100 yards furthest from the road, and calipered 23.5" (at 30") (Photo 80). Adjacent to that tree was a light yellow crabapple with a red blush (Photo 122). Across the road at Exotic Site #11 were two trees, caliper 13" (Photo 103, mislabeled), and 11 (at 36"). NOTE: Due to uncertainty about precise locations, it is possible that this section refers to Exotic sites #8 and #9.

Sommes Sound

At a summer residence along Rt. 198 (exotic site #14) was an apple, caliper 13" (at 36"), with very large apples (Photo 79). Exotic site #1 is at a cemetary on Sargent Drive with trees of 14.5" (at 36") (Photo 81) and 10.5" (Photo 120) caliper.South of the cemetary were two residences with a number of fruit trees. The tree closest to the road calipered 15.75 (at 36"), the northernmost 14.5" (at 36"), and the tree in the door yard 18" (at 36").

Storm Beach Cottage

Just to the east of the former superintendent's residence was a 12.5" caliper (at 40") apple tree, rotten in the center, with healthy looking foliage, but no fruit. Fruit and foliage were collected from a second tree of the same caliper (Photos 74, 75).

Sand Beach Cottage

Six other apples were found running roughly north and south in a field right after Great Head parking area. Calipers were 15.25", 16.5, 17.25", and 13" for numbers 1, 2, 3, and 4 respectively. Fruit and foliage samples collected at the site are shown in photos 76, 77, 93, 98, 108, 109, and 123. Photos 76 and 77 are interesting in than they show a fruit with no indentation in the stem cavity, an unusual occurrence.

Otter Cliff Road.

At Exotic Site #26 were 6 trees, 4 of which ranged from 5" to 9.5" in diameter. Right at the side road intersection was a leaning apple with a caliper of 21.5" (at 36"). On the south side of the road was another tree growing out of an embankment, which calipered 13.%' (at 36") (Photo #121).

Walking south along Otter Cliff Road we noted trees at several locations along the road. The first tree calipered 9.25" (at 24"). About 50 yards from the road intersection was a stand of 4 apples about

20 yards off the road. Caliper of the first, second, and third trees in were 19" (at 24"), 18" (at 36'), and 14.5" (at 36") (Photos 94, 95), respectively.

At the turnoff to the Fabre memorial picnic area were about 5 apple trees, the largest of which had a diameter of 9" (at 24") (Photo 82).

At Otter Cove, there are about two dozen trees, the largest of which was 13.5" (at 24") (Photo 100).

Wildwood Riding Stables

Just north of Wildwood riding stables were 7 fruit trees not mentioned on the exotics map (Smith et al., 1986, 1987), the largest being one at 16.4" (at 36") (Photo 96, foliage only), and one caliper 22.5 (at 24") (Photo 116). Additional fruit were collected from a 9.5" (at 24") double trunk apple (Photo 84).

Cadillac Mountain

On Park Loop Road towards Cadillac Summit Road were 6 apple trees, all bearing fruit, the largest of which calipered 17" (at 24"). Eight more trees were found on the slope between Eagle Pond and Cadillac Summit (Photos 78, 90, 91) the largest of which calipered 14.5" (at 12").

Jordon Pond House

At the restaurant were 7 NPS planted trees in various stages of decline. Plastic mouse guards failed to protect the tree from mice after several years. The largest tree at the site calipered 17" (at 24") (Photo 92). Fruit and foliage collected from apples on the front lawn of Jorden Pond House are shown in photo 102 (Tree closest to the house, caliper 24.5" at 36"), and photo 112 (Tree furthest from the road, caliper 25.25" at 36").

Hardin Farm

The site had a few small (6.75" caliper at 36") seedling apple trees (Photo 113) which draw deer, and is reportedly frequented by poachers.

Management and conservation recommendations - Most trees in Acadia were likely to be seedlings of limited genetic value. Extensive woodpecker or sapsucker injury, indicates they are likely a significant food resource for those species in the park. Deer also utilize the fruit trees for food, and many of the trees seen probably owe their location to seed movement by deer. Park personnel were concerned with apple trees attracting deer for poachers, and to roadsides where they represent a traffic hazard. No enhanced management is recommended for the majority of Acadia apple trees. The majority of small, apparently seedling trees, which have neither genetic or cultural value, should be removed where feasible.

Trees at the Carroll Farm are large enough to date to the latter part of the primary period for the

site, and so should be conserved. Recommend collecting budwood from trees at the site which are rotten in the center and in danger of being lost to storms.

b. Adams NHS

The park was one of three initially worked with prior to the onset of the servicewide inventory. Detailed reports on activity at the three sites in 1986 and 1987 are contained in Appendix H. and I. of this report. The site contains a remnant historic orchard with extensive documentation. At the initiation of this study, overall tree condition was fair, and many trees had not born fruit in recent years. Trees were attacked by apple scab, black rot, and sooty mold pathogens, and a variety of common arthropod pests.

After initial training of site staff, a low-input pest monitoring and management program was designed, red sphere apple maggot traps were purchased, and staff trained in their positioning and use. A hygrothermograph was purchased and modified, and a weather shelter constructed to allow weekly weather monitoring. UMASS visited Adams on several occasions during critical times in the 1987 growing season, to assist staff with orchard pest monitoring, sprayer calibration, etc. Most spraying occurs in the early season, directed at plum curculio and various plant pathogens.

Fruit quality dramatically improved in response to the enhanced management, although some trees do not bear a sizable crop. In harvest surveys in 1987 and 1988, total fruit injury averaged about 5%, with most of that caused by plum curculio. Enough fruit of reasonable quality were produced to allow apples to be given to local charities or nursing homes.

Management and conservation recommendations - The Adams NHS orchard IPM program as implemented by Ron Catudal and Gene Gabriel since 1986 is well developed, and enhanced orchard management has been well integrated into the landscape management plan for the site. The low input spray program used at the site has provided excellent control of apple scab and black rot, as well as acceptable control of arthropod pests. Trees have been pruned annually, according to techniques that foster tree openness and fruit-bearing surface. Fertilization management based on soil or foliar analysis now meets tree needs.

I recommend a continued program of light annual pruning via "thinning" cuts of watersprouts, and dead, dying drooping or crossing branches, taking care to not remove excessive fruiting wood via "heading" cuts. Continue maintainence of adequate fertility and pH by semi-annual soil and/or foliar analysis. Continue low-input IPM program, emphasizing monitoring of weather and protection of trees and fruit from pathogens, with minimal number of insecticides against early sesason arthropods. Two insecticide sprays normally applied in summer against apple maggot fly may be avoided if staff time allows extensive use of red sphere apple maggot traps as a direct control. Staff should remain on Cooperative Extension mailing lists to receive weekly pest alert IPM newsletters.

c. Cape Cod National Seashore

We visited with David Mansky, Resource Management Specialist at the Headquarters Building.

He directed us to 4 or 5 areas where fruit trees have been identified by an extensive inventory done after the questionnaire was submitted.

Pamet Pt. Rd., Lehac House

Identified as W5A or record #13 in NPS database. We located one large apple, east of the garage of caliper 19" (at 36" above ground). Tree bark was covered with sapsucker holes, and foliage showed black rot, very little scab, aphid colonies. A few fruit were present in the tops of tree, and many mummified fruit were evident. Two good fruits inside the canopy were oval, with a long stem and quite fuzzy. This appeared to be a grafted tree with an apparent union 6-8" above ground. Although the inventory map showed another apple to the east of the house, we found nothing. However, there was another apple south and west of the house, caliper 17.5" (at 36"). Fruit and tree condition looked identical to the first tree seen. Both trees were rotten in the center.

Pamet Pt. Rd., Larry Shaneberg house (RR.1, Pamet Pt. Rd., Wellfleet, MA)

Trees identified as records 15, 16, 17 and 18 were earlier found here. The first tree on entering the driveway had a 5" caliper. Trees appeared to be recent based on their size, but a stump of similar size to the other trees here was at least 80 years old from the growth rings, when cut. Since that was cut over 10 years ago, and the other trees were here at that time, these trees could be 90 or more years old. This gives evidence that the trees seen elsewhere on the Cape could be much older than their caliper would indicate. This site also contained two other trees calipered at 3.5" and 7.5" southeast and east of the house.

Pamet Pt. Rd., near fire Road.

North of the previous tree, next to an old brick cistern was a 17 inch caliper (at 2.0 ft) apple (record #19, tree W7A), hollow in the center and in similar condition to all others. About 25 ft to the east of that tree was another partly fallen down tree with a caliper of 15" (at 1 ft) with no fruit but healthy foliage. In the corner of the driveway was a crab apple with a 12½" diameter, showing typical pest injury, as well as deer and sapsucker damage. To the south of that was a large apple (17.5" caliper) which we cored. Immediately South of the ell part of the house was a 14" caliper (at 36") apple, with a reddish cast to the bark, and bearing many 1¼" diameter fruit. Apple scab, aphid injury, black rot, and plum curculio injury evident. East of the house was another 16" caliper tree with long stemmed fruit, 1¼" diam. A few mummified fruit were present and all the fruit and foliar injury seen previously as well. These last two trees appear to have been pruned.

Waters property

Trees noted W9A and W9B were not apple as on the map, but pears. Both were small, with 8" and 6.25" caliper respectively. No fruit were evident. In addition, the site had one small seedling apple.

Isaiah Doane Homestead

Next to Nausett Rd., opposite the Eastham Senior Center, there were 3 trees in a row, one of which had fallen over. One calipered at 20.25" (at 24") although this could be two trees grown together. The second calipered at 16.5" (at 36"). The third calipered at 15 inch. Also in this line along the road were two pears with 8.5" and 10" calipers (at 36"). All apples and pears at this site were rotten in the center and could not be cored.

Management and Conservation Recommendations - due to the complex nature of the park, with many trees still on private property, and no obvious focal point, no enhanced management is recommended for any of the above sites. I recommend collecting bud wood from the largest trees at Isaiah Doane homestead, and at the Lehac and Fire Road sites for maintainence and varietal ID.

Ryder House

Trees were found at two different locations. A group of smaller trees, nearest the house, were reportedly planted around 1940 by a then resident. Another group of apparently older trees were much larger, one with a 14.5" caliper (at 12"). According to an unconfirmed report by the house caretaker, local oral tradition holds that the larger trees were salvaged from the wreck of the tall ship Franklin. Tree condition was fair, and trees showed evidence of dead wood pruning, and painting of pruning wounds with tree paint. The trees apparently are biennial bearers as they had a large crop last year and did not bloom this.

Two small trees near the road were each 8" caliper (at 36"). Both had multiple trunks. Another tree nearer the house was 11" in caliper, with carpenter ant nests in old pruned branch stubs. Predominant pathogens seen were black rot and cedar apple rust (the latter especially evident on the 8" caliper tree just mentioned). Due west of the house was an apple with 12" caliper at 36", also showing evidence of pruning. The bark shows a red tinge, possibly fungal fruiting bodies. In the woods north of the trees just described was a tall (> 30 ft) pear or apple, 19" caliper at the base of the 3 main branches. Also nearby were two smaller (12") apparent volunteer apple seedlings.

Just north of the corner of the house was another apple with a 9" caliper, showing black rot, many water sprouts and decent foliage, probably a volunteer. North and east of the house in the woods were a number of smaller apple trees also apparent volunteers. Along the road near a pond was a 14" caliper apple with 5 branches. This is in an area that was once a vegetable garden.

Management and conservation recommendations - I recommend site historic research to confirm if the trees growing to the West of the house were in fact salvaged from the wreck of the Franklin. While their caliper is relatively small, this does not necessarily mean they are recently planted. Cape Cod has very sandy, poor soil and trees are subject to saltspray. These factors combined with little or no care could account for their relatively small caliper. Inasmuch as trees appear to be susceptible to common pests (some highly susceptible to cedar apple rust) they are not likely of any genetic value. However, pending historical confirmation of their origin, I recommend a limited program of fertilization and pruning to restore and maintain their health.

Behind the block of pears were many more apple trees with estimated calipers of >24", all on the same overgrown condition noted earlier. Some of these showed severe leaf curling from aphids, and black rot lesions on the leaves. All fruit were about 1-1¼" diameter at the time of the visit. The last apple calipered, behind the Rogers house and near a newly constructed home, was 29".

The trees on the opposite side of the road in the maple woods, were not as big so were not visited. Other trees were seen along Rt. 2A south of the Battle Road Visitors Center, just east of the cranberry bog. All were overgrown and fruit showed plum curculio and sawfly injury. One tree calipered 17". These are clearly younger than the ones at Noah Brooks and most likely date to the 20th Century.

Hartwell Tavern

A site visit was made to the Hartwell Tavern area to look for fruit tree remnants at a site shown on Malcom's map as having been an orchard surrounded by a stone wall. Thick brush made careful examination of the site impossible. One tree of estimated 30"+ caliper was alive, with fruit like 'Duchess of Oldenberg', 'Gravenstein', or 'Ben Davis'. One large blown-down dead apple tree was estimated as caliper 30".

Management and conservation recommendations - All of the larger trees at Noah Brooks are likely in excess of 100 years old, and they could date to the mid 19th century, given their caliper. The single remnant at Hartwell Tavern could be of a similar age or older, given the size of surrounding new growth forest. I recommend that trees at both sites be cleared of brush and surrounding forest and fertilized/limed according to soil and leaf analysis. The tree at Hartwell should be propagated from immediately, if possible. Trees at Noah Brooks should be pruned of dead wood initially, with eventual rejuvenative pruning by trained individuals.

Both sites are suitable for enhanced interpretation of the historical role of orchards at the time of the battle and over time. The Hartwell site would require a larger resource investment in order to rehabilitate as an orchard, but presents the better interpretive opportunity because of the presence of old stone walls, and since the building is open to the public. I would support plans to replant an orchard at Hartwell Tavern.

g. Morristown NHP

The park was one of three initially worked with prior to the onset of the servicewide inventory. Detailed reports on activity at the three sites in 1986 and 1987 are contained in Appendix H. and I. of this report.

Wick Farm

The orchard covered about 8 acres behind the farmhouse. At the time of an initial site visit the site contained about 160 trees, 100 of which were NPS planted and less than 5 years old. Most trees were in poor condition, especially the older ones, some of which could exceed 50 years of age. Only one tree, completely rotten in the center, could be more than 100 years old. Recent managment had been

limited to mowing, maintaining deer fences, and removing dead wood. A horse had been pastured in the orchard.

In cooperation with John Donahue, Resource Managment Specialist, a program of enhanced pest and orchard management was designed and implemented. In February, 1987, site staff received hands-on training in orchard pruning for newly-established and older trees. The entire orchard was later pruned. In 1988, current site staff were very experienced and knowledgeble about IPM concepts and horticultural techniques, including pruning. Because of this, the site had an excellent opportunity to implement a successful IPM program with available resources.

On an August 21, 1987 site visit I met with John Donahue, Dan Dearborn, Lynn Whiteman and other site staff at the orchard. We examined the orchard and discussed progress of IPM program implementation in 1987 and plans for future seasons.

The structure of both newer and older trees appeared significantly improved due to pruning the previous winter. A single semi-dormant oil spray was applied in 1987, and trees were fertilized. Because no other pest management was performed, however, fruit were few and of generally poor quality, virtually all showing damage from one or more direct pests, especially Plum Curculio and Codling moth. The park has had difficulty securing a spray contractor to maintain the trees properly, and this undoubtedly contributed to reduced foliar and fruit quality. In spite of this, canopy condition and terminal growth were reasonably good.

In addition to those earlier identified as 'Yellow Bellflower', fruit on some older trees resembled 'Baldwin' although lack of fruit quality and maturity made positive identification impossible. Grass inside wire deer fences had been trimmed recently, although several young trees appeared to be dying, apparently from pine vole injury to the roots.

Eight or ten relatively tame deer were resident in the orchard during our entire time there, and they were not hesitant to take apples knocked from trees or thrown toward them. Their presence will place practical limits on tree structure and shape as they consume lower branches and fruit.

On December 23, 1987, I met with John Donahue, Lynn Whiteman, Paul Labounty, and Dan Dearborn at the Washington Headquarters building, and discussed my report from the August orchard visit and my preliminary recommendations. We discussed an appropriate level of management for the orchard, and agreed that a program to maintain tree growth and vigor but not to produce higher quality fruit was appropriate. I agreed to submit sample management plans for staff to choose from. We discussed that several of the trees that appeared to be dying at my earlier visit had died, apparently from vole injury, although string trimmer damage was also noted as a possible contributing cause.

Management and conservation recommendations - Since 1989, several of the most knowledgeable staff have been reassigned to other sites, a problem common to the NPS system. Changing staff make maintenance of management continuity extremely difficult. Specific recommendations for the site are: Continue an annual program of light pruning of young trees, and moderate pruning of older ones; maintain proper soil fertility and pH based on soil or leaf analysis; perform mineral analysis annually,

and correct deficiencies as needed; apply a minimum number of fungicides during primary scab season against apple scab and black rot based on weather monitoring and use of a Mill's chart; use no insecticides due to the nature and use of the site, and since high quality fruit production is not a primary consideration; should higher fruit quality be desired, use Dipel* sprays, insecticidal soap, codling moth pheromone-impregnated wicks as a mating-deterrent program, and red sphere traps for apple maggot fly control; replant trees as they die with appropriate varieties, and document the planting plan for future resource managers.

The whitetail deer population at the site is unusually high due to the cover and browse provided by the Park and adjacent acreage. Hence, staff should continue to protect trees from deer with wire fences and repellents. Maintain contact with fruit specialists at Rutgers Univ. for updates on pest problems, IPM training sessions, newsletters, etc., and should subscribe to other state Extension Newsletters for more pest management information.

h. Saint Gaudens NHS

I conducted a site visit on July 26, 1989, meeting with Bill Noble. The site was a tavern in the early 19th century. There are photos taken in the late 1800's showing fruit trees around the studio, probably planted by St. Gaudens. The trees in front of the house along the road may pre-date St. Gaudens' occupancy as photos show trees at that location in 1885.

The trees 50 yards apart to South of house were very tall, and showed damage from various leaf chewers, apple scab, black rot, hail, tentiform leafminer, plum curculio. The first had a caliper of 19" at 30" above ground. Fruit were 0.75" to 1.25" diameter, with a long stem and resembled Gravenstein. Leaves were smooth. The tree was rotten in the center with a large branch broken out of it. No evidence of a graft union was found. Nearby small trees with caliper of 3" and 7" were planted by NPS, and reported by the previous superintendent as being "McIntosh". These showed good terminal growth, all the same pests described above. In this area, the tree closest to the house showed leaf curling from aphids, now gone. This appeared to be a different fruit as it lacked the red blush that the previous tree's fruit showed.

As we headed west along the road, we noted another group of two older trees (one a crab and one apple) and 4 newer, perhaps NPS planted trees, all showing the same injury as before. Trees had good (8-12") terminal growth in tops, apparently benefitting from fertilizer applied to the lawns. Trunks showed apparent mower or weed-chopper injury.

Along the road was a large, probably original tree of 24" caliper (at the base of the first branch). The tree is probably one-half its original caliper as a large branch broke off many years ago. It showed the same types of injury seen before plus sapsucker damage to the trunk. Some scab was present on the foliage, but damage was much less severe than other trees at the site, and no fruit scab at all was seen. All fruit were about 1 inch in diameter and most had fallen to the ground. This tree reportedly has done this each year Bill Noble has been at the site. No evidence of a graft union was noted.

Further west along the road was a large, probably original, crab apple with .5 to .75 inch fruit, and all the types of injury noted before. Foliage was small, and terminal growth is limited (6" in to top). This tree also had 50% of the trunk removed from breakage. Caliper of remaining was 20.5" at base of burl on west side of tree.

At the front of the barn showroom (the little studio) there were six trees in a line, all apparently planted by St. Gaudens. One, which Bill Noble has worked with UNH (Dr. Bill Lord) to propagate, was nearly dead. It's caliper was 15.5" (at 36"). The last tree in this line was badly rotten in the center, and cracked open several years ago. Half the tree may be a root sucker. A few large (2") all green fruit were still on the tree, but most had dropped. Very little scab was noted, but sooty mold from aphids was evident.

Management and Conservation recommendations - All but the NPS trees at the site are clearly historic and should be maintained. I recommend a limited program to fertilize trees based on tissue analysis, and to spray with at least fungicide to protect from scab. In addition, I support the site's interest in acquiring North Atlantic Region special project funds for propagating all the trees planted by St. Gaudens and the large trees along the road, which are vulnerable to ice storms.

i. Saratoga NHP

Site documents (Gordon, 1987) indicate that the battlefield site was inhabited at the time of the primary historic period (1777) by English settlers. However, according to Gordon, settlement had not progressed very far between the late 1760's and 1777, and many of the upland farm sites probably only contained between 8-15 acres of cleared land. River bottom farms, which had been natural meadows to begin with, would of course have had more cleared land. The battlefield was apparently covered "either with woods of varying density or with shrub growth".

Nothing contained in Gordon's treatise refers to the planting of apple or other fruit trees. The historic base map of July 25, 1949 (C.W. Snell) shows a large field with trees scattered in it which is suggestive of an orchard, (north of the Vandenberg house on the Hudson) but is not so noted. Paul Okey, park historian, supplied me with a copy of an indenture made in 1772 between Killion De Ridder and William Strang to lease 100 acres of land "lying and being at Saraghtogue in the County of Albany on the West side of the River in Lot #14". The terms of the lease called for Strang to "manure a suitable piece of upland and on the most proper place at the distance of 45 foot from each other, plant 100 good sound apple trees, one half whereof to be grafts".

In a visit on Sept. 11, 1989, to the site of the Bemis farm, no trees were found. At the Freeman farm overlook, near an NPS signboard wass an apparent Golden Delicious with a 10" caliper. Also visible were 2 or 3 other trees of similar recent vintage. The site of the Asa Chatfield farm contained one relatively small apple which was across a deep ravine and not reachable.

Scattered throughout the park were a large number of apple trees, mostly chance seedlings and none of a size that would indicate any significant age. An example is an 8" caliper tree at the site of Bourgoyne's headquarters. The largest trees found were in a large field opposite a housing development

visible from the access road into the Visitor's Center. The largest tree found had a caliper of 20.75", indicating an age of approximately 100 years. I did not core the tree although the trunk appeared solid and its age could likely be determined if need be. The tree had greater than 12" of terminal growth, senescing foliage and signs of scab and black rot. This and all other trees also showed fruit injury from plum curculio, codling moth, sawfly, plant bug and sooty blotch.

Management and conservation recommendations - All trees seen certainly postdate the battle period, hence no enhanced management is suggested. None showed evidence of resistance to key fruit or foliage pests, so value to genetic diversity is limited to their contribution to wildlife food and habitat. No specific conservation measures are recommended.

j. Women's Rights NHP

During my Oct. 13, 1989 site visit to the Elizabeth Cady Stanton Home, I met with Superintendent Linda Canzanelli, and discussed site documents describing E.C. Stanton's activities in growing and preserving food including fruit. We found one pear with a caliper of 12" (DBH) growing behind the home to the south. Fruit were few, small, and completely yellow. At the time of the visit, the tree was in poor condition although terminal growth was good. I saw no evidence of a graft union. A second pear had a caliper of 12.5" (DBH). About 25 yards from the pear was a multiple-trunked apple, rotten in the center, with mature, yellow fruit similar to yellow transparent. Fruit had a very short stem, a shallow stem cavity, and an oval shape. The largest trunk had a caliper of 14" (at 36"). No graft union was evident. Also of interest was a large (20 inch) mulberry out behind the house. This tree could be original.

Management and Conservation Recommendations - The apple and pear trees do not appear to have been grafted, do not have sufficient size to date to the mid to late 1800's, nor is their location compatible with the location of the original orchard (Patterson et al., 1986). No enhanced management of existing apple or pear trees is recommended. The lifetime of the mulberry will be enhanced by a modest fertilization program. The site has an extensive amount of documentation about the importance of the orchards, berry bushes and vegetable gardens. The site grounds tour incorporates information about the orchard location to the east of the house.

Given the references to preserving fruits in Stanton's documents, reestablishment of a few representative examples, using fruit common to the area and time, would enhance site interpretation. I recommend propagating the existing trees as they could be seedlings descended from originals. Attempts should be made to determine the age of the mulberry tree. In the interim, the tree should be propagated to conserve a potentially original plant type. Blatch (1940) mentions the cherry varieties 'white oxheart' and 'black' near the house at the back. The USDA germplasm inventory does not list either, although there is listed a 'Black Tartarian', a well known and high quality variety which is still planted for commercial and home use. Perhaps NPS could enlist the aid of a local garden club, or historical society to plant and maintain the trees and a small garden, such as Stanton might have tended.

k. F.D.R. Home NHS and Eleanor Roosevelt NHS

The park was one of three initially worked with prior to the onset of the servicewide inventory. Detailed reports on activity at the three sites in 1986 and 1987 are contained in Appendix H. and I. of this report. The F.D.R. home orchard is sited on about 3 acres of sloping land below and to the rear of the home, and can be view from a vista point used by interpreters on the lawn facing west toward the Hudson river. About 2/3 of the orchard had been replanted since 1980, but remainder of trees were original. At the Val-Kil Cottege, trees were planted at several locations around the site. Trees at both sites had not had significant management for some time, and were overgrown, weak, and growing poorly. Production of fruit for any purpose other than maintaining the historic scene was of no importance at this time at ROVA.

A program of pruning, enhanced fertilization, and limited pest management was developed by the principal investigator in concert with site staff. In February, 1987, staff received hands-on training in orchard pruning, and all of the NPS-planted trees were pruned. On August 13, 1987 I met with Henry Van Brookhoven and Ron Galente, and discussed the role of the orchards in the overall site management plan. We also discussed plans to propagate the original varieties prior to removing the old trees, which were in severely deteriorated condition. We came to agreement that at least a few of the more healthy original trees would remain until the success of the propagation attempt was determined. Samples of bud wood were collected from trees of both original varieties, and sent to Roaring Brook Nurseries, Monmouth, Maine, for propagation.

Younger NPS planted trees appeared to be growing reasonably well, and the orchard had been mown at least once as of the visit. Fruit were few, and those of poor quality, showing evidence of the pest complex identified in an earlier report. No lime or fertilizer and no pesticides had been applied in 1987. Pruning of young trees performed in February, 1987 had improved tree structure. No pest monitoring or attempts at intensified orchard management had been performed by site staff due to maintenance demands of a large grounds.

On Dec. 24, 1987 I met again with Henry VanBrookhoven and Ron Galente. I was informed that a serious early snowstorm in October had caused substantial ice damage to trees at the Val-Kil Cottage, and that about 30% of the trees had been removed.

Since these earlier site visits, additional orchard trees dating to the historic period have been acquired by the park on land immediately south of the FDR Home. A Resource Management Specialist position was filled in 1989, and periodic contact has been maintained on several occasions with David Hayes. Trees grown at the UMASS Horticultural Research Center from budwood collected at the site have borne Golden Delicious', 'Red Delicious', and 'McIntosh' fruit. Surprisingly, although only two trees were initially collected from, three varieties of apples, have been fruited. None of the varieties found are rare or unique.

Management and conservation recommendations - It is not feasible to significantly increase intensity of orchard management at ROVA unless this is compatible with changing site plans. However, the orchard at the FDR home is a component of site interpretation, and should be maintained as such. A moderate level of maintenance integrated into the total management plan for the site is recommended to sustain existing or yet to be planted trees. With enhanced maintenance, original trees will be less

likely to decline and will provide a source of tree replacements if needed. Specific recommendations are: Continue an annual or semiannual program of light pruning of young trees to maintain proper structure and bearing wood surface; maintain proper fertility and soil pH based on soil and leaf analyses; apply a minimum of fungicides at key tree phenological stages and/or by environmental monitoring during primary scab season to protect trees from apple scab and black rot pathogens; and apply a delayed-dormant oil spray annually to protect against mites and scales.

No monitoring program or control actions are recommended against plum curculio, codling moth, apple maggot fly or other arthropods unless the interpretive needs of the site change.

ii. MID ATLANTIC REGION

a. Delaware Water Gap NRA

Roberts Farm

The site contains several of the largest apple trees seen in the context of this project. Trees appear to have been planted in widely spaced rows. After 3 separate visits in successive years, no fruit were seen on any of them. Each year visited, all trees showed less than 2 inch terminal growth and would have been propagated only with difficulty. The tree closest to the road had a caliper of 31.5 inches. Further into the field is the largest tree, too large for a tree caliper, estimated at 42" (at 36"). Proceeding toward the farm house is a tree of 26.5" caliper, another of 30.75", and another of 31.5". The furthest tree from the road is 38".

Along River Road

River road is a winding paved road which begins where Rt. 206 leads to the bridge back to Pennsylvania. Many relatively small apple trees grow along the road, including an overgrown remnant orchard of small trees near a sign about the old Mine Road. Further down River Road is an old stone farmhouse with several walnut trees nearby which were not reported on the original survey.

On Rt. 561 near the Montague Grange building

In this area there were several old orchards, all badly overgrown. One orchard site, on the way to the grange hall east of a large NPS owned building (gambrel roof opposite Overlook Drive) is delineated with a stone wall. All trees were rotten in the center, but most were still alive. None had any fruit, and all showed signs of black rot and apple scab. Tree calipers taken were: 1st tree in complete row closest to the house (22.75"), next tree in the row (28.75"), next tree in row (27.63"), adjacent to last tree but in row closer to the road (28.25"), 4th row in from the road (31.75"), row nearest road close to telephone pole marked 22 (32.75"), and row next to road in corner of stone wall and road (29.63").

Peter's Valley

In the Peter's valley area there were a few scattered trees, all rather small.

Along Route 209 in Pennsylvania

Crossing over Dingman's bridge into Pennsylvania and turning right, there were scatterred trees at several locations along the road, including a large, relatively recent orchard on the river side of the road, estimated to be at least 10 A. From earlier conversations with growers at the Apple Pit Farm Stand, this was described as containing 'McIntosh', 'Cortland' and other recent commercial cultivars. The site had some cherry trees, a few pear trees, and a quince that may have once been a pear rootstock. Trees appeared to be grafted, semi-dwarf trees which have not been pruned in several years. There were at least 12 rows of trees. The largest tree calipered was was an apple (22.6"). All trees were badly defoliated by apple scab.

Zion Church

The area above Zion Church had many trees, all very badly overgrown. Trees were relatively large, ranging up to about 18" caliper. Very heavy rains when visiting this site, combined with the thick underbrush meant that not much time was spent in the field.

Management and Conservation recommendations - After 3 consecutive yearly visits to DEWA and an additional attempt to have NPS staff collect fruit, it appears that trees are so debilitated that they may never, or rarely, fruit. Hence, without enhanced management, it will never be possible to identify trees of genetic value. A limited program of liming and fertilization of trees at Roberts farm and near the Montague grange, would likely result in enough additional terminal growth to allow successful propagation of existing trees on a precocious, dwarfing rootstock. For eventual varietal identification collected specimens should be planted at a nursery site and maintained under a minimum IPM program until fruiting.

Given the long history of settlement and farming in the area, NPS has an excellent interpretive opportunity associated with either the Roberts Farm or the Minisink District near the Montague Grange. Current NPS resources to maintain the old houses, mow fields, cultivate fruit trees, etc. are limited. Given the age of the existing trees, I would recommend that the Roberts Farm property be made available on a historic lease basis with a specific requirement of the agricultural lease to renovate and manage existing trees. The site will never have adequate productivity needed to sustain commercial activity unless new trees are planted, but it is suitable for rehabilitation of an historic scene.

b. Valley Forge NHP

Ranger Brain Lambert assisted with locating sites within the park, and with access to old maps showing fruit trees. The Duporté maps show an orchard at Varnham's quarters, at Washington's Headquarters, and at the Pot House. Table 3. contains results of a complete tree inventory carried out as a site visit follow up by Don Pumphrey and Brain Lambert in cooperation with the project investigator, in December, 1988. These data are also contained in the database attached to this report.

Huntington's quarters

The site had 11 pear trees present about 100 yards south of the parking lot (Photo 200), remnants of 3 or 4 rows planted 15 feet apart. Pear trees were in very poor to poor condition, with extensive dead wood, no fruit, and senescing foliage. Trees were small, with tree calipers (DBH) ranging from 11 to 15 inches. About 15 yards south of the parking lot was one apple caliper 22 in. which was 90% dead. This tree showed an apparent graft union.

The Pot House

At the west side of the building, there was one apple with a caliper of 23 in. growing at the site noted on site maps. The tree is in very poor condition, with very little growth (short internodes), evident wood rot, and extensive damage from cedar apple rust and leaf skeletonizers.

Maxwell's Quarters

To the northwest and west of the greenhouse were 5 apple trees in fair to poor condition, and 1 pear with a rotten center. The largest tree in this group calipered at 22" (D.B.H.), and showed evidence of a graft union (Photos 206, 207). The smallest was 9" (D.B.H).

The Lafayette House

At this site, there were 4 pears along the road, and 2 other pears on the house grounds. Most were rotten internally, and bore no fruit. The two trees closest to the road calipered at 20" and 19" respectively. The Lambert/Pumphrey inventory located two other apples at this location as well, with calipers of 14" and 16".

TABLE 3. Inventory of fruit trees in Valley Forge National Historic Park, carried out by Don Pumphrey, 12-20-88.

SITE NAME	TREE TYPE	D.B.H	FRUIT	CONDITION	TREE LOCATION
Boulware Springhouse	Apple	21"	Yes	Fair	corner of lot
Orchard McConnell	La.Apple	12"	Yes	Fair	East, between two buildings
	Apple	12"	Yes	Good	" " " "
	Peach	12"	Yes	Good	" " " "
Orchard Y.A.C.C.	La.Apple	13"	No	Fair	Next to road
	Apple	16"	Yes	Good	Back of green garage
	Apple	10"	Yes	Good	S. east corner Y.A.C.C. fence
Orchard Qualey	La.Pear	13"	Yes	Fair	West side of parking lot

Bakehouse	Apple	23"	Yes	Very good	West side of building
Wash Concession	Apple	15"	No	Poor	End of all-purpose path
Stirlings	Pear	17"	Yes	Good	First east side of driveway
	Pear	17"	Yes	Good	Third east side of driveway
Maxwell's	Pear	18"	No	Poor	Northwest of greenhouse
	Apple	22"	No	Poor	" " "
	Apple	13"	No	Poor	" " "
	Apple	17"	No	Poor	" " "
	Apple	22"	No	Fair	" " "
	Apple	9"	No	V. Poor	West of greenhouse
Lafayette's	Apple	16"	Yes	Good	Southwest toward turnpike
	Apple	14"	Yes	Good	" " "
Defender's Gate	Apple	22"	No	V. Poor	Field, 70 yds. south of Rt.23
Huntington's Quarters	Pear	12"	No	Poor	100 yds. South of parking lot
	Pear	12"	No	Poor	" " " " " "
	Pear	12"	No	Poor	" " " " " "
	Pear	11"	No	V. Poor	" " " " " "
	Pear	11"	No	V. Poor	" " " " " "
	Pear	15"	No	Poor	" " " " " "
	Pear	14"	No	Poor	" " " " " "
	Pear	14"	No	Poor	" " " " " "
	Pear	14"	No	V. Poor	" " " " " "
	Pear	14"	No	V. Poor	" " " " " "
	Pear	13"	No	V. Poor	" " " " " "
	Apple	22"	No	V. Poor	15 yds. south of parking lot
Mrs. Wilson residence	Apple	31"	Yes	Fair	West side of garage
Ranger Station	Apple	24"	Yes	Good	Field between station and admin.
Betzwood					Northside - 1st fountain
	Pear	13"	Yes	Good	Southside - 4th parking lot
	Apple	18"	Yes	Good	" " " "
	Apple	19"	Yes	Fair	Northside between 4 and 5 lot
	Apple	12"	No	Good	" " " " " "

Apple	12"	Yes	Good	Southside between 5 and 6 lot
Apple	15"	Yes	Poor	Northside between 5 and 6 lot
Apple	12"	No	Good	Extinct remnants of 10 trees
Apple	10"	No	Dead	

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c. Hampton NHS

At Hampton NHS (Photo 186, 187), I was assisted by Bill Curtis. He directed me to a portion of the grounds containing an old pear tree identified by Paul Betsell. A map dated 1843 by Joshua Barney shows a substantial orchard in the area where the pear is now, however, the map does not say how long the trees had been there.

The surviving pear (Photo 188) was about 30 feet tall, caliper 20' (at 36"). Terminal growth was very short, and it bore no fruit. A second larger pear (34" caliper) about 50 yds to the east of the first was badly overgrown, appeared dead. Based on its size, the larger pear could date to the mid to late 1800's, within the primary period for the site.

The black walnut trees at Hampton are in excellent condition, and show evidence of being well cared for.

Management and conservation recommendations - I recommend priority propagation of the surviving pear to determine if it is a rare or unique cultivar and to conserve the original plant material. If staff resources allow, it would be desirable to pull the poison ivy and other vines out of the second pear to confirm if it is dead. No enhanced management is recommended for the surviving pear tree or the walnuts. The pear will eventually succumb to old age as the other apparently has.

d. Shenandoah NP

At the Headquarters of Shenandoah National Park, I was assisted by Terry Lindsay, the North District Naturalist. I was unable to meet Alison Teetor, who has maps of all the old homesites in the park, with at least some types of vegetation noted. Elwood Fisher has done a lot of collection in the park, although most of it in the South District, and could be contacted for a more complete idea of cultivars present. Due to time limitations, I only visited the Hog Wallow Flats and Beans Gap areas, and hiked about 15 minutes up the Applacahian trail after turning onto Skyline Drive at the Park entrance. This area has been reported to have the 'Milum'(?) apple, a name which I have never heard of.

I found no trees anywhere in the park with evidence of a graft union, or of large caliper. Most were in fair condition, although many were overgrown by surrounding forest.

Hog Wallow Flats

Just past the sign, a little clearing contained 3-4 apple trees, possibly laid out in a line. Non had

fruit within reach. Tree condition was poor, similar to others seen in the park.

Beans Gap

Along Skyline Drive at Bean's Gap, there were 2-3 trees similar in size and condition to those seen elsewhere in the park.

Appalachian Trail

About 15 minutes up the trail beginning at the fire road just past the entrance to the park, was a cluster of apples at an apparent old homesite. Trees had multiple trunks, no fruit, and foliage in fair condition. The largest in this group calipered at 12". An additional 8 minutes up the trail was another cluster of trees along a flat stretch, part of a large remnant orchard now overgrown by forest. Foliage showed evidence of damage from an unknown leaf chewing insect, and no trees had fruit. Another 5 minutes up the trail where it branches, was another cluster of trees, one of which had fruit like golden delicious (caliper 9.5").

Management and conservation recommendations - Due to the nature of the park, no enhanced maintenance of fruit trees is recommended. Trees should be left to provide food and habitat for wildlife. Although desirable, a complete inventory of fruit trees in the park would take substantial staff resources and time. A large-scale fruit collection is not recommended, because fruit would be extremely difficult if not impossible to identify in their current condition. I recommend that site staff working on plant inventories or site maps contact Elwood Fisher for input on varieties he may have collected, or knows were grown in the park.

iii. National Capitol Region

a. Antietam NB

After visits to several other parks in the region, I arrived at Antietam after the visitor center closed, and was not able to confer with site staff. The original survey reported that there were a few scattered remnant fruit trees at old homesites. Without NPS escort or advance permission, I did not walk onto the homesite property, but an abandoned home near the visitor Center had a few fruit trees, all of apparent recent vintage (small caliper).

Management and conservation recommendations - No enhanced management or conservation is recommended at this time. Documents on site indicate that at least two orchards were present at the time of the battle. Should site plans call for replanting, historically appropriate planting plans, rootstocks and cultivars are recommended

b. Prince William Forest Park

In Prince William Forest Park, I visited three sites: the Taylor Farm, parking lot E, and two CCC Camps from the 1930's. Of the nine fruit trees seen, the largest had a caliper of 19.37", indicating and age of between 75 and 100 years. None showed evidence of a graft union. All trees were in poor condition, with very little if any terminal growth, and most had no fruit. Ranger Waldow informed me that several have borne no fruit in the last four years. Pest injury seen was from scab, defoliators and black rot.

Taylor Farm

This was the site of a homestead from the early 1900's which was the largest and most succesful farm in the park. There were 2 apples here, one of which was badly overgrown and mostly dead, the other of which was also very poor condition. Calipers were 14.5" and 19.37" respectively. Near the cemetary was a cherry of some sort although I was not able to determine if it was cultivated.

Parking lot E.

At this location, there were two apples, one of which was dead, the other of which was virtually dead, also several persimmon trees, which had excellent fruit. This was the location of two C.C.C. barracks in the 1930's. Near the location of Camp 2 there were two apple trees which produced fruit last year. Foliage is sparse, showing black rot symptoms, tent caterpillar eggs, some apple scab. One calipered at 15.25" (at 24").

Management and conservation recommendations - All apples seen likely date to this century given their size. Trees have little or no value to maintaining genetic diversity or enhanced site interpretation. I recommend no enhanced maintenance or special conservation efforts.

iv. SOUTHEAST REGION

a. Blue Ridge Parkway, Moses Cone Estate

On July 17-18, 1989 I conducted a site visit with Ian Furth, University of Georgia, Elwood Fisher, James Madison Univ., and Nora Mitchell, NPS North Atlantic Region. The site is characterized by many acres of old, often overgrown orchard, and an extensive network of old carriage roads. An historical base map from the early 1900's shows locations of trees and cultivar names.

Orchard portion in Maps #6 and #8

Trees were spotty (scattered), and almost all had dead wood throughout. All were heavily overgrown with lichens, and foliar condition was poor to fair. Tree spacing was about 18 x 20, training as an open bowl. Most trunks appeared solid although some were cracked and rotten in the center. Most fruit were between 1-1.5", with codling moth injury and some fruit scab present. Foliage showed very little leaf scab, white apple leafhopper injury and evidence of possible nutrient deficiencies.

Orchard portion in Map #5

At a tree listed as "Magnum Bonum", fruit were heavily russetted from the calyx, with a short stem. Another russet type apple in this area is up against the fence lying on its side (16-18 inch caliper at the base). Foliage was in excellent condition. Also in this same area was a tree that had 2 varieties on it, one a russet and one the tentative "Magnum Bonum", many showing Codling moth injury. That tree was growing well, with 8-10 inch terminal growth, still succulent.

South of the last tree, tree age and size changed noticeably. Calipers averaged about 12 inches. Fruit were much more infested with apple scab lesions than previously.

Areas #2 and #1

Varieties listed on the map include "Pippen" and "Bonum". This area was overgrown with pines and trees were mostly dead. Survivors are in very poor condition. Walking through the woods near a bluebird house marked #54, Fisher found a possible "Abermarle Pippen", with fruit damaged by scale and codling moth.

Area #4

On the edge of the woods were 3-4 trees clearly suffering from shading. One tree had very small fruit with signs of oblique-banded leafroller or green fruitworm feeding injury. Walking down through the woods to the next road we noted a heavily overgrown tree with very conical fruit, possibly a seedling.

Area #26

One tree near the smaller siltation pond had no fruit, but contained a colony of Rosy aphids and apparent potato leafhopper burn.

Area #7

Near the livestock loading area was a tree that Fischer tentatively ID'd as a "Jonathan". The tree was covered with an unidentified, all green geometrid.

Area #21 (?)

Just below the upper Carriage Rd. in a fenced in area, 3 rows down from the fence was the largest tree seen to date, with a caliper estimated at 36". There were several trees in this area. Foliage showed evidence of Gracillariid leafminer injury, and additional Rosy aphid injury. Fisher collected bud wood from a tree described on the map as "Carmack Red".

China Orchard

The site is very isolated and steep. The map lists several unusual cultivars here (Area #17) including "Gragg". Caliper of trees was about 18", tree condition overall was very poor. Area #16 had

many large trees in poor to fair condition, some with fruit 1"-1.75" diameter, with a long stem. Trees held mummified fruit and showed signs of fireblight.

Apple Barn Sawmill Orchard

All trees in this area were very tall (>25 ft.) and heavily shaded by white pines. Some fruit were apparently present in the tops, since the ground contained numerous drops.

Management and Conservation Recommendations - In addition to the historic Mansion and the network of carriage roads, the site is clearly focused on orcharding, and trees are original to the primary historic period. However, given the topography, size, and condition of the trees, enhanced management of most orchard sections would be difficult if not impossible. I recommend that certain sections, such as the family's orchard and the Flat top orchard, be pruned, fertilized and sprayed with a minimum fungicide program.

Dr. Fisher (pers. comm.) has confirmed the presence of at least one cultivar ("Gragg") not currently in the USDA germplasm repository, I recommend a large scale collection of existing trees using the base map. A small portion of the site (1-2A) could be developed into a well-fenced and managed nursery in which to grow the collected budwood on M9 or M26 rootstocks, for possible identification of additional rare cultivars.

v. MIDWEST REGION

a. Cuyahoga Valley NRA

At Cuyahoga Valley NRA, I received assistance from Gary Williamson and Dave Humphrey. Many sites within the park had fruit trees, some of substantial size. All trees seen were in poor to fair condition, with injury evident from internal trunk rot, apple scab, sooty blotch, fly speck, black rot, leafhoppers, plum curculio, and other assorted arthropods. Those at Frizee House were covered with poison ivy vines, making coring or careful caliper determination impossible.

Visitors center, Headquarters Building, Shady Grove and Columbia Run picnic areas

Trees at the Visitor's Center and at the picnic areas had the appearence of recent, ornamental plantings. A sizeable remnant orchard of older trees was seen in the woods in back of the park library.

Vaughn site

The site was behind a gate opposite a red barn up Riverview Road from park headquarters. After walking in some distance, we found a number of crab apple trees, one small (5" caliper) apple with fruit in very poor condition, and 2 small (6") apples with green fruit showing ridges emanating from the calyx.

Intersection of Riverview, Brookside and pleasant Valley Roads

At this location were four apples, caliper 8", 8", 18" and 21.75", and one pear, caliper 12.5". Fruit and foliage all were in very poor condition.

Knapp Homestead

No fruit trees were found at this site

Gleason site

Trees at this site appeared to have been part of a kitchen garden rather than a commercial orchard. On the hillside above the Gleason house were an apple, caliper 15.25", and a pear, caliper 15" (Photos 43, 44). The apple had unusual foliage, round to oval leaves with very sharp serrations.

Frizee House

Two large original apples, calipers 24.25", were noted on a terrace above the historic house. Both were in poor condition, with no fruit, little or no terminal growth, and heavily overgrown with poison ivy. Propagation would require climbing into the top of the trees in order to access living bud wood.

Sanford Hostel

The site had several fruit trees of varying age, including two crabapples in the front yard, the larger of which calipered 14". To the north of the house, between the house and the barn was a large, caliper 25.75" apple with most of the trunk broken out of it. Behind the chicken coop were 2 apples, caliper 18" and 20", and one pear, caliper 18" (Photo 41). Immediately behind the barn were two more apples, caliper 15.75 and 15.25. All trees were in fair to poor condition, and none showed evidence of a graft union. Up the road from the hostel are old houses which may not be NPS owned, with fruit trees of large caliper, 24.5"and 28".

Boston Mills Road

During the site visit, we were not certain the extent of park land, but along Boston Mills Road we found at least two sites with fruit trees (Photos 11, 12, 40, 42). A substantial orchard of relatively small, heavily overgrown fruit trees was noted at the second white barn. Continuing out to a red roofed barn, we found a number of pear, ranging in caliper from 9" to 18.75", and apple trees. This was apparently a commercial scale orchard at one time. Fruit and foliar condition was generally good, although the larger planting out back was very heavily overgrown.

Management and conservation recommendations - Culture of fruit trees for home use and at a commercial scale appears to be a significant component of the cultural landscapes in the park. The trees at Sanford Hostel and Frizee House were the largest encountered, up to 29.75 inch caliper, and as such are likely to be over 100 years of age. At the Frizee House, restoration of the historic structure was well underway, but no work had been done on the terrace above the house on which the fruit trees were growing, and which may have been the kitchen garden. I would recommend a program of limited

clearing in this area, to allow more light to the existing apples. Poison ivy should be pulled down from the trees during the winter, and kept out of the trees with repeated herbicide applications. A program of fertilization would enable these trees to be propagated so that new trees propagated from original budwood could eventually be replanted.

Trees at Sanford Hostel ranged from 14.75 inch to 29.75 inch in caliper, indicating that they were planted over a period of time. A program of limited pruning and fertilization is recommended to maintain tree vigor.

b. Indiana Dunes National Lakeshore

At Indiana Dunes NL, I visited the Bailey Homestead, the historic Chellberg Farm, Goodfellow Camp, and a site at the beginning of the horse trail (Photo 37). The latter three had apples and pear trees in generally poor to fair condition. Many more fruit trees were found than were reported on the original survey. Several black walnuts or butternuts were growing at the Chellberg Farm.

Pest damage seen on apples was from apple scab, sooty blotch, apple maggot, and codling moth. Some trees were rotten internally. I was unable to locate a cherry tree reported in the original survey.

Chellberg Farm

The site had 5 remnant apple trees raging in caliper from 16.25" to 26.75", and one pear, caliper 13.5". Based on their caliper, the surviving apple trees at the Chellberg Farm likely date to at least the 1880-1890 primary historic period for the site, especially the hollow, 26.75 inch caliper apple which had lost a large (16.5 in.) branch just prior to my visit. A request to site staff to send a slab off that branch to determine its age was not carried out. Additional follow-up calls were made to the site. After the branch had been cut up and removed, a small segment, perhaps not even from the correct tree, was eventually collected from a woodpile and sent to Amherst. Since the origin of the sample could not be confirmed it was not possible to use it to determine the age of the tree in question.

Goodfellow Camp

Several trees at Goodfellow camp are also likely to be at least 100 years old (22.5" and 23.5" caliper). The road into the camp appears to have once been lined with apple trees, many of which still survive (Photos 14, 15, 16). At least two kinds of pear were also noted (Photos 38, 39).

Bailey Homestead

No cultivated fruit trees were noted at this site, although there was a small native hawthorne opposite the main house. On the trail between the homestead and the cemetary, was a huge, potentially record sassafrass tree.

Horse Trail

At the beginning of the horse trail was a pear with a caliper of 14.75" (at 36"). The tree is in good condition, with very little dead wood. Some yellow, heavily russetted fruit were present, but out of reach.

Management and conservation recommendations - No positive identifications were made for any fruit collected at Indiana Dunes, although specimens from Goodfellow Camp resembled 'Yellow Transparent' or 'Lodi'(Antonovka family) and 'Wagener' or 'Ben Davis'. One specimen from Chellberg Farm (Photo 17) resembled 'Fameuse" (Snow apple) or another member of the same apple group which includes 'Canada Baldwin', 'Louise', 'Scarlet Pippin' and the well known 'McIntosh'. At least the largest trees at the Chellberg Farm are very likely to be original, although none could be confirmed to be rare or unique. Photographs in the visitor Center showing the Chellberg house with a dusting of snow, indicate that the area around the house was once almost completely cleared. None of the large walnuts or other deciduous trees currently present show in the photo. However, these trees now shade out the remaining fruit trees.

Given that site interpretation now includes pressing apple cider, one of the historical farm activities, I would recommend removing some of the walnuts and other non fruit trees near the house. This would allow better light penetration to the surviving fruit trees. In addition, a program of limited fertilization and pruning of existing fruit trees would generate sufficient new growth to enable propagation of these trees for replanting. If removal of non fruit trees is not possible, propagation of existing fruit trees is still desirable. Replanting could be done at some other open location near the Chellberg farmhouse. The largest trees at Goodfellow Camp should also be collected.

c. Isle Royale NP

With the assistance of Bruce Weber, and Tim Cochrane, Park Naturalists, I visited Isle Royale NP during July, 1989, and conducted site visits to Ransom (Photos 30, 31, 32, 33), Daisy Farm Campground, Siskiwit Mine area, Chippewa Harbor, and Windigo (Washington Harbor) (Photo 29). I collected specimens of fruit where they were present (Photos 34, 35, 36), and site staff conducted additional collections in September, closer to fruit maturity at Chippewa Harbor (Photo 166), Siskiwit Bay Campground (Photos 136, 137, 138, 139, 140, 141, 142, 143), Daisy Farm Campground (Photos 132, 133, 134, 135), and Windigo (Photos 124, 125, 126, 127, 128, 129, 130, 131). No intact tree cores were taken, although attempts were made, and tree calipers were recorded where possible.

Maximum tree caliper was 10 inches, indicating that none are more than an estimated 50 to 75 years of age. Some could be older but showing reduced growth due to the extreme environmental conditions they are growing under, and the absence of any management or care. Signs of a number of pathogens and arthropods were noted, including: black rot, unknown leaf skeletonizers, leafrollers and fruitworms, and gall-forming eriophyid mites. Vertebrate damage to fruit was from birds, and trees at some sites were heavily browsed into a thicket by moose (Photo 173).

Fruit samples were brought to experts at the New York State Agricultural Experiment Station, Geneva, NY for assistance with identification. For Isle Royale fruit, no conclusive identification was possible for several reasons, including: poor fruit size and condition; the small number of samples; and

the apparent seedling nature of the fruit. One sample from Windigo was tentatively identified as related to Malus iloensis, a native crabapple, and was definitely not a named cultivar. Others (sample #1 from Ransom Photo 30, 31) had the characteristic shape of 'Black Gilliflower', an old, uncommon cultivar, and was likely a seedling of 'Black Gilliflower'.

Management and conservation recommendations - All trees on Isle Royale were associated with human habitation or activity. However, the absence of any graft union, or obvious planting pattern supports the conclusion that all trees, with the possible exception those at Windigo, were chance seedlings resulting from the accidental discard of apple seeds. Hence, none are likely to be named cultivars, merely their open-pollinated progeny. Careful studies of available records of the Washington Club, steamship bills of lading, etc., might reveal information concerning types of apples brought as food to Isle Royale, and could confirm parentage of existing trees. Should such information be found, trees, especially at those Washington Harbor and the 'Black Gilliflower type at Ransom, provide an historical and botanical interpretive opportunity. Trees at Washington Harbor should be opened up by removal of brush and other competing vegetation.

None of the trees found appear to have any resistance to foliar pathogens, although many are reported fruit annually, in spite of a short growing season and extreme winter temperatures. In the absence of any interest on the part of USDA in winter-hardy breeding stock, or site plans which call for including trees in site interpretive materials, no further collection or enhanced maintenance is recommended.

d. Sleeping Bear Dunes National Lakeshore

On August 9 and 10, 1990, I conducted site visits to Sleeping Bear Dunes National Lakeshore, and met with Resource Management Specialist Bill Heard, who gave directions to a number of sites he knew contained fruit trees. North and South Manitou islands, both of which had active farms on them in the past reportedly have fruit trees as well as American Chestnut. Many old farmsteads in the park contained fruit trees, including apple, pear, cherry, and mulberry, as well as grape vines.

Locations where fruit trees were found were: at the intersection of Sutter Rd. and Route 22; along Route 22 past the Platte Ranger Station (Photos 53, 54); at the intersections of Esch Rd., Stormer Rd., Norkonk Rd. (Photo 61), Aral Rd. and Rt. 22; near the old town of Aral; near a barn on Stormer Rd.; on the D.H. Day farm (Photo 56); at the farm at the end of Miller Rd. (Photo 55); at Pyramid Point, in the Port Oneida area (Photos 57, 58, 59, 60, 63); on Baker Rd. behind an old, falling down house (Photo 64); and in the Good Harbor area (Photo 62).

Trees ranged in caliper from about 10" to as large as 34.5". A number of the largest trees were at a farm on Miller Road. Most of the trees seen on the mainland had fruit present in surprisingly good condition. However, evidence of apple scab, black rot, apple maggot fly, plum curculio, codling moth, and leafrollers (or fruitworms) could be seen.

Several trees at various sites in the park showed evidence of a graft union, indicating that they had been planted from grafted or budded stock. A few had multiple trunks, indicating that they were

likely chance seedlings. Park residents with whom we spoke, including Mr. Esch Sr. and Mr. Esch Jr., and Mr. Warren Deering, reported that varieties commonly grown in the area in the past included: Winter Banana, Wealthy, Tollman Sweet, Wagener, Wolf River, Northern Spy, Strawberry, Baldwin, Common Red Delicious, Russets (one of the oldest). I was referred to Mr. Jim Lawback, who lives on Diamond Rd., who is said to know about, and to have a number of old apple trees.

Management and conservation recommendations - None of the cultivars of apples mentioned by residents are unavailable or rare. None of the fruit seen had unusual characteristics. While it is conceivable that some old farmsteads could have other cultivars which residents did not mention, the likelihood of finding such is probably low, and does not justify expending the effort and funds required for a widespread collection.

Trees in the Pyramid Point/Port Onieda area are the oldest seen in the park, and could date to the late 1800's. As such they are a significant element of the historic cultural landscape. A minimum maintenance program of fertilization/liming and pruning out dead wood is recommended. Nothing can be done to reverse the internal rot seen in many of the trees, and these will eventually succumb to wind storms. Replacement stock from historically appropriate varieties are available from a number of sources.

e. Saint Croix NSR

At Saint Croix NSR, I was assisted by Victoria Grant, Natural Resources Specialist, and shown several old house or farm sites by Ranger Joe Hutin, Natural Resources Specialist. We did not stop at the Bower or Deeter sites, which date back around 25 years, but visited the Foster, Northview, Geidel, Glen Brae, Horton, and Wescheche sites. Pathogen and arthropod injury seen was from cedar apple rust, black rot, sooty blotch, fly speck, whiteapple leafhopper, plum curculio, a scale, and an unknown fruitworm.

Foster site

No fruit trees were found at this location, which dates to the late 1800's or early 1900's.

Northview site

Many apparently wild plums (Photo 23) were seen at this site, as well as a crabapple (Photo 50), one tree with a stripey red apple (Photo 48), and two larger apple trees (Photo 49) (caliper of 16.75") with an evident graft union, and large, tart, yellow apples (Photo 45).

Geidel site

The Geidel site contained the remnants of a substantial orchard, although most of the trees were dead. Trees showed evidence of a graft union, and a 16 ft. x 16 ft. spacing pattern. One tree of 20.75 in. caliper with fruit resembling 'McIntosh' (Photos 51, 52), remained alive.

Glen Brae site

Two apple samples were collected from this site from trees in fair condition (Photos 46, 47).

Management and conservation Reccommendations - None of the sites visited appear to have unusual or rare cultivars. No enhanced management is suggested. If plans come to fruition for an additional visitor center at the Geidel site, maple trees which have shaded out the old orchard should be removed, and surviving trees from that and other sites should be propagated for reestablishment of the old orchard.

f. Effigy Mounds NM

With assistance of Park Ranger Jim Langhus and Jim David, I visited several sites in the park which had fruit trees, including: North unit (Photo 8); South Breckner farms (Photos 18, 19, 20, 21, 22); an old homestead south of the county road (Photos 1, 2, 3, 4, 5, 6, 7, 157, 158, 160, 161, 161a, 162, 163) settled by a relative of park employee Joyce Nading; and in the South Unit (Photos 9, 10), on Rattlesnake Hill. Pests seen were cedar apple rust (very severe on certain trees), apple scab, black rot, sooty blotch, fly speck, codling moth, fruitworm or leafroller, white apple leafhopper, and nutrient deficiencies.

The park contained many trees, most of which were small (6" caliper), with few as large as 18". No fruit collected during the site visit or later collected by site staff could be positively identified, but tentative ID's included: a crab apple with many of the descriptive characteristics of 'Transcendent crab', a possible 'Golden Sweet', possible 'Grimes', possible 'Wagener', and an 'Antonovka' family type.
Management and conservation recommendations - None of the sites visited lend themselves to special interpretation, especially given the pre-historic focus of the par. No enhanced management of the fruit trees is recommended. No fruit appeared to be resistant to diseases, and, in fact, susceptibility to cedar apple rust was extreme in some cases. One specimen showed an unusual feature; only 4 lobes to the core rather than the usual five. I recommend further attempts to relocate this tree to collect additional specimens in order to determine if this is a genetically-based characteristic which may be of interest to USDA.

g. Apostle Islands NL

At Apostle Islands, I was assisted by site historian David Snyder and Resource Management Specialist Julie Van Stappen. There were fruit trees and/or grape vines at three sites: McCloud-Brigham; Michigan Island north of the lighthouse; Hermit Island by Cedar Bark Cottage; and the Noring Farm and Shaw-Hill Farm on Sand Island. Pathogen, arthropod, and vertebrate damage seen was from black rot, possible fire blight, white apple leafhopper, a tentiform leafminer, and sapsucker. Little if any evidence of apple scab was seen on any fruit or foliage.

The McCloud-Brigham site

This location had apples (Photo 25), plums (Photo 26), grapes, and currants (Photo 27). Trees appeared to have been planted on an 18 by 18 ft. spacing. A 1938 aerial photo shows an orchard at the site, so trees may be over 50 years old. Tree calipers ranged from 9.25 inch to 15 inch. None showed a graft union. One sample from McCloud-Brigham, taken from a 9.25 inch caliper tree growing next to

the trail was identified as an open-pollinated seedling (Photo 24).

Michigan Island

Site documents refer to a Michigan Island lighthouse keeper in the 1870's who propagated and gave away thousands of apple seedlings. Trees I observed at this site were all apparently seedlings of a long stemmed crab apple, with very large, non-hairy, sharply-serrated leaves. Trees were overgrown and showed little or no terminal growth. I took one good core from one tree which calipered 19.75' (at 18").

Hermit Island

Two trees of about a 6 inch caliper at Hermit island appeared to be seedlings of the long-stemmed crabapples seen at Michigan Island (Photo 28). One showed symptoms similar to fire blight.

Sand Island

Although not visited by the principal investigator, NPS site staff collected a variety of apple specimens from 13 trees at four different locations on October 11, 1989: Shaw Hill Farm (6 apples), section 25, T52N, R5W; Campbell-Jensch summer residence (1 apple), section 25, T52N, R5W; Noring Farm (5 apples), section 13, T52N, R5W; and edge of trail, clearing west of Hansen/Westhagen residence (1 apple), section 18, T52N, R4W (Photos 145, 146). The Shaw-Hill farm was occupied by the Shaws since the 1870's and cultivated as a farm until the 1940's. The Campbell/Jensch residence dates from about 1910

Management and conservation recommendations - Although trees showed little or no signs of apple scab, further study would be needed (in a year when rainfall was frequent during primary scab season) to determine if there is any genetic resistance. Trees have value to wildlife, and to site interpretation at McCloud-Brigham, and Michigan Island. I recommend a limited program of brush cutting and tree removal to open up existing trees to better sunlight penetration. Some trees could still be propagated from in order to replant younger trees, especially at the Michigan lighthouse given its history. Additional attempts should be made to date, using caliper and/or coring, and to identify apples from Sand Island

vi. ROCKY MOUNTAIN REGION

a. Zion National Park

The primary focus of the park is the spectacular cliff and canyon landscape. Most of the fruit trees in Zion originated on family farms of Dennett, Schiefer, Crawford and Winder which were added to the park in 1960. Surviving trees were in Watchman Campground and were managed for campground shading, not for fruiting. A very good base map showing the locations of fruit trees was done in 1988. According to the original survey, Stuart Dennett (a retired NPS employee) reports that 'Rome Beauty', 'Winter Pearmaine', 'Double Red Delicious', 'Twenty Ounce', 'Winesap', and 'Banana' apples were grown in the area, as well as 'Bing' and 'Lambert' cherry, 'Elberta' peach, 'Bartlett' pear, pecan,

mulberry, apricot, plum, and 'California' grape.

During a site visit on August 28, 1990 I met J.L. Crawford, whose grandfather was one of the early setllers. Mr. Crawford was a wealth of knowledge on the fruit trees, and the history of the area. He referred us to a number of sources for information, including an interview he gave in Springdale, Utah on 10 June, 1981 as part of the Zion Oral History Project (in Zion National Park Library). He also referred to the biography of W.L. Crawford, contained in another park library reference called "Pioneers and Settlement". A quote from that source refers to several apples grown in the area, including 'Sweet Belle', 'Black Ben' (possibly 'Black Ben Davis'), 'Duchess', 'Grimes Golden', 'McIntosh', 'Limbertwig', and 'Stayman Winesap'. During the site visit, he also pointed out grape vines reportedly from the variety 'California' mentioned by Dennett.

Management and conservation recommendations - Neither the grape variety 'California' nor the apple 'Sweet Belle' are listed in the NCGR listing, although a 'Sweet Bough" is. I recommend collecting and propagating existing grape vines to determine if specimens of 'California' still exist. Four specimens of 'Limbertwig' apple are listed in the NCGR listing. Given the low likelihood of finding a surviving 'Sweet Belle', no collection of apple budwood is recommended. Some sections of old irrigation ditches feeding the fruit trees have broken down, and many trees are no longer receiving irrigation water. Although no other forms of enhanced maintenance of fruit trees is recommended, restoration of damaged ditch sections should be be done. Without a modest labor investment to provide trees with adequate water, the shading and wildlife food resource provided by the remnant fruit trees will inevitably decline and die.

vii. SOUTHWEST REGION

a. Fort Davis NHS

We met with Mary Williams and Britt Fryary about a fig tree that is apparently original to the site. An archival photo dating from the mid to late 1940's shows the fig growing in one corner of the Commanding Officer's quarters. Mary reported that the fig had been cut down within the last 3-5 years because it was damaging the historic structure. We observed later that it had sprouted from the roots. The fig was growing within a rock border which is apparently original to the house, which was finished in 1869 after the fort was reopened following the end of the Civil War. The first C.O. was not married.

I took a core from the largest remaining trunk, but it was short and dry rotted. In pushing against one of the smaller stumps, it broke off at the base and I brought that specimen along as well for attempts at dating. The US Forest Service Lab in Durham, New Hampshire was only able to document 13 annual growth rings from a slab off the stump, and the small core was unreadable.

Down by the picnic area along the access road were several more recent fruit trees. One was a 6" caliper apricot with good quality fruit and foliage. There were two others as well, one of which calipered at 11" at the base of the 1st branch. Walking away from the picnic area were 2 other apricots with no fruit that calipered at 11.75" (at 36"), and showed gummosis on the trunk. Also nearby were 2 pears, one of which had very round, light green colored, sweet tasting fruit, and a caliper of 15". The

second pear had different fruit and showed signs of fireblight. This tree had a few late blossoms, indicating the it was under stress. The 3rd tree in this area was an apple bearing green fruit with a red blush and with a caliper of 14.75". I was not able to take any solid cores. Given their size, I would estimate these trees date from the 20th century.

Management and conservation recommendations - According to George Leavitt, a fig specialist at U. C. Davis, a fig planted in California in 1910 has attained a diameter of two feet growing on a heavy clay soil, and a 13 year old fig would have an 8" diameter; larger than the stumps from Fort Davis. Because of their Mediterranean origin, fig trees are sensitive to low temperatures, and above ground wood will die at between 0 and -15 F. In west Texas, periodic freezes would have likely prevented a fig from achieving great size. The propensity of the roots to survive and regrow, however, could have allowed the plant to survive its inhospitable environment for a long time. Hence, while the current study has not been able to document the age of the fig prior to the 1940's, there is a real possibility that the tree could date to the late 19th century. I recommend that steps be taken to care for the living portions of the fig until further research sheds light on its age. If it has not already been done, site staff historic document research should be conducted for any reference to the fig or its fruit.

No enhanced management or conservation is recommended for the fruit trees along the entrance road.

b. Carlsbad NHP

Rattlesnake Springs Historic District, Ranger's residence

August 23, 1990 - The orchard at this site was an obvious part of the Historic District Landscape, with trees growing along irrigation ditches. Trees have not been pruned within the last few years according to Superintendent Felix Hernandez. We started the site visit inventory at the irrigation pond. Heading away from the pond, the first fruit tree we came to was a plum or apricot, with a multiple trunk, good foliar condition but some dead branches up top and a 15.5" caliper. The next tree in line was another plum or apricot again with multiple trunks, evidence of dead wood pruning, and a 15" caliper. Third in line was a similar tree with a 15.75" caliper.

The fourth tree in line was an apple with large green fruit showing a red blush. The tree was very thick and could benefit by substantial pruning by a trained person. Next in line was a tree with a tagged as a plum, with an 11.5" caliper at the base. No fruit were present. Next in line was another apple, with multiple trunks and a few fruit, and showing cork spot and possible codling moth injury (out of reach) and a caliper of 15.25". All trees to this point showed very limited terminal growth, less than 2". The next tree in line had woolly aphids present and appeared to be a thicket of suckers off the roots of a tree whose top had died.

Just at the entrance cattle guard were 2 or 3 very small plums, possible seedlings. Just outside the cattle guard was a pear showing good terminal growth, good foliage (although possible magnesium deficiency, interveinal chlorosis), several Bartlett type fruit and a caliper of 12" (at 36"). Heading back from the gate toward the ranger's house was a six trunk apple which calipered 17.5" at its base. The tree

had a large number of fruit resembling yellow transparent, very limited terminal growth, no signs of scab and very little injury to the fruit of any kind. The next tree in line was a pear with an 11.5" caliper and a lot of dead wood in the top. Pears were all green and gnarly with a very deep, sunken calyx. Foliage showed damage from a defoliator like tent caterpillar or fall webworm.

The next apple tree had a very thick canopy with fruit starting to show a lot of red color and a 17.5" caliper. The fruit were very heavily russetted at the stem end, extending down to the shoulders. Next was another apple similar in condition to others seen. Very few fruit. I cored this tree, and removed a 7-8 inch core. Immediately adjacent to the last apple, and to the West of the Ranger house were about 10 pecans, many with nuts and calipers ranging from 17.75" to 22.3" (at 36").

Ranger Kelley showed us a copy of a map made by R.J.H. dated 3/16/64 showing fruit and nut trees in the area. Names noted are 'Barton' pecan, 'Western Schley' pecan, 'Merideth' plum, 'Red Delicious' and 'Yellow Delicious', 'Improved Wine Sap', 'Summer Champion' apples, 'Bartlett' pear, 'Red June' pear, 'Lodi' apple, 'Holland' apple, 'Jonadel' hybrid apple, 'Rice' plum, 'Wickson' or 'Hickson' plum, 'Early Golden' apricot, 'Tilton' apricot, 'Moonpark' apricot, 'Royal' apricot and several peaches which don't seem to exist any more. Attached to this is another map which seems to represent what exists today. It is not known if the 1964 map was a planting plan or a map of tentative identifications of trees existing at that time.

Comparing the 1964 map to the current living trees we found good agreement as to tree positions. However, there was no sign of the easily identified 'Golden Delicious' or 'Red Delicious'. Hence, I believe the '64 map was an attempt to inventory trees growing on site at the time, rather than a plan for planting.

Management and Conservation Recommendations - Two of the fruit listed on the 1964 map (e.g. 'Rice' plum, 'Red June' pear) are not in the NCGR listing, so that collection of fruit for possible identification is recommended. The US Forest Service Lab was unable to read the one tree core taken due to rot and twisting. However, given their size, it is my belief that the fruit trees most likely pre-date 1964 and hence are likely an original part of the historic landscape. In the absence of any solid tree cores, I would suggest site document research or personal interviews be carried out to look for photographs, documents or other evidence which could help date the fruit and nut trees. Fruit trees should be pruned over 2 years by a skilled fruit tree pruner, and fertilized according to individual leaf tissue analyses. Because the site is so dry, improved irrigation but no pest management program is recommended. Given modest additional care, trees will likely survive for many more years.

c. Guadalupe Mountains NHP

The site contained a number of pecan trees reportedly planted around 1900. Most were in excellent condition, apparently receiving enough water from the spring. In addition, nitrogen leaching from the horse stables probably also contributes to their condition. Two pecans right inside the compound wall and three outside the wall to the east showed signs of stress, including dead wood and limited terminal growth. Also at the site was one remnant pear in very poor condition, calipered at 17.75" (at 24"). It probably has only survived because it has been watered. The pear had lost a major

branch and could not be cored. From its size it apparently dates to the primary period for the site. A swelling at the soil line may indicate a graft union. We walked out to the Manzanita Spring area to check on possible fruit trees at that location, but found none.

Management and conservation recommendations - Steps should be taken immediately to insure that the pecans and the lone pear receive adequate water to help them survive the dry climate. Given its condition, not much time is left to try and conserve and propagate this pear. Applying well-rotted horse manure to its base under the drip line would be desirable to provide nutrients, and to help retain moisture. As of the visit, site staff discussed plans to restore some of the buildings within the next few years to enhance interpretation. Especially in this event, but even if not, the pecans should be pruned of dead wood and the pear should be propagated. Site staff should contact the New Mexico St. University Research Center at Artesia, NM, just north of Carlsbad, to solicit assistance with conserving the fruit and nut trees.

d. Bandelier NM

Fruit and nut trees at the site were reportedly brought to Frijoles Canyon by judge Abbott in 1913. Although the primary focus of the site is the cliff dwelling and kiva period, the park has a long history as a tourist destination begun by Judge Abbott and continued by Mrs. Fry. During an August 24, 1990 visit, we were informed of an archeological survey underway which has done a map of the existing original orchard and the locations of trees that have been planted in an attempt to bring back the complete appearance of the orchard. On the trail to the orchard near the stone structure marked 7, 8, 9 on the site map was a healthy walnut calipered as 14" (at 36"). A second walnut is at the end of the orchard closest to the visitor's center. Other than some dead branches, this tree was also in good health.

Next to the walnut (heading toward the Visitor Center) was an apple calipered at 9" (at 36"), suffering from shading by adjacent trees. The tree had a lot of dead wood, but foliar condition was very good. A swelling about 3 feet above ground on the trunk could be evidence that the tree has been topworked. Nearby were remains of a system of old irrigation ditches originally feeding from the stream. Walking further into the orchard we noted a 8.5" caliper apple in poor condition, rotten in the center. The tree showed leaf curling from water stress, but had several shoots from which it could be propagated. This tree showed the same swelling as the previous apple. Neither showed evidence of a graft union at the soil line.

Continuing into the orchard we noted one of the largest original trees, with a 22" caliper at the base of the first branch, and showing an open bowl structure. Terminal growth averaged about 8"- 10". The center was rotten and would not core. Continuing away from the Visitor Center in the same row as the last apple was what appeared to be a plum tree with a 4" caliper. Like other NPS planted trees, it was growing in a wire enclosure. As we headed towards the cliff dwelling from this plum we noted another apple with no fruit, but with large leaves and good terminal growth, caliper 8". The trunk was almost completely dead.

The NPS planted trees appeared to have been well protected by deer and some were doing reasonably well. However, several enclosures had nothing growing in them at the time of the site visit,

perhaps due to lack of water and fertilization, and strong competition from grasses. In the row with the empty enclosures was a nice specimen of an original tree, with a caliper of 20" at the base of the first branch. Other than some yellowing of older leaves, this tree was in good condition, with vigorous growth that could easily be propagated from. No fruit were present. The next tree in that row, also an apparent original, was growing as a thicket of twisted branches. The caliper was 17" at the base of the first branches. The last tree in that row with the 3 original trees was a pear with a 14" caliper (at 36"). Foliar condition was excellent, terminal growth good. In the top were 1 or 2 small, tear drop-shaped reddish pears.

Near the last tree was a newly planted pear with a few very small, immature fruit. The last tree in the row with the newly planted pear is a nectarine which is doing reasonably well, bearing one small purplish colored fruit.

After leaving the orchard and climbing up to the storage structures, we noted 2 small walnuts right up next to the cliff face. Also, there were 3 other larger walnuts ranging from 36"- 40" in caliper.

Management and Conservation Recommendations - All trees at the site would benefit by reducing competition from groundcover and by regular irrigation, fertilization and pruning. Given the original nature of the orchard, I recommend all original trees be propagated and grown in a nursery for 2-3 years. During that time, tree planting holes should be dug and filled with organic manure. Also during this time, the old irrigation ditches should be restored, and arrangements made to pump water to the site on a regular basis. When trees are planted, maintenance of deer fences or use of deer repellants should be a priority. In addition, mulching or herbicides around the base of each tree to control grass competition is also essential. No pest management is suggested due to the dry nature of the site.

Specimens should be collected to determine if the walnuts seen are black walnut (*Juglans nigra*) or Arizona walnut (*J. major*). If they are the former, these trees are the result of human activity, as *J. nigra* is not native to the southwest U.S. (Little, 1976). If identified as the latter, confirmation as to species would potentially merit publication of a short scientific note as trees at Bandelier are outside of the published range for the species.

f. Lyndon B. Johnson NHP

With the assistance of Superintendent Melody Webb, and Evelyn Klein, I conducted a site visit to LBJ on August 19, 1990. The initial survey reported that the site has over 700 pecans, both native and named varieties: Western Schley (182), Burkett (67), John Garner(11), San Saba (12), Chactaw (2), Cheyenne (30), and Mahan (1). The pecan trees at LBJ are a component of current site interpretation. President Johnson reportedly would give the pecans away, and wanted the groves to be maintained. Facility Manager William B. Hodges (Buddy) has responsibility for the pecans. Pest management consists primarily of fungicide (Benlate approved) applied as needed. Use of an alternative material if available, would be desirable. No insecticides other than B.t. are approved. Major pests are Pecan Weevil and Pecan Casebarer.

Johnson Settlement

At the old Johnson settlement, there was a Mahan at the corner of the building with a caliper of 16.25". Dead wood has been pruned out, but the tree receives little irrigation and normally bears only every 2-3 years. Also in this area were scattered Berkett, and a number of large (29-40 inch) native pecans. Just outside the gate were 5 other natives.

LBJ Ranch

At the birthplace were Western Schley put in by Jordan in 1947-48 with calipers of 17.75", 22.25", 22.75", and 25". Next to the cemetary were San Saba. North of the grandparent's house was a small (8.25") Choctaw which may have been a graft, and a very large native. North of the elm tree by Jordan's barn was a 16" caliper John Garner. Several John Garner have been budded over to Cheyenne.

Management and conservation recommendations - No changes in current levels of managment are required. From a resistance management perspective, alternating fungicides would be desirable.

g. Canyon de Chelly NHS

Quoting from E. Fred Patton's response to the original survey: "Canyon de Chelly represents a unique land status situation in which the National Park Service is mandated to protect cultural resource sites and provide for visitor acces to Navajo tribal lands. Navajos have farmed, raised stock and planted fruit trees in the canyons since the 1700's and continue to do so today. Historical records indicate that in August 1864, U.S. troops under the command of Captain Thompson destroyed all or most of the fruit trees within Canyon de Chelly and del Muerto. Records show this to be approximately 5,000 peach trees.

Since that period, Navajos have replanted hundreds of trees within the canyons. While it is possible that some trees escaped the 1864 destruction, the Park Service has no records of any. The Park Service has no records of when trees have been planted or the number or variety. Nor does the Park Service have a current orchard inventory of the thousands of fruit trees within Canyon de Chelly."

On August 26, 1990, I visited Canyon De Chelly with the assistance of Gino Bahe. We visited several sites along the canyon, including the Peach Pit site, and the Basketweaver site. Many of the small side canyons lived in by various Navajo families have peach trees present, but we saw none which contained large numbers. Most trees were small, with few to no fruit.

I met and interviwed Chauncy Nagoya, reportedly the oldest Navajo living in the canyon. He and his family still raise sheep and produce an excellent yield of peaches. The site has a video made about the family. According to Mr. Nagoya, Navajo oral tradition holds that peaches were acquired by the Navajo from the Hopi, who had in turn acquired them from the Spanish. Asked if there was an oral tradition that peaches survived the cavalry destruction, he replied that there was such a "song". He reported that when he was first married, his wife's family gave him peach pits said to be from survivors, and these are the basis of his current orchard. Mr. Nagoya reports knowing the location of the side canyon, reachable only by horse, where the surviving trees had been.

The location Gino called the Basketweaver site, had at least two large and very gnarled walnut

trees, either *Juglans nigra*, *J. major*, or *J. microcarpa*. If either of the latter two, the site is well outside of the published range for both species (Little, 1976). See previous comments for Bandelier.

Management and conservation recommendations - Prior to the site visit, I spoke to Dr. Dan Parfit, National Clonal Germplasm Repository, Dept. of Pomology, University of California, Davis. Dr. Parfit was aware of the history of fruit trees in the canyons, and had earlier collected specimens from near the park entrance. He commented that any germplasm that survived the destruction, would represent an isolated and unbroken genetic line up to 400 years old. The Clonal Repository would be interested in possible cold hardiness or other desirable genetic characteristics. The site can make a potentially significant contribution to maintaining genetic diversity. In recent years, a conservation group has been planting newer varieties of peach in the canyon. This new material represents a potential threat to the integrity of the original Canyon de Chelly germplasm. I recommend that NPS attempt to have plantings halted until further investigation of the potentially original genetic material are completed.

I recommend that adequate NPS or other resources be used to carry out the following: 1.) To enlist the aid of native speakers to confirm and better document the oral tradition concerning peaches that survived the cavalry destruction, 2.) to locate and visit the side canyon where trees reportedly survived to look for any remnant stumps, 3.) to more completely inventory the location and numbers of peaches currently growing in the canyons which are potentially decended from survivors, as well as those which have been more recently planted by conservation groups, 4.) to collaborate with the NCGR to systematically collect and screen genetic material collected in the canyons. In order for the latter recommendation to be carried out, I assume that some arrangement would need to be made between NPS, NCGR and tribal leaders concerning ownership of potentially valuable genetic stocks.

I also recommend collecting foliage from the walnuts at the Basketweaver site to identify to species.

h. Hubbell Trading Post NHS

C.S. Peterson (In: Homestead and Farm: A history of farming at the Hubbell Trading Post National Historic Site) describes trader John Lorenzo Hubble's "flirtation with fruit trees" in a region whose climate and elevation (6,300 feet) does not lend itself to fruit growing. Records show that: "On December 12, 1906, the Spencer Seedless Apple Company Of New Mexico in Roswell, shipped 110 'seedless apple trees'" to the trading post, and that a Witchita nursery also shipped apple and pear trees in February of that same year. Hubbell reportedly planted fruit trees along the irrigation ditches so that trees would benefit from adequate water.

During a site visit on August 25, 1990, three remnant apple trees of sufficient size to date to 1906 were found along remnants of the original irrigation system. All were in very poor condition due to lack of water and nutrients. Terminal growth was virtually nil, leaves were small and few, and no fruit were present. In 1991, one tree bore a fruit, which site staff collected and shipped to UMASS. Lack of an adequate sample of apples and leaves made identification impossible.

Peterson also mentions the role of black walnut (*Juglans nigra*), growing at the site as a source

of natural dyes for indian weavers. A substantial grove of black walnuts in good condition is still present along the entrance road into Hubbell Trading Post.

Management and conservation recommendations - Given the condition of the irrigation system remnants, and the cost of potential restoration, enhancing levels of management for remnant fruit trees is not feasible. However, the trees are original components of the cultural landscape which are in danger of being lost. I recommend collecting bud or graft wood from all remaining trees as soon as possible to be grown out until fruiting in a nursery. Fruit can ultimately be compared with the NCGR acquisition 'Spencer Seedless' (I.D. Code #5903-1675).

Walnuts would benefit from dead-wood pruning and protection from grazing animals. No enhanced management is recommended.

viii. WESTERN REGION

a. Chiricahua

Faraway Ranch and Stafford Cabin

Fruit tree culture at Chiricahua dates from the era of the Faraway Ranch and the Stafford orchard, both eventually owned by the Ericksons. The site once had extensive orchards, which were a highly important part of ranch operations. It is remarkable to note that in spite of a long period of conflict between the cavalry and the Chiricahua Apache, the indians never bothered the settlers, and some Apache are known to have worked in the orchards. Several original photos show fruit trees, and a substantial collection of documents are available should interpretation increase.

Most of the fruit trees are dead, but the remainder appear to be original. Surviving are pear and apricot, as well as black walnut.

Management and conservation recommendations - Based on a single site visit, it is not possible to determine if surviving trees are of value to conserving diversity. Existence of a possible tree order form should be pursued to shed light on varieites which may once have been present. In order to maintain the trees as a cultural artifact, I recommend an increase in level of management, including providing for adequate nutrition and water needs of current trees. I recommend collecting bud or graft wood from all remaining trees for propagation by a commercial nursry, prior to reestablishing a small orchard.

ix. PACIFIC NORTHWEST REGION

a. Olympic National Historic Park

Within the park, a total of 14 sites were visited in the Lake Quinault, Queets, Lake Ozette, Lake Crescent and Elwah areas, and in Port Angeles. The culture of fruit trees pervades the whole Olympic area as an integral component of all homestead sites visited. More often than not, several different types of fruit were found at each site, pears, plums, cherries, apples, and native crabapple.

Overall, most trees were in poor condition but surviving. Some were badly overgrown by brush and other trees. Although a few fruit could be found on some trees, often 35 feet above the ground, many bore no fruit at all.

Lake Quinault Area

Ranger Francis Kocis provided maps, clear directions and other support, calling attention to 5 sites on the north shore of Lake Quinault, the Yurkis site, the Higley homestead, the Dickey/Bishop site, the Bunch fields/orchard and the Haas site. Substantial documentation exists for these sites and members of the previous owner families are still alive with information relating to the role of orchards at the site.

Yurkis Site

At least 6 apple trees were seen, showing foliage and fruit in poor condition, and all overgrown with brush and moss (Photo 179). Several bore inaccessible fruit, pointed at calyx end, and with long stems like Delicious. At least 1 large pear bore many fruit. Signs of apple scab were evident, as was elk feeding. Trees showed limited (6-8 inches) terminal growth. Sapsucker damage covered trunks. Trees were in an open bowl shape. The largest apple calipered at 18 inches at base of first branch.

Higley Homestead

About the nicest homestead site we saw in Olympic (Photos 180, 181). Weathered fences, an old farmhouse, and barns in good condition, as well as several acres of fields and over a dozen probably original fruit trees made this a special site. Trees were also overgrown with moss, and very tall with evident dead wood and crowding. Trees were lined in a narrow spaced grid pattern. Many trees contained fruit about 1.5" in diameter. Apple scab was very evident, as was frog eye leaf spot, and white apple leafhopper injury. Caliper of the largest apple tree in the corner of the first field you come to entering the site is 23.5" (at 36"). We took a decent core of this tree.

Nearer the house were two pear trees bearing decent foliage, but showing skimpy terminal growth. Fruit in clusters high in tree had brown skin, about 1 inch in diameter. There were at least 2 other pears at the site, as well as an oval crabapple with deep burgundy fruit (Photo 153), at least two cherry trees with a few fruit, and an apple immediately in front of the house bearing large green fruit (about 2" in diameter) with long stems and a reddish blush, and a distinctive leaf shape.

Dickie Bishop site

This site was about 1/2 mile past the Higley site at a hard to see road marked by a blue-green trailer and a mailbox across the road. A number of trees were here, in poor condition but in an apparent grid pattern (Photo 203). One tree had fruit and foliage similar to the farmhouse tree at the previous site. Elk have browsed trees up to 10 feet. Heavy apple of scab, moss, and frog-eye leaf spot were evident. The first tree approached as we entered the field calipered as 15.5" (at 36"). We cored this tree. Along an old wire fence line were several apple trees and a cherry, all in poor condition.

Bunch site

This site had 15 or 16 apple trees in a field closest to the Ranger station. The second field also had 1 apple, possibly a chance seedling. The larger group was lined out in narrow spaced rows. Condition of trees ranged from poor to good. The second tree in from the road calipered at 17.75" (at 36"). Many trees were similar in size. Walking toward the woods from the 17.75" tree, were several other large trees, one of which calipered 21.75". Several more similar trees were on the other side of the road and possibly on the far side of a stream we can't ford. One pear tree and several crabapples were noted also.

Right next to the road was a solitary tree with a 12" caliper showing crabapples and a small green variety growing on the same stock. This is possible evidence of Topworking (Photo 154).

The Haas Homestead

Ranger Kocis feels this may be the oldest in the area. The site had surviving buildings. Several fruit trees right near the house, included a possible Red Delicious near the clothesline with several fruit between 0.75" and 1.5" diameter, and a caliper of 15". We cored this tree. Out past the barn was another large tree with round fruit and substantial red color,and a caliper of 19". The largest tree at the site was right behind the barn and bore round fruit. We were only able to extract an 8" core since center was cracked and full of water. Going away from the house towards a small shed along the road we noted a line of three trees with red plastic electric fence insulators on them. Two had fruit, one of which was different from the others seen today, tapered sharply toward calyx, about 1.25" diameter, with a red blush and light green background color.

Queets Area

Ranger Clay Butler gave us information on three locations in the Queets Valley, the Anderson, Streeter and Gwynne sites.

Anderson site

The first side road off the road into Queets had an orange gate. The site had a shed standing, and four apple trees, two plums and two cherries (Photo 201). The first tree encountered was a badly overgrown apple with a caliper of 12.5", and a few fruit, about 1" in diameter with a red blush and. We were only able to get 3 inch core out of this tree, which was rotten in the center. Immediately behind the previous tree was a plum with some fruit. Behind that was a cherry with fruit and another plum with many fruit. One tree had long stemmed fruit with a very pronounced calyx. A second cherry was past the barn. A leaning cherry calipered 9.75" inches at the base of first branch. We took a 5 inch core out of this tree which was also rotten in the center.

Due to confusion over landmarks, we were unable to locate the Streeter or Gwynne sites. Ranger Neal Smith knows there are 'Gravenstein' and either 'Yellow Delicious' or 'Winter Banana' at Gwynne.

Bogachiel Area

Janet Calen at the Hoh Visitor Center knew of no orchards or fruit trees in the Bogachiel.

Lake Ozette Area

Ranger Kevin McCartney was conducting a training session during the site visit, but summer staff mentioned 3 possible sites: one at the Ozette Station near the camp ground, one at Sand Point next to the Northernmost privy, another at Cape Alaawa, and possibly at homestead sites around the lake such as Eagle Point and Erickson's Bay. These latter are unconfirmed. No trees were found around the campground, but past the ranger station, across the bridge to the parking area next to the Volley Ball Net, was a large multi-branched apple in poor condition, rotten in the center, with large leaves.

We noted at least 1 cherry and several large, hard-to-reach apples here, both of which had no fruit. One forked trunk apple with a 14.75" caliper was in the woods to the left of the net. It had few fruit, and was rotten in the center. As we walked along the stream with the net to the left, we noted a 20.5" caliper tree. We were able to take a decent core out of this tree.

Lake Crescent Area

Ranger Carl Newman was very helpful, taking us to two sites and directing us to a third.

Rosemary Resort

Here there was one large tree with a caliper of 16.75" (near a birdbath) that reportedly has yellow fruit with a red blush at maturity (Photo 196). Tree condition was good, with good terminal growth and evidence of pruning, although scab was present. At Lake Crescent Lodge, there was a large cherry and another forked trunk apple with a 20.5" caliper which we cored. Also at the end of low profile unit #110, were another pear and an apple.

Walking west along the shore of the Lake away from the parking area lead to a clearing in the woods. Here there was an old cherry with a few fruit and a 10" caliper. Also here was a pear with an 8" caliper and another cherry and an apple in a row. The apple calipered at 9" at base of a sawed-off branch. All were in condition typical of other Olympic trees. Several showed powdery mildew on terminals. Another apple here had very large leaves and fruit with pronounced calyx, and a 6" caliper. Another 10.5" caliper pear had quite a few Bosc-like fruit. Ending the row was an apple with large, smooth leaves and a distinctive grooved calyx. This tree had an 11" caliper.

Bovee's Meadow

At this site there were trees identified by Ron Tyker as Yellow Transparent. Although heavy rain limited our visit to this site there were many trees lined out at this site, including a pear with a 10 inch

caliper. Tree calipers estimated between 18"-24". Some fruit were present (Photo 195).

Spruce Trail Head

At least a dozen apple trees were found at this location. Still others could be seen in an area just off NPS land. Also 1 pear and 2 cherries. A few apple trees had fruit, some showing the distinctive calyx end of a green/yellow fruit (Photo 152). Some trees were in relatively good condition although showing black rot, possible nutrient deficiencies and deer browsing. About 25 yards up Spruce Trail was one of the largest trees in this area with a 10.5" caliper from which I took a 6" core.

Elwah Area

Ranger Lloyd Hickerson was very helpful in discussions and with site directions.

Hume's Ranch

This area reportedly still has fruit trees with green fruit, about 1/2 hour walk in. Due to heavy rain, we did not walk in.

Access road

Although it was still raining heavily, we stopped at a grove of fruit trees visible from the entry gate. There were about 12 apples, 2 plums, and 2 cherries. Plums, cherries and most apples bore fruit, some apples appearing like 'Red Delicious'. Trees were large and in reasonably good health. The second tree from the end away from the road calipered 18" and was cored. This was a sizable orchard in comparison to other sites in Olympic. It has good visibility from the access road.

Port Angeles Area

Ranger Curt Sauer helped locate some landscape trees of recent vintage.

Mount Angeles Road

On the road to Hurricane Ridge was a gate on the right and a thicket of small (about 10" caliper) trees with 1.5" diameter fruit that showed the distinctive calyx of Lake Crescent fruit (Photo 149). Foliage and fruit were in good condition.

Management and conservation recommendations - Trees clearly date to the settlement period. Additional collection and propagation of trees in Olympic for screening and varietal indentification, is not recommended due to their relatively recent vintage. Present NPS policy calls for removal of exotic species, including fruit trees, so on site conservation is incompatible with sites managed for natural value. However, fruit trees are a significant widlife resource, and should be retained. Existing trees would benefit from pruning and fertilizing, but no pest management program is recommended. Even if all domesticated fruit trees are ultimately removed, crabapples, even those planted as part of an orchard

(as at the Bunch site) could be left, as they are native.

In addition, the Higley homestead in Lake Quinault has excellent interpretive potential, as does the Haas homestead. I recommend that the trees at these sites be maintained even though Olympic is predominantly a wilderness area. Collection and propagation of trees at the Higley, Bunch and Haas sites is recommended for varietal identification and possible genetic diversity value.

b. San Juan Island National Historical Park

Special thanks to Ranger Steve Gobat for showing us several areas with trees.

Possible location of Hoffmeister property

On the road to British camp we visited a site Steve Gobat ascribes to an individual named Hoffmeister who sold goods to the troops (Photo 178). Although not yet a confirmed site with a mandate to be preserved, I will report on my observations and recommendations should the site later be confirmed.

The location has an old building site, and a number of fruit trees in a grid pattern, including several plums, 8-12 pears (Photo 177) ranging from 13" to 23" in caliper, and several apples. The site is heavily grown over and some trees have died; others are in fair shape. Most trees had fruit. Probably several different pears. We cored a 23" caliper pear and a 13" caliper pear as well. One large cherry had a 24" caliper. A 9.5" caliper apple with red fruit standing next to the road was cored. The 23" pear was later confirmed to be at least 115 years old.

Management and Conservation Recommendations - Given the age of the trees at the site, I recommend collecting budwood for nursery culture and varietal I.D. The site has good interpretive potential, lying as it does between British and American camps. Site research should be undertaken to document its history. The site needs to be cleared of brush to protect remnant trees. Existing trees are probably too tall to be pruned to a more manageable size, but they should at least be fertilized/limed according to soil and leaf analysis results. Dead trees can be replaced with new stock propagated from existing, original trees.

British Camp

A large cherry at the far end of the parking area had a caliper of 18.25". We cored this tree.

Crook homestead

The farmhouse had an 8.5" caliper plum in front. Out past a pile of metal and farm equipment, there was an apple with large (2") fruit. Foliar condition was generally good, with some leafroller and possible rosy aphid injury.

Management and conservation recommendations - The badly overgrown old orchard near the

farmhouse likely dates from the homestead period. Given the condition of the trees, varietal identification and screening for importance to conserving genetic diversity is not possible. I recommend removal of surrounding forest and brush to conserve existing trees for possible future interpretive value. Should a regional NPS nursery be initiated, scion wood should be collected from the orchard for varietal ID. No pest management program is recommended for existing trees.

Garrison Bay

The whole area was once fruit trees apparently dating from the homestead period. Photographs # 172, 467, 99, 83, 887, 140, 188 at site show fruit trees. Altough frame of reference is not good, I estimate that trees in the photographs taken around 1910-1920 to be about 12 feet tall.

At the time of the visit, there were about 10 pear trees of different varieties growing at the site (Photo 176), including: one which is reported to ripen in October; and a small round green pear which was sweet and ripe on the tree in July. One tree had 2 varieties on it (Photo 151). The fourth pear in the row closest to the homestead had a 17.5" caliper. We cored it. Past the formal garden was another small pear. Near the ranger phone there were a plum and cherry.

Walking away from Garrison Bay to the northeast corner of the field and about 400 yards north of the homestead house, we noted another large orchard of unknown history. Some clearing has been done and the trees have responded with fruit. The largest tree we saw had a 20" caliper. We cored it.

Management and conservation recommendations - Although trees at Garrison Bay are held by NPS to be "not contributing to the historic scene", I recommend that trees be maintained until identified. Trees bear fruit so that eventual varietal identification should be possible. Pears should be pruned and fertilized/limed. I recommend continued attempts to identify fruit.

American Camp

In the parking lot was a cherry, tentatively identified as 'Queen Ann' variety, with a caliper of 15.5". In addition to plums, apples and cherries near the stable area, there were 3 or 4 cherry/apple next to the officer's house.

Management and Conservation Recommendations - I recommend research on site to determine whether trees date from primary period or later. I recommend continued attempts to identify fruit. These trees should be collected and propagated in a regional nursery.

c. North Cascades National Park

Buckner Homestead/Lake Chelan National Recreation Area, Stehekin

Special thanks to Ranger Diane Allen for her excellent help and cooperation. This exceptional site (Photos 182, 183), was the most focused on fruit growing of any in the Pacific Northwest Region. The significance of the site to the region, old irrigation ditches, and old farm equipment make the site

ripe for further interpretation. The Buckner orchard and homestead management plan was well developed and comprehensive. The IPM plan draft of 4/26/88 was also well done.

All apple trees reportedly have large crops every other year (biennial bearing). Little fruit thinning has ever been done. Trees seen were in structurally excellent shape having been pruned regularly. Terminal growth of most main orchard trees was about 6"-8". Existing varieties were 'Rome', and 'Common Red Delicious'. A few 'Jonathan' remnants were in relatively poor shape. Rosy aphids tended by carpenter ants, white apple leafhopper and powdery mildew injury were noted. Parts of the orchard can not be reached by irrigation due to needed repairs to ditch system.

Management and Conservation Recommendations - This site represents an excellent interpretative opportunity. The geographic isolation of the site makes organic or integrated controls appropriate. I strongly support additional resources to this site to rehabilitate the old irrigation system to benefit the orchard and enhance interpretation. The suggestion in the IPM plan to hand thin fruit is good in that it will likely bring trees into an annual bearing cycle again.

Because of the site's isolation and because fruit need not be high quality, no pest management program is suggested. However, monitoring of pests such as codling moth and annual assessment of fruit and foliar injury from pests may indicate the desirability of a low-input or organic pest management program in the future. Because so few fruit were present during my visit, it's difficult to suggest the focus of such a program, although protecting trees from apple scab during the early part of the season may be desirable. It is possible that apple scab infections occurring during bloom are responsible for poor crops in some years, for example, rather than a biennial bearing tendency.

d. Coulee Dam National Recreation Area

Hawk Creek Camp Ground

Trees appear to be 'Red Delicious' (Photo 199). One tree had a caliper of 14.5". Foliar condiction overall was good, root suckers have been cut back and some branches pruned off. Some trees still had dead wood; most showed little terminal growth. We cored 2 trees here.

Management and Conservation Recommendations - While the trees at this site are an cultivar which is not rare, the trees provide shade and wildlife habitat. Recommended management would be periodic pruning of deadwood. No pest management is recommended.

Fort Spokane

Thanks to Ranger Walt Udall for his help. The site was a cavalry fort, and later an Indian Agency School. During the latter period, orchards were an important aspect of the site, and much site documentation exists. Many of the original trees were apparently removed by farmers in the 1960's. One original, old remnant apple next to the parking lot was barely surviving (see photographs at site and Photo 148). Small yellow-green fruit were in very poor condition, with black rot, and internal lepidopteran feeding. On the other side of the lot was another apple tree with many aphid colonies

exhibiting very high levels of parasitization.

Also in the field near this last apple were two plums also showing aphid injury and little terminal growth (Photo 147). Behind the Officer's quarters was an apricot with a caliper of 15.5". The tree was mostly dead wood and has borne no fruit since 1982. At the time of the visit, it could still have been propagated.

Near the spring overflow was a large old apple described as being yellow-green with red blush and ripening in September; 12.5" caliper at base of 1st branch. Fruit were large (2.5 - 3 inches) and confined to the top of the tree.

Management and Conservation Recommendations - I recommend propagating all existing trees at Fort Spokane, especially the apple near the parking lot and the apricot near the officer's quarters. I recommend supportive resources for staff who are interested in replanting orchards for interpretive purposes. The site has high interpretative potential, so I recommend replanting a small orchard near the parking lot. Many historic documents on site or elsewhere could probably lead to determination of appropriate varieties for replanting. Because fruit trees at the site date from the late 19th or early twentieth century, the list of fruit brought west by Lewelling in 1847, would indicate appropriate varieties to plant (see Whitman Mission). No Pest management program is recommended. Site research could indicate if any was practiced during the site's use as the Indian School. High levels of aphid parasites, highly desirable biological controls, would be seriously affected should even minimum insecticide use be introduced.

e. Nez Perce National Historical Park

Spaulding Mission

Fields below the Visitor Center had large numbers of dog ticks in the tall grass, as well as a number of fruit trees (Photo 192). Walking from the visitors center towards the river, near the railroad crossing and the pumphouse we noted 2 apples trees, both with fruit like 'Gravenstein'. Foliar condition was good on one tree; the other had extensive dead wood. Codling moth injury was evident.

In front of the Indian Agency Building (circa 1870-1900) was an apple tree, possibly 'Yellow Transparent' with large (about 3" fruit), and a caliper of 15.75". Also in front was a large (17.5" caliper) black fruited mulberry. Behind the house was a small pear (6.5" caliper) with no fruit. Nearby were 3 apricot trees which had already dropped their fruit. One with solid forked trunks had a caliper of 12.5". Near the apricots was a prune type plum with good foliage, but fruit which were falling.

Further out past the apricots was a similar apple ('Gravenstein' type) with an 11.5" caliper, and foliar damage from white apple leafhopper, a leaf-miner and a leaf skeletonizer. The house below the visitor center had a large apple (17" caliper) with some fruit, which I cored. Also nearby was a 19" caliper apricot or plum, and 2 large (19.75" caliper) pecan trees (Photo 194), with 3 stone mortars at their base (Photo 193). Near the metal storage shed were 2 very large apricots. One calipered at 22" where branches fork. Other large apricots were noted in this area. Further out in the field was an apple

with 1.5" diameter, solid green fruit, and 16.5" caliper. Drops were "stripey" and similar to others seen earlier.

Near the railroad tracks growing in a rockpile was a thicket of Hawthorne with deep purple fruit. Following the railroad tracks we found a large horsechestnut tree and an apparent double row of prune type plums, most bearing fruit. Also in this line was a pear, possible Bartlett.

Walking along the access road near the river, we noted a 10" caliper tree first taken to be a cherry. Upon closer examination, the tree is bearing a few plums 0.75" to 1" diameter, sweet, yellow turning to dark red. Only one specimen in good condition was available for collection. Several attempts were subsequently made to have NPS staff locate this tree and collect additional fruit for identification.

Management and Conservation Recommendations - Based on their size, the trees likely date to the late 19th or early 20th century. NPS signboards tell of the Noah Bredell family of Nez Perce described as living "in an elegant home surrounded by orchards on the river terrace below" (late 19th, early 20th century). The site has a high potential for enhanced interpretation specifically dealing with the fruit trees, with a modest additional investment. Given the amount of information available and the importance of fruit growing to the mission, I would recommend that the orchard area be mowed, and that trees be given additional management (pruning, fertilizing, watering). Tree cores may allow more precise dating of trees.

Continued attempts should be made to determine if the species of plum found at the site is the same as the prunus species collected at Fort Vancouver. The only other sites at which this plum was seen were Fort Vancouver, where it occurs in great abundance, and at the Bybee-Howell Preservation Orchard, Portland Oregon, where there is one specimen. The plum fits the description of *Prunus subcordata*, a plum native to Northern California and Southern Oregon (Childers,). It is highly possible that this species of plum, although not necessarily this tree, could have been introduced to the site by Rev. Spaulding's wife who had spent time at Fort Vancouver, and is known to have collected seeds of fruit found growing there. No pest management program is recommended.

f. Whitman Mission National Historic Site

Thanks to Jack Winchell for sharing his store of knowledge, references, research, and other information pertaining to orchards at the site. The citation "The First Fruits of the Land", Cardwell, J.R., Dr. 1906. Quarterly of the Oregon Historical Society, Vol. 7 (2): p. 151 and Vol 7 (1): p. 28 mentions the following varieties were common in the region: Red Astracan, Red June, Thomlin Sweet, Summer Sweet, Gravenstein, White Winter Permain, Blue Permain, Genet, Gloria Mundi, Baldwin, Rambo, Winesap, Jeneting, Seek No Further, Toll Pahackin, American Pippin, Red Cheek Pippin, Rhode Island Greening, Virginia Greening, Little Romanites, Spitzinberg, Swaar, Waxen, Spurious Yellow Newton Pippin since called Green Newton Pippin.

The reconstruction orchard appeared well maintained generally (Photo 197). The orchard contained trees of different ages, apparently growing well and bearing some fruit. Terminal growth was good, especially on young trees, but pruning and training of trees was not evident. Trees and fruit

showed injury from leafrollers, codling moth, bird pecks, and white apple leafhopper. Near the park entrance gate were two trees, one a Hawthorne or crabapple, another an apple with heavily damaged, 2.5" diameter, green fruit described by Jack Winchell as "Whitman College Apples".

Management and Conservation Recommendations - All trees could benefit from pruning and training. The non-crab apple near the entry gate should be collected or maintained better for positive identification. Over the years since the Whitman orchards were destroyed there has been discussion of the existence of a possible "Whitman apple" which survived the massacre of the Whitmans. It is likely that what Mrs. Whitman brought back were open pollinated seedlings of Fort Vancouver trees. Since these would not breed true, what may have grown back after the massacre (the roots) probably represented no named variety. Historical records of fruit from "Whitman" trees growing on Whitman College grounds in 1897 describe them as of small size and poor quality. Such fruit would likely have no commercial value except as rootstocks even if its parentage were certain. However, they would have high cultural value if their heritage could be documented.

g. John Day Fossil Beds National Monument

The site had several large, probably original fruit trees (Photos 190, 191), as well as a few planted by NPS about 15 years ago. One large apple just outside the Cant house had a 23" caliper, a few green fruit (1.5" diameter) showing codling moth injury. Most trees had very good terminal growth (18" to 24"), and good overall foliar condition, although some trees showed signs of water stress (curled leaves). Trees reportedly are biennial.

One prune-type plum had a caliper of 11.75", and terminal growth only 4-6 inches. The trunk showed signs of borer injury. South of the rotten center apple tree marked A-3 (tentative identification as 'yellow transparent' by Mr. Larry McGraw in 1980) was a 'Bosc' type pear with a 16" caliper, substantial dead wood.Condition of fruit was good.

An apple marked A-7 was 16.5" caliper, showing black rot, codling moth, and powdery mildew injury. Apple A-7 also had quite a lot of dead wood and terminal growth of only 4"-6". One of the largest apples had a caliper of 25.5", with very rough bark, and good terminal growth, perhaps due to sheep manure at its base. Pear P-6 had a nice crop of fruit, tentatively identified as Anjou.

Also present was one large apricot, most likely original. Apple A-5 was an unknown variety bearing a few small green fruit and with a caliper of 19.5".

Management and Conservation Recommendations - Trees would benefit from increased watering. I recommend rehabilitation of the old irrigation ditches or some other way to improve irrigation to benefit the new trees and extend the life of existing original trees. Site staff have previously received an example of a minimum spray program and general pruning guidelines which they requested. A semi annual pruning of the trees by trained individuals is suggested. Larry McGraw claims the site was not first settled by the Cant family. Some of the trees are large enough to be more than 90 years old, hence they could pre-date 1910. I recommend research to determine if trees pre-date the Cant family. Tentative fruit identifications by L. McGraw should be confirmed by additional cooperating experts.

h. Fort Vancouver National Historic Site

Thanks to Rangers Stan Rooney and Bob Appling. The site had a well-maintained reconstruction orchard with an excellent crop of pears. An unknown apple, similar to 'Golden Delicious" (Photo 149), and a pear were noted in the "wild area" (Photos 184, 185) above reconstructed Fort. On the hillside below the other Fort Vancouver, (not NPS land) were dozens of plum trees all apparently of the same type found at Nez Perce (Photo 144).

Management and Conservation Recommendations - I recommend hand thinning of pear fruit if staff time allows as an additional means of improving crop quality. Tree fertility should be maintained by soil and leaf analysis and appropriate liming/fertilization. Since the site visit, several attempts were made with the cooperation of site staff to collect additional plum specimens for identification by cooperating experts. In at least two years, the trees have not borne fruit due to late spring frosts. In 1992, specimens were secured and sent to Drs. Cecil and Mary Compton. If it can be documented that these relate to the period of Hudson's Bay Company activity, specimens of the plum should be propagated and added to the reconstruction orchard. If additional research confirms that the same plum is growing at Nez Perce, this would also allow enhanced interpretation of missionary's wives role in bringing exotic fruit to their missions. I recommend continued efforts to collect samples of the wild plum for I.D. and possible addition to the reconstruction orchard. Fruit or bud wood from unknowns in the "wild area" should also be collected for future identification.

i. Fort Clatsop National Memorial

Thanks to Ranger Lloyd Hickerson, we found one overgrown apple and a prune type plum in woods near an old homesite and apparent wild plums in several spots along trails at Fort. Small, hard, green plums, possibly Prunus subcordata (Photo 150).

Management and conservation recommendations - I recommend no enhanced management, but recommend collecting wild plums for I.D.

IV. RESULTS AND DISCUSSION

A total of 139 sites in 44 parks were visited by investigators during the conduct of the study. Table 3 contains a summary of site visit assessments of the significance of the resource to the primary historic period of the site. Historic means a site had trees that date to the primary period, or were descendents from such trees; Cultural means that trees are not historic, but that they have cultural resource value; Other includes trees deemed by us to have little or no genetic or cultural resource value due to their condition or some other factor; NPS or other newer trees, planted or seedling; and sites which had no trees or which can not yet be classified. As of this report, we have classified 33.8% of sites as Historic, 13.7% as Cultural, and 52.5% as Other. Classifications are partly based on printed matter or other information from site staff concerning the primary interpretive focus of the park or site.

We consider these classifications to be conservative and tentative, as in the case of the Ryder House at Cape Cod National Seashore which unconfirmed oral history indicates may contain trees salvaged from the wreck of the tall ship Franklin, and the Noah Brooks Tavern in Minuteman NHS which contains an orchard of trees greater than 30 in. diameter, potentially 150-200 years old (now listed as Cultural, but potentially historic). A detailed summary of site classifications is found in Table 2. In all instances, while we attempted to be careful and thorough, time that could be spent researching each site was limited. Although very few sites have good base maps, we are confident that much additional information concerning cutivars of fruit present, dates of planting, and importance to the site, can be uncovered by site-specific research.

A good example of the kind of follow-through and detail acquisition which was impossible for the principal investigators to conduct, but which greatly added to the completeness and accuracy of the study is the survey of orchards within the Cape Cod National Seashore conducted by Bernadette Anderson in 1988 in response to the original survey questionnaire.

Another example is the complete tree inventory conducted at Valley Forge by site staff under the direction of Brian Lambert (See Interim Report #2, Appendix III.) after a site visit we conducted in October 1988. Observations at that time indicated that the majority of trees at Valley Forge do not appear to date to the primary period. Subsequently, Lambert Don Pumphrey carried out plans to conduct an extensive collection of tree cores in order to more precisely date larger specimens. Mounted specimens were examined and aged by the Northeast Fiorest Service Lab in Durham, New Hampshire. Results confirmed the recent age of all specimens cored. A few scattered trees with calipers greater than 20" are likely to be over 100 years old.

Table 3. Site visit assessments of tree historical or cultural status by NPS Region.

REGION	HISTORIC	CULTURAL	OTHER
Pacific Northwest	Coolee Dam NRA	Coulee Dam NRA	Fort Vancouver
	Fort Spokane	Hawk Creek	Fort Clatsop
	John Day Fossil Beds	Olympic NHP	Olympic NHS
	Cant Ranch	Yurkis Site	Dickee-Bishop
	Nez Perce NHP	Higley Site	Anderson Site
	Spaulding Mission	Bunch Site	Port Angeles
	North Cascades	Haas Site	San Juan Is. NHP
	Buckner Homestead	Lake Ozette	American Camp
	San Juan Is.	Rosemary Resort	Whitman Mission
	"Hoffmeister" Site	Bovee's Meadow	
		Spruce Trailhead	
		Elwah	
		San Juan Island NHP	
		Garrison Bay	
		Indiana Dunes NRA	

Midwest	Apostle Islands NRA McCloud-Brigham Site Michigan Island Cuyahoga Valley NRA Frizee House Indiana Dunes NRA Chellberg Farm Isle Royale NHP Windigo Siskiwit Bay Daisy Farm Camp Chippewa Harbor Sleeping Bear Dunes Fourteen sites St. Croix NSR Geidel Site	Goodfellow Camp Cuyahoga Valley NRA Stanford Hostel	Apostle Is. NRA Hermit Island Sand Island Cuyahoga Valley NRA Headquarters Vaughn Site Knapp Homestead Brookside Road Gleason Farm Boston Mills Effigy Mounds NM Breckner Site Rattlesnake Hill County Road North Unit Indiana Dunes NRA Bailey Homestead Horse Trail St. Croix NSR Deeter Site Foster Site Glen Brae Site Horton Farm Northview Wescheche Site
Mid Atlantic	Delaware Water Gap NRA Roberts Farm Minisink District Hampton NHS		Delaware Water Gap River Rd. Peter's Valley Route 209 Zion Church Shenandoah North Appalachian Trail Bean's Gap Hog Wallow Flats Valley Forge NHP Huntington Qtrs. Maxwell's Qtrs. Lafayette House The Pot House Boulware Orchard Lane (3) Bakehouse Wash. Concession

			Stirling's Defender's Gate Wilson Residence Ranger Station Betzwood
National Capitol			Antietam NB Prince William FP CCC Camp Parking lot E Taylor Farm
North Atlantic	Acadia NP Carroll Farm Adams NHS Edison NHS Roosevelt NHS FDR Home Val-Kil Saint-Gaudens NHS	Cape Cod NS Ryder House Minuteman NHS Noah Brooks Tavern Hartwell Tavern Morristown NHP Wick Farm	Acadia Compass Harbor Bar Island Seal Cove Rd. Sommes Sound Storm Beach Sand Beach Otter Cliff Rd. Wildwood Stables Cadillac Mountain Jordon Pond House Hardin Farm Cape Cod NS Pamet Pt. Rd. (4 sites) I. Doane House Saratoga NHP Women's Rights NHP
Rocky Mountain		Zion NP	
Southeast	Blue Ridge Parkway Moses Cone Estate		
Southwest	Canyon de Chelley NM Carlsbad Caverns NP Rattlesnake Springs Fort Davis NHS Guadalupe Mtns. NP Hubbell Trading Post Bandelier NM		

West	L. B. Johnson NHP	Fort Bowie NHS
	Chiracahua NM	
	Faraway Ranch	
	Stafford Cabin	

Table 4. Final assessment of tree historic, cultural or other status relative to the primary historic period, December, 1992.[1]

	Site Classification		
	Historic	Cultural	Other
Pacific Northwest	5	11 [2]	7
Midwest	23 [2]	2	22
North Atlantic	6	4	18
Mid Atlantic	3	0	22
National Capitol	0	0	4
Rocky Mountain	0	1	0
Southeast	1	0	0
Southwest	7	0	0
West	2	1	0
Total	47	19	73

[1] Does not include sites which were not visited.

[2] At certain of these sites, the landscape is the primary period, but successive agriculture to which trees date, is an important aspect of the park.

As noted earlier in this report, budget and time limitations made it impossible to visit a significant number of parks reporting historic fruit and nut trees on the original survey. Based on site documents we have obtained, a number of sites not visited clearly have trees which date to the primary period. An example is olive grove remnants dating from the plantation period at Dungeness, Cumberland Island National Seashore (Zeichner, 1988). As of the 1988 Zeichner report, there were "nine olive trees remaining in the area of the original orchard, all near the base of the water tower", as well as "A large olive tree, probably also dating back to the plantation....just above the garden wall west of the Fountain Garden." According to Zeichner, "Most of these trees show signs of heart-rot and severe cold damage from recent winters." Given the threatened condition of these historic trees, I would support any plans to propagate original trees for rehabilitating the grove before all surviving remants succumb to age and weather.

Other sites which submitted positive replies whose status has not yet been confirmed by site visits include: Biscayne NP (only lime grove in the NPS system); Fort Frederica (fruits and nuts of unkown cultivar

and age); Canaveral NS (Oranges, grapefruit of unknown cultivar and age); Pea Ridge NMP (large potentially historic pecan); Glacier NP (remnant orchards at a number of sites); Grand Canyon NP (remnant fruit trees at historic ranch in canyon); Hawaii volcanoes NP (6 pre-1940's apples); Eugene O'Neill NHS (historic orchard, oranges, limes, almonds); and Great Basin NP (historic orchard remnants), to name a few. In addition, sites such as great Smokey Mountains (Remnant orchards, Cherokee orchards, 'Shockley' apple), which was not visited, and Shenandoah NP, only part of which was inventoried, require additional effort to completely identify tress with genetic or historic significance.

TREE AGE DETERMINATION RESULTS

Foresters have substantial experience with estimating tree age from tree caliper, especially for certain ring porous softwoods, however, no comparable experience exists for diffuse porous fruit trees. What is known of annual growth of fruit trees is drawn from commercial orchard situations where trees are grown in the open and under good fertility and moisture management; conditions which do not apply to most NPS sites.

In most cases, the collection of complete cores was not possible; the largest, presumably the oldest, trees at NPS sites typically yielded very small intact cores. Due to twisting and breaking of some cores, and presence of dry rot in others, some readings could not be considered reliable. Where only a partial core was obtained, an estimated tree age was developed in some cases by dividing the radius (1/2 of caliper) by the mean annual ring increment determined by the dendrochronometer.

Based on these calculations, several trees from which only a small readable core could be removed, were calculated to be substantially older than the dendrochronometer readings would indicate. Calculations of this sort may still underestimate the age of the tree, because fruit trees typically make less and less average annual growth when left unmanaged. Hence, short cores, made up principally of the outer few inches of the trunk, would represent less annual incremental growth than those which go all the way to the pith. Data from Forest Service readings, including calculated tree ages are summarized in Table 5.

Table 5. Location, species, caliper (in.), core length (in.), and age (Dendrochronometer and calculated) of tree corings from the Pacific Northwest, Midwest, and Mid Atlantic Regions, 1988, 1989.

Location	Plant Type	Caliper	Core length	AGE	
				Dendro.	Calculated
SAN JUAN ISLAND					
Garrison Bay	Apple	20.0	10.0	76	87
Garrison Bay	Pear	17.0	8.5	83	83
Garrison Bay	Cherry	18.5	----	26	38
Hoffmeister	Pear	----	----	24	----
Hoffmeister	Pear	23.0	12.0	115	----
Hoffmeister	Cherry	18.5	6.0	63	97
Hoffmeister	Pear	13.0	5.5	81	91

Hoffmeister	Apple	----	----	67	----
American Camp	Cherry	----	----	36	----
OLYMPIC					
Anderson	Apple	12.5	4.5	40	60
Anderson	Cherry	9.8	2.0	39	78
Bunch	Apple	----	----	26	----
Bunch	Apple	----	----	25	----
Bunch	Apple	----	----	45	----
Dickey Bishop	Apple	15.5	6.5	66	85
Haas	Apple	15.0	5.0	56	88
Haas	Apple	19.0	6.8	61	86
Higley	Apple	23.5	7.0	58	73
Higley	Pear	----	----	40	----
Higley	Apple	----	----	40	----
Yurkis	Apple	----	----	51	----
Spruce Trail.	Apple	10.5	4.0	46	61
Lake Crescent	Apple	20.5	10.0	57	61
Lake Ozette	Apple	20.5	6.5	40	50
Elwah	Apple	18.0	6.5	57	81
COOLEY DAM					
Fort Spokane	Apple	----	----	33	----
Fort Spokane	Apple	12.8	4.5	49	92
Hawk Creek	Apple	----	----	81	----
Hawk Creek	Apple	----	----	59	----
NEZ PERCE					
Core #1	Apple	17.5	4.0	33	49
Core #2	Apple	17.0	7.0	52	58
FORT CLATSOP					
Core #1	Plum	----	----	23	----
Core #2	Plum	----	----	23	----
Core #3	Apple	----	----	37	----
VALLEY FORGE					
Core #1	Apple	22.2	----	43	----
Core #2	Apple	14.3	----	25	----
Core #3	Apple	22.2	----	33	----
Core #4	Apple	11.4	----	21	----
Core #5	Apple	23.0	----	55	----
HAMPTON					
Core #1	Pear	20.0	----	83	----
CARLSBAD					
Core #1	Apple	17.5	----	UNR.	----
CAPE COD					
W8B #1	Apple	----	----	34	----

SLEEPING BEAR Core #1	Apple	----	----	UNR.	----
CAYAHOGA Core #2	Apple	----	----	26	----

Based on the dendrochronometer readings the oldest confirmed trees sampled were the 23" caliper pear (115 years), and a second pear (83 years) at San Juan Island, Hoffmeister site. The age of the larger tree puts it and several other comparable trees at the same location within the primary period for the park.

Results indicate that sampled trees from Olympic NHP in the Pacific Northwest region date to the settlement period. A 'Red Delicious" apple tree from Cooley Dam NRA, Hawk Creek Campground (81 years) dates to the early part of this century; a finding which is in agreement with known history of the site. The calculated age of an apple growing next to the Fort Spokane parking lot confirms on-site photographs that this tree dates from the Indian School period.

The surviving pear at Hampton NHS was estimated as 83 years old, although the specimen was noted as being of "very poor" quality, with "low reliability because of extensive breakage and twisting." Hence, its age could be substantially greater than determined by the dendrochromometer reading.

From a limited sample of cores from two NPS regions, we attempted to develop a rule of thumb to estimate apple tree age from tree caliper, based on a linear regression of the two parameters. The analysis indicated a non-significant relationship between tree calipers and tree age, with only a weak predictive value for this model. This is likely due to the small number of samples at our disposal. Further development of this regression model would require collection and reading of a much larger sample set, from a number of different regions. However, based on our analysis, on caliper readings from commercial apple orchards of known age, and consultation with others, we suggest a tentative formula for estimating apple tree age as about 100 years for each 18" to 20" of caliper at 36" above ground. This is a very conservative estimate, inasmuch as apples at St. Gaudens NHS (New Hampshire), which were known to have been planted in the late 1800's, had calipers of 15.5".

Based on the rule of thumb, the oldest trees identified to date on NPS land are in Delaware Water Gap NRA, on the Roberts Farm site in New Jersey. The largest tree at this site is in excess of 40 inch caliper, and could approach 200 years of age. Several other large trees can also be found at Roberts Farm, and other comparably large specimens have been located and measured in the Minisink District of DEWA. The Noah Brooks Tavern and the Hartwell Tavern in Minuteman NHS also had relatively large trees, up to 30.25" caliper, which have not been cored. I estimate that these trees date from the early to mid 19th century.

Even when absolute tree age can not be determined, the rule of thumb can help to indicate when trees are not original. This was the case at Women's Rights NHS, where two pear trees were deemed to be too small (young) to be those mentioned growing at her home in Seneca Falls in the papers of Elizabeth Cady Stanton.

CULTIVAR IDENTIFICATION RESULTS

The positive identification to cultivar of fruit trees in the national park system proved to be a daunting problem for a number of reasons. Principal among these was the lack of fruit, or poor fruit condition due to lack of tree maintenance and/or pest management. For example, as discussed in the site visit report for Delaware Water Gap, apple trees at the Roberts Farm, the largest yet found in the NPS system, bore no fruit over a period of three consecutive years. In other instances, (e.g. the yellow apple growing at Fort Spokane) fruit size and shape, important identification parameters, as well as fruit condition, were negativwely affected by lack of nutrients, and damage from direct pests.

Fruit and nut trees may either be propagated clonally, by cuttings, budding or grafting, or reproductively, by growth of seeds. For most fruits, clonal propagation is the only way to insure that progeny are identical to parents. Although budding and grafting of fruit trees pre-date settlement of North America, the majority of NPS trees are likely to be reproductively produced "own-rooted" seedlings. For example, the apple trees bought to the Whitman Mission by Mrs. Narcissa Whitman would have fallen in this category, as she is known to have planted apple "sprouts" she collected at Fort Vancouver. Others which are likely to fall in this category include: at least some of the apple trees now growing in Apostle Islands NHP, where a lighthouse keeper was known to have planted and distributed hundreds of seedling apple trees he propagated, and trees growing on Isle Royale NHP, in association with old mining and fishing sites.

In some instances, site visits revealed the presence of a graft union which indicated clonal propagation (Photos 205, 206). However, even in such cases where grafting was evident, it was not possible to determine conclusively if fruit were named cultivars bought from commercial sources or propagated from a locally favorite tree. Even when fruit were present, condition was often too poor to have any value in cultivar determination due to pest injury, and the effects on fruit color and size of nutrient deficiencies and shading. The large trees at the Roberts Farm in Delaware Water Gap, for example, have not fruited in either 1988 or 1989, obviously making cultivar identification impossible.

As described in Appendix J. of this report, a number of tentative or conclusive identifications were made during the course of this study. Ultimately, however, it proved impossible to identify unknowns from many NPS sites due to problems with fruit and tree condition noted earlier, because certain trees on NPS sites may be seedlings and not necessarily named cultivars, and because the majority of once-named cultivars received only limited description and are not contained in the USDA apple germplasm repository (contains under 3,000 specimens).

A potentially important contribution to genetic diversity is the location at the Moses Cone Estate in Blue Ridge Parkway NHP of the cultivar 'Gragg', which is not currently in the USDA Gerplasm Repository. The Moses Cone Estate is primarily focused on the extensive network of carriage roads, and a history of orcharding on a large scale going back to before the turn of the century. The site has the benefit of a series of detailed maps of the orchards done in 1900 which enabled the location of specific trees, some apparently unique, during a site visit in 1989 with Dr. Elwood Fisher and Dr. Ian Firth. After a site visit to the Moses Cone Estate, Elwood Fisher was able to identify the cultivar 'Gragg' from budwood he collected and propagated (Fisher, personal communication). This successful identification of an apple which is not in either the USDA Clonal Germplasm Repository or in Dr. Fisher's personal collection, was lagely possible due to the extensive orchard maps done for the site early in this century.

With the assistance of Mr. Ken Livermore of the New York Agricultural Experiement Station, Geneva, NY, a number of tentative or conclusive identifications were made of specimens collected from the Midwest Region. An example is the apple collected from the Ransom site on Isle Royale which, due to its distinctive shape, is likely related to the old cultivar 'Black Gilliflower'. In this case, the apple shape is so distinctive, as to be diagnostic, a relatively unique occurence.

However, even the expertise of the individuals who initiated and are most familiar with the contents of the USDA apple germplasm repository, could not make positive identification in a majority of cases, due to poor fruit condition, inadequate sample size, or collection of specimens prior to physiol;;ogical maturity. For future collections, staff should note age of trees (if known), area of planting, description of trees, including caliper, growth habit, and bark characteristics, and should take larger samples (> 5 fruit) of representative fruit.

V. SERVICEWIDE MANAGEMENT RECOMMENDATIONS

In general, fruit trees in the NPS system receive little or no maintenance, the exceptions being sites such as Adams NHS, Morristown NHP, Oxon Hill Farm, and Fort Vancouver, where trees are an important component of site interpretation. As a consequence of low maintenance, condition of trees in the majority of sites visited is poor to fair. Tree restoration by pruning and fertilizing is still possible in many instances, but the majority of trees seen to date are highly stressed by shading, nutrient deficiencies, and pests, and will ultimately die. Most trees are not in immediate (1-3 years) danger of death, although the cumulative effect of shading and pests will ultimately reduce the numbers and diversity of the resource. Although collection of bud wood for propagating trees would often be difficult, in most cases it would still be possible.

Commonly seen pests attacking the tree are: Vertebrates, wood rotting fungi, apple scab, black rot, cedar apple rust, internal borers, white apple leafhopper, apple leafminers, and aphids. Commonly seen pests attacking fruit were: apple scab, codling moth, apple maggot, leafrollers, fruitworms and plum curculio.

Given the diversity of sites visited, management recommendations are site specific (see Site Visit Reports). In some instances, various resources such as Integrated Pest Management manuals, pest identification fact sheets, names of University experts, sources of historic fruit cultivars, pruning and fertilization guidelines, etc., have been offered to site staff. Some parks, (e.g. Adams NHS, Morristown NHP, and Roosevelt/Vanderbilt NHP) have made substantial progress toward enhanced management of historic orchards by site staff in consultation with the Principal Investigator and other Land Grant College staff. In other cases, management recommendations made during site visits or in site visit reports have yet to be carried out, due either to lack of appropriate staff expertise, limits on available resources, or staff disinterest.

Given existing limits to NPS resources, and competing demands within parks (e.g. maintenance of trails, historic structures, visitor accomodations, etc.) it is not feasible to significantly increase intensity of fruit or nut tree management unless such is compatible with changing site plans. However, a moderate level of tree maintenance is needed to sustain existing or yet to be planted trees. At many sites visited, grounds maintenance staff who have responsibility for tree care are not knowledgeable in proper tree management, especially pruning. Several sites were noted where staff prune trees in a manner which tends to remove each year's flower buds (heading cuts).

Recommendations are: Where suggested in site visit reports, continue or initiate an annual or semiannual program of light pruning of young trees to maintain proper structure and bearing wood surface; maintain proper fertility and soil pH based on soil and leaf analyses; repair or enhance irrigation capability at sites which require it; apply a minimum of fungicides at key tree phenological stages and/or by environmental monitoring during primary scab season to protect trees from apple scab and black rot pathogens. It should be possible to integrate increased orchard management into the total management plan for most if not all sites. No monitoring program or control actions are recommended against arthropods unless the interpretive needs of the site change. Application of a delayed-dormant oil spray annually to protect trees against aphids, mites, and scales is desirable, especially if other pesticides are being applied.

Due to problems with apple replant disease, sites which choose to rehabiliate old orchards should consider fumigation of planting holes or dipping of tree roots with materials registered for this purpose prior to planting. Young trees should be protected from deer with repellants or fences, and from vole injury by frequent mowing and maintenance of wire trunk guards. **Staff from NPS sites with fruit or nut trees should develop contacts with specialists at local tree fruit Experiment Stations, and request their tree fruit newsletters from University Cooperative Extension in their or neighboring states.** Appendix C lists tree fruit extension entomologists throughout the US. Most of these will be pleased to serve as a resource person regarding pest management of NPS fruit trees, or could recommend colleagues who would.

Without a significant committment of additional staff and other resources by the Park, Regional, or National offices, it is unreasonable to expect that most parks, even those where fruit/nut trees are seen to be significant cultural resources, will ever receive enhanced management. Even where such resource reallocation may occur, periodic reassignment of NPS staff to new locations and/or duties appears to be a potential organizational barrier to enhanced management and interpretation of historic fruit/nut plantings. **NPS should continue to make available to interested staff, the educational information needed to pursue improved management strategies, and to carry out enhanced management for significant sites or trees (e.g., Moses Cone Estate, Saint-Gaudens NHS, Hampton NHS, John Day Fossil Beds NM, etc.). NPS staff training in horticultural practices relevant to fruit and nut trees, in Integrated Pest Management, and in proper tree pruning and training are critical if existing or newly planted trees are to survive.**

VI. SERVICEWIDE CONSERVATION RECOMMENDATIONS

There is some disagreement among experts on the potential value to genetic diversity of old, named cultivars. Some believe that the most likely source of genetically diverse germplasm with the potential to improve resistance to pests will prove to be native crabapples, such as *Malus floribunda*, a parent of all commercially available disease-resistant apple cultivars selected to date. These individuals would argue that all previously named cultivars are descended from a rather narrow gene pool and hence would add little to the conservation of genetic diversity.

Others say that while this may be the case with the present state of knowledge, some as yet unidentified aspect of an obscure specimen, may prove to be important to plant breeding programs of the future. A good comparison would be with taking a conservative approach to the conservation of native endangered plants which currently have no known economic or other value. Margery Oldfield, in her book *The Value of Conserving Genetic Resources* observes that..."while many of us would save endangered wildlife or crop and livestock gene

resources for historical interest or love of wildlife or esthetics...their most important value is their hidden potential for enhancing the quality of life for present or future generations."

In either case, NPS may make a contribution to conserving genetic diversity. According to Dr. Philip Forsline (in charge of maintaining the USDA apple germplasm repository at Geneva, NY) specimens showing unusual aspects are of interest to USDA. To date from this study, these include: an apple from Acadia NHP which had no stem cavity, an apple from Effigy Mounds NHP which had only four seed cavities instead of the normal four, an apple from Olympic NHP which has deep ridges characteristic of apples of Asian origin, a small Seckel-type pear from San Juan Island NHP which ripens on the tree (not typical for pears) and in July (early), and several seedling apples from Isle Royale NP which set fruit annually despite severe winter temperatures (-40 F).

Several possible conservation strategies are open to NPS. For some parks, on-site conservation is possible, although redundant maintenance may be desirable, especially for unique specimens. In many cases, maintenance of genetically-valuable resources in place at the park is not feasible for reasons cited earlier. **Known rare cultivars or otherwise unusual germplasm (e.g. Canyon de Chelly peaches, Moses Cone Estate apples, etc.) should be made available to USDA for inclusion in the appropriate repository.**

NPS administration should consider the establishment of regional sites within the NPS system where unusual (or unknown) fruit or nut specimens could be propagated, screened, and maintained or discarded. Although it is desirable to maintain some redundancy of specimens in order to guard against possible catastrophic loss of unique specimens by wind or ice storm, USDA does not currently do this. Hence, any specimens made available to USDA should also be maintained in NPS regional nurseries. The Moses Cone Estate is seen as one such possible center, given the scope of existing plantings, and the significance of fruit culture to the park. Other possible NPS sites include: Fort Vancouver NHS, Hopewell Furnace NHS, Oxon Hill Farm, National Colonial Farm, and Capitol Reef NP. In addition, a number of University sites, could be considered for this purpose as well, should NPS staff and equipment resources prove insufficient. Such regional nurseries could also be used for propagating and conserving other unique or rare NPS plant specimens.

Exclusive of any contribution NPS fruit or nut trees may make to genetic diversity at this time, a strong case can be made for conservation of NPS fruit and nut tree resources due to their cultural or interpretive value. Robert Melnick (1984), in the manual *Cultural Landscapes: Rural Historic Districts in the National Park System* makes the points that, "...any landscape is a product of various factors as they evolve through time to produce various forms", and that "...the factors of a natural landscape may be climatic or vegetational, resulting in forms such as topography, vegetation, sea, and coast." Further, "In a cultural landscape, the factor is culture as it interacts, over time, with the medium of the natural landscape to finally result in the landscape we see and experience." Hence, even parks with a natural or wilderness mandate contain within their boundaries sites which have significant value as a cultural landscape worthy of conservation.

Similarly, in the August, 1989 issue of the NPS magazine Courier, Ian Firth argues that, although the criteria for inclusion in the National Register "...were developed with buildings and structures in mind....they need to be extended to apply to biotic cultural resources." The example he cites of the orchards at the Moses Cone Estate is important in this context, but also because of the presence of apparently unique genetic material as noted earlier in this report. We strongly concur with Melnick's and Firth's position that rural cultural

landscapes are an often overlooked factor in evaluating and registering "historic districts" in the National Register, and believe that many of the cultural landscapes we have visited, with their associated fruit and nut trees, are suitable candidates for inclusion in submissions to the National Register.

NPS sites should retain all original trees for propagation as replacements where appropriate, or until NPS addresses issues and recommendations made in this report.

NPS should provide special project funds to appropriate sites (e.g. John Day Fossil Beds, Buckner homestead, Bandelier, Zion, etc.) to rehabilitate historic irrigation systems or arrange for other mechanisms to provide adequate water to trees. Funding for nutrient analyses, and required fertilization should also be provided to sites which intend to enhance maintenance of historic or culturally-significant fruit or nut trees.

VII. STUDY IMPLICATIONS

A. NPS POLICY ISSUES

Prime among the NPS policy issues which should be addressed at the regional or national level is to resolve whether fruit trees are undesirable exotics, or important contributors to site interpretation and/or wildlife. Many sites visited recognize the potential value of non-native fruit or nut trees, however, a significant number of others do not. The author's experience has been that parks with a predominantly "natural" or "wilderness" mandate, such as Olympic or Great Smokies, continue to view fruit trees as undesirable "exotics" to be actively removed or benignly neglected until they succumb to natural mortality factors.

From a natural resources management perspective, non-native fruits are clearly an important food resource for many wild animal species, including birds, small rodents, porcupines, deer, and other large mammals. This point has been convincingly made by Vaughn and Karish (1991) in their study of black bear population dynamics in Shenandoah National Park. They found that close to 50% of the diet of park bears consisted of (exotic) tree fruits, and that an abundance of native and exotic foods, enhanced bear reproduction and survival, and allowed extensive range overlap, normally an important population regulatory mechanism. **NPS should address this question on a servicewide basis, taking into consideration both natural resource and cultural resource management factors.**

From the survey and from site visits, we noted a variety of past and present dispersal practices of potentially rare and/or commercially valuable germplasm. For example, cuttings of trees from a number of NPS sites have been removed and propagated by private individuals, sometimes for resale. In lieu of clear NPS policy concerning this issue, decisions have been, and are continuing to be, made on individual site levels. These findings illustrate the need for additional guidance to parks on strategies for conservation within park sites, and for propagation practices in cooperation with organizations outside of the NPS. **NPS administration should develop a clear servicewide policy regarding collections and propagation of fruit and nut germplasm from national park lands.**

B. SITE INTERPRETATION

The authors believe that many NPS sites could substantially enhance site interpretation of cultural landscapes in a variety of ways. For example, Minuteman National Park could rehabilitate a lot adjacent to the Hartwell Tavern which was an orchard during the battle, and potentially gain an increase in revenue by pressing and selling sweet cider. A similar activity is currently being demonstrated at the historic Chellberg Farm at Indiana Dunes National Park, using apples purchased from an outside vendor, rather than from fruit produced on historic trees at the site.

Elsewhere, historic scenes at battlefield sites such as Gettysberg NB could easily be recreated, helping to make the visitor's experience at the site even more vivid. Many other such opportunities await the Park Service should sufficient resources be available.

Note: Any other ideas to discussion here?

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IX. ACKNOWLEDGEMENTS

My sincere thanks to the many National Park Service staff whose help was invaluable in arranging and carrying out site visits, collecting specimens and other aspects of this study; to Craig Hollingsworth for conducting a site visit to Acadia NHS; to Holland Mills and Joe Lyons for technical assistance in developing the computerized database. Special thanks and appreciation to Nora Mitchell, Resource Management Specialist, North Atlantic Region NPS, whose ideas, enthusiasm and hard work were of great value in support and conduct of this study.

This study grew out of a previous Cooperative Agreement (Amendment #20 to Cooperative Agreement CA1600-4-0005) between the National Park Service and the University of Massachusetts, Amherst. Objectives of the earlier CA were: to use site visits and other means to provide appropriate NPS personnel at North Atlantic Region historic orchards at Adams NHS, Morristown NHP, and Roosevelt-Vanderbilt NHS, with a working knowledge of, and hands-on experience in, current integrated pest management (IPM) practices for orchards; to develop site-specific IPM recommendations for the 3 sites consistent with NPS policies, and; to provide written evaluation of NPS implementation of recommendations.

Some of the information in this document is excerpted from interim summary reports previously submitted to NPS, contained in Appendices F-I.

IX. APPENDICES

Appendix A. Individual and Organizational Sources of Assistance For Cultivar Identification

Prof. James Anderson Plant & Soil Sciences Univ. of Mass. Amherst, MA 01003	Curator of the U Mass. wax apple collection
Andy Baker Route 20 1 Old Sturbridge Village Rd. Sturbridge, MA 01566-0200	Working with old-time apple varieties
Dr. Robert Becker N.Y State Agricultural Experiment Station Dept. of Hort. Sciences Hedrick Hall Geneva, NY 14456	Published material, historic property work, studying and growing heirloom seeds, for 12 years
Dr. Elwood Fisher Dept. of Biology James Madison Univ. Harrisonburg, VA 22807	Maintains one of largest private collections of fruit trees, shrubs, and vines
Peter Hatch Thomas Jefferson Center for Historic Plants Monticello, P.O. Box 316 Charlottesville, VA 22902	Horticulturalist in charge of historic collection of over 130 plants, including fruit trees
Charles Huckins	Former director, American Horticultural Society, and expert on apples
Brent Ingram 202 Wurster Hall Univ. of CA Berkeley, CA 94720	UNESCO contact for genetic resources (malus)
Robert Kurle North Am. Fruit Explorers	Has access to network of pomologists and old collections

Organizational Sources for Cultivar Identification

Garden Club of America
Charles Lewis
Morton Arboretum
Lisle, Illinois

Hans Herr House
1849 Hans Herr Drive
Willow St., PA 17584

Anderson Horticultural
Library
3675 Arboretum Drive
Chanhassen, MN 55317

Clark Kerr Apple Variety Museum
Pennsylvania State University
Dept. of Horticulture
University Park, PA

Cornell University
Bailey Hortatorium
467 Mann Library
Ithaca, NY 14853

Genesee Country Museum
P.O. Box 1819
Rochester, NY 14603

Home Orchard Society
2511 S.W. Miles St.
Portland, OR 97219

Institute for Historic
Horticulture
Sleepy Hollow Restorations
150 White Plains Road
Tarrytown, NY 10591

Longwood Library
Longwood Gardens
Kennett Square, PA 19348

Shields Library
University of California
Davis, CA 95616

Southmeadow Fruit Garden
2363 Tilbury Pl.
Birmingham, MI 48009

Worcester Horticultural Society
30 Elm Street
Worcester, MA 01608

National Plant Germplasm System
Lab. for Information Science in
Agriculture
P.O. Box 2160
Arlington, VA 22202

Native Seed/Search
3950 W. New York Dr.
Tucson, AZ 85745

Oliver H. Kelley Farm
15788 Kelley Farm Road
Elk River, MN 55330

Plant Finders of America
106 Fayette Circle
Fort Wright, KY 41044

Smithsonian Institution
Historic Research Division
Washington, D.C.

Southern Exposure Seed Exchange
P.O. Box 158
North Garden, VA 22959

The Homeplace 1850
T.V.A.-L.B.L.
Golden Pond, KY 42231

National Academy of Sciences
Conservation of Germplasm
Resources
Washington, D.C.

Ass. for Living Historical Farms and Agricultural Museums
Smithsonian Institution
Washington, D.C. 20560

Converse Nursery
Amherst, NH

Living History Farms
2600 N.W. 111th St.
DesMoines, IA 50322

Mass. Horticultural Library
Horticultural Hall
Boston, MA 02115

National Agricultural Center
Special Collections
10301 Baltimore Blvd.
Beltsville, MD

The National Plant Germplasm
Agricultural Research Service
& Nat. Agricultural Library
Beltsville, MD 20705

Northern Nut Growers Ass.
4518 Holston Hills Rd.
Knoxville, TN 37914

Pennsylvania Hort. Library
325 Walnut Street
Philadelphia, PA 19106

U.S. Dept. of Agriculture
Agriculture Research Service
National Seed Storage Lab.
Colorado State University
Fort Collins, CO 80523

National Colonial Farm
3400 Bryan Point Road
Accokeek, Mayland 20601

Plant Sciences Data Center
American Hort. Society
Mt. Vernon, VA

Old Sturbridge Village
Sturbridge, MA

Brogdale Experimental
Horticulture Station
Kent, England

Long Ashton
Bristol, England

East Malling Research Station
Kent, England

Nederlandse Stichting Fruitrassen
Postbus 303 4100 AM Culumborg
Netherlands

APPENDIX B. Commercial Sources of Historic Apple Cultivars

Adams County Nursery, Inc.
P.O. Box 108
Aspers, PA 17304

Bear Creek Nursery
P.O.B. 411, Bear Creek Road
Northport, WA 99157

J.E. Miller Nurseries
5060 West Lake Road
Canandaigua, NY 11424

Grootendorst Nurseries
15310 Red Arrow Highway
Lakeside, MI 49116

Henry Leuthardt Nurseries, Inc.
Montauk Highway, Box 666
East Moriches,
Long Island, NY 11940

Stark Brothers
Nurseries & Orchards Co.
Louisiana, Missouri 63353-0010

Hidden Springs Nursery
Route 14, Box 159
Cookeville, TN 38501

Living Tree Centre
P.O. Box 797
Bolinas, CA 94924

Worcester County Horticultural Society
30 Tower Hill Road
Boylston, MA 01505

Sonoma Antique Apple Nursery
4395 Westside Road
Healdsburg, CA 95448

M. Worley Nursery
Box 158
98 Braggtown Rd.
York Springs, PA 17372

Carlton Nursery
P.O. Box 398
Dayton, OR 97114

Mellinger's Nursery, Inc.
2310 West South Range Rd.
North Lima, OH 44452-9731

Van Well Nurseries
P.O. Box 1339
Wenatchee, WA 98801

Vernon Barnes & Son Nursery
P.O. Box 250 L S
McMinnville, TN 37110

J.W. Jung
Box B283
Randolph, WI 53957

Boyer Nurseries
405 Boyer Nursery Road
Biglerville, PA 17307

Rocky Meadow Orchard & Nursery
Rte. 1, Box 104
New Salisbury, IN 47161

Kelly Brothers Nursery
19 Maple Street
Dansville, NY 14437

Savage Farms Nurseries
P.O. Box 125
McMinnville, TN 37110

Southmeadow Fruit Gardens
15310 Red Arrow Highway
Lakeside, Michigan 49116

N.Y. State Fruit Testing Coop. Assoc.
P.O. Box 462
Geneva, NY 14456

Frank R. Edwards
Route 2 - Box 1086A
Spruce Pine, NC 28777

Hillcrest Nursery Co.
Marshfield, VT 05658

Womack Nursery
Rte. 1, KBox 80
DeLeon, TX 76444

Greenmantle Nursery
3010 Ettersburg Rd.
Garberville, CA 95440

Mr. Herman L. Luter
3220 Silverado Trail, North
St. Helena, CA 94574

Southern Exposure Seed Exchange
98 Braggtown Road
North Garden, VA 22959

California Nursery Co.
Box 2278
Fremont, CA 94536

Samuel J. Rich, Nursery
21600 N.W. Cornell Rd.
Hillsboro, OR 97123

Johnson Nursery
Rte. 5, Box 29J
Ellijay, GA 30540

Lawson's Nursery
Route 1, Box 473
Ball Ground, GA 30107

Rayner Bros., Inc.
P.O. Box 1617
Salisbury, MD 21801

Emlong Nurseries, Inc.
P.O. Box 236
Stevensville, MI 49127-0236
Zilke Brothers Nursery
P.O. Box 8
Baroda, MI 49101

Ken Parr
Blue Wax Farm
E. Burke, VT 05832

St. Lawrence Nurseries
R.D. 2,
Potsdam, NY 13676

Dean Foster Nurseries, Inc.
P.O. Box 127
Hartford, MI 49057

Gurney's
Yankton, SD 57079

Converse Nurseries
Amherst, NH 03031

Baums Nursery
R.D. 2
New Fairfield, CT 06810

Cumberland Valley Nurseries, Inc.
P.O. Box 471
McMinnville, TN 37110

Raintree Nursery

Thomas Jefferson Center for Historic Plants
P.O. Box 316
Charlottesville, VA 22902

391 Butts Rd.
Morton Wash. 98356

Appendix C. Sources of Assistance For Crop and Pest Management

Tree Fruit Extension Entomologists

John R. McVay
Extension Hall
Auburn University
Auburn University, AL 36849-5413

Bill F. Jones
321 Agriculture Bldg.
University of Arkansas
Fayetteville, AR 72701

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Dept. of Entomology
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Tucson, AZ 84721

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Kearney Agricultural Center
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9240 S. Riberbend Ave.
Parlier, CA 93648

Eugene Nelson
Cooperative Extension Service
Colorago State University
Grand Junction, CO 81501

Lorraine M. Los
Plant Sciences Dept.
University of Connecticut
1376 Storrs Road
Storrs, CT 06268

George C. Rock
Dept. of Entomology
NC State University
Raleigh, NC 27650

James F. Walgenbach
Mountain Horticulture Crops
Research & Extension Center
2016 Fanning Bridge Rd.
Fletcher, NC 28732-9628

William G. Lord
Dept. of Plant Science
University of New Hampshire
Durham, NH 03824

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P.O. Box 309
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212 Price Hall
Virginia Poly. Inst. & State University
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Fred C. Swift
Dept. of Entomology and
Economic Zoology
Rutgers University
New Brunswick, NJ 08903

Dean F. Polk
Rutgers Cooperative Extension
Fruit Res. & Develop. Center
R.D. 2, Box 38
Cream Ridge, NJ 08514

Lloyd M. English
Box 3AE
New Mexico State University Las Cruces, NM 88003

Art Agnello
Dept. of Entomology
NYS Agric. Exp. Station
Geneva, NY 14456

Franklin R. Hall
Dept. of Entomology
OARDC
Wooster, OH 44691

Stanley Coppock
501 Life Science West
Oklahoma State University
McAlester, OK 74501

Helmut Riedl

Baton Rough, LA 70803

Glen Koehler
Plest Management Office
491 College Avenue
Orono, ME 04473

Ronald J. Prokopy
Dept. of Entomology
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University of Massachusetts
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Penn State University
University Park, PA 16802

Appendix D. Database Diskette

Appendix E. Catalog of slide set *

Photos 1-64 taken August, 1989 by Randy Ciurlino and Bill Coli from fruit and foliage collections from Miswest Region NPS site visits.

Photo 1	Effigy Mounds, County Rd. #1. Dark purple fruit. No leaves.
Photo 2	Effigy Mounds, County Rd. #2. Good taste, nearly ripe
Photo 3	Effigy Mounds,County Rd. #3. Large lenticels. Cross section plus 2 leaves
Photo 4	Effigy Mounds, County Rd. #4. Golden Delicious type, good taste, nearly ripe
Photo 5	Effigy Mounds, County Rd. #5. Green apple, long stem
Photo 6	Effigy Mounds, County Rd. #6
Photo 7	Effigy Mounds, County Rd. #6. Half section
Photo 8	Effigy Mounds, North unit #1. Very tart, immature seeds
Photo 9	Effigy Mounds, South Unit Rattlesnake Hill Hawthorne
Photo 10	Effigy Mounds, South Unit
Photo 11	Cuyahoga Valley, Russet apple, not mature.
Photo 128	Isle Royale, Windigo F.
Photo 129	Isle Royale, Windigo F.
Photo 130	Isle Royale, Windigo G, very ripe, mature seeds, red skin, pink flesh, only 4 seed cavities
Photo 131	Isle Royale, Windigo A-G group shot
Photo 132	Daisy Farm L.
Photo 133	Daisy Farm M.
Photo 134	Daisy Farm N.
Photo 135	Daisy Farm L., M., N. group shot
Photo 136	Siskiwit Bay A. Seeds nearly mature, very deep seed cavity
Photo 137	Same, half section
Photo 138	Siskiwit Bay B. Immature seeds very "chemical" taste
Photo 139	Same, half section
Photo 140	Siskiwit Bay C. Mature seeds
Photo 141	Same, half section

Photo 12	Cuyahoga Valley, White barn #2, plum
Photo 13	Cayahoga Valley
Photo 14	Indiana Dunes, Goodfellow camp S. 2
Photo 15	Indiana Dunes, Goodfellow Camp
Photo 16	Indiana Dunes, Goodfellow Camp
Photo 17	Indiana Dunes, Chellberg farm, mature seeds, fruit tart
Photo 18	Effigy Mounds, S. Breckner #1
Photo 19	Effigy Mounds, S. Breckner #3
Photo 20	Effigy Mounds, S. Breckner #2
Photo 21	Effigy Mounds, S. Breckner #4
Photo 22	Effigy Mounds, South Breckner, Plum
Photo 23	St. Croix, North View, Plum
Photo 24	Apostle Islands, McCloud Brigham, Apple #2. Along trail
Photo 25	Apostle Islands, McCloud Brigham, Apple #1.
Photo 142	Siskiwit Bay D. Immature seeds
Photo 143	Same, half section
Photo 144	Fort Vancouver, Plum

Continuing in this column on following pages are additional photos taken by R. Ciurlino and W. Coli on November 7, 1989

Photo 145	Apostle Islands Sand Island, Shaw Hill Farm A. #5-1. Sand Island, Shaw Hill Farm B. #3-1. Sand Island, Shaw Hill Farm C. #4-1, 2. Sand Island, Shaw Hill Farm D. #1-1. Sand Island, Shaw Hill Farm E. #6-2. Sand Island, Shaw Hill Farm F. #2-1. Sand Island, Near West Hagen's Field, #13-1, G. Sand Island, Caroll Jenock Home, Yard H, #7-1.
Photo 146	Apostle Islands Sand Island, Noring Farm A #11-1. Sand Island, Noring Farm B. #9-1. Sand Island, Noring Farm C. #10-1. Sand Island, Noring Farm D. #8-1. Sand Island, Noring Farm E. #12-1.
Photo 147	Fort Spokane, Plum

Photo 26 Apostle Islands, McCloud Brigham, Plum

Photo 27 Apostle Islands, McCloud Brigham, Currant

Photo 28 Apostle Islands, Hermit Island

Photo 29 Isle Royale, Windigo

Photo 30 Isle Royale Apple #1. Ridged, Long Stem

Photo 31 Isle Royale, Ransom Ridged, Long Stem

Photo 32 Isle Royale, Apple #3.

Photo 33 Isle Royale, Ransom #2.

Photo 34 Isle Royale, Apple #4.

Photo 35 Isle Royale, Apple #5.

Photo 36 Isle Royale, Apple #2.

Photo 37 Indiana Dunes, Horse Trail Camp, Pear

Photo 38 Indiana Dunes, Goodfellow Camp, pear #1.

Photo 39 Indiana Dunes, Goodfellow Camp, pear #2.

Photo 40 Cuyahoga Valley, Boston Mills Rd., Barn #3, 2nd tree

Photo 41 Cuyahoga Valley, Stamford Hostel

Photo 42 Cuyahoga Valley, Red Roof

Photo 148 Fort Spokane, Apple next to parking lot

Photo 149 Fort Vancouver, Wild area Golden Delicious type

Photo 150 Fort Clatsop, Wild plums

Photo 151 San Juan Island, Garrison Bay pears

Photo 152 Olympic, Lake Crescent, Spruce trailhead

Photo 153 Olympic, Higley, Burgundy crab apples

Photo 154 Olympic, possible topworking

Photo 156 Almata

Photo 157 Effigy Mounds, County Rd. #4. Pronounced dots

Photo 158 Same, with 1 fruit halved

Photo 159 Port Angeles

Photo 160 Effigy Mounds, County Rd. #3

Photo 161 Effigy Mounds, County Rd. #5, open calyx

Photo 161a Same, with 1 fruit halved

Photo 162 Effigy Mounds, County Rd. #1.

Photo 163 Effigy Mounds,County Rd. #2

	#3. Pear #2. First tree
Photo 43	Cuyahoga Valley, Gleason Farm, Pear
Photo 44	Cuyahoga, Gleason Apple leaves
Photo 45	St. Croix, North View, Apple near homesite #3.
Photo 46	St. Croix, Glen Brae #1. Nearly ripe, good taste
Photo 47	St. Croix, Glen Brae, Apple #2 (single apple)
Photo 48	St. Croix, North View, Apple #1. Good taste
Photo 49	St. Croix, North View, Apple #2.
Photo 50	St. Croix, North View, Crab
Photo 51	St. Croix, Geidel
Photo 52	St. Croix, Geidel #2.
Photo 53	Sleeping Bear Dunes, Apple #4. 1st exposure, along Rt. 22 (incorrect label)
Photo 54	Sleeping Bear Dunes, Along Rt. 22, Apple #3.
Photo 55	Sleeping Bear Dunes, Miller Rd.
Photo 56	Sleeping Bear Dunes, D.H. Day Farm
Photo 164	Indiana Dunes, Chellberg Farm
Photo 165	Indiana Dunes, Goodfellow Camp
Photo 166	Isle Royale, Chippewa Harbor, Possibly 2 different apples based on red blush and background color. All immature seeds.
Photo 167	Acadia, Bar Island Orchard
Photo 168	Acadia, Bar Island
Photo 169	Acadia, Carroll Farm
Photo 170	Acadia, Deer area
Photo 171	Acadia, Deer area
Photo 172	Acadia, Deer area
Photo 173	Isle Royale, Browsed seedling
Photo 174	Acadia, Sand Beach
Photo 175	Acadia, Near Sand Beach
Photo 176	San Juan Island, Garrison Bay
Photo 177	San Juan Island
Photo 178	San Juan Island
Photo 179	Olympic, Typical overgrown tree
Photo 180	Olympic, Homestead
Photo 181	Olympic, Homestead

Photo 57 Sleeping Bear Dunes, Port Oneida, Apple #1. Tentative Wagener

Photo 58 Sleeping Bear Dunes, Port Oneida Community club

Photo 59 Sleeping Bear Dunes, Port Oneida, Apple #2.

Photo 60 Sleeping Bear Dunes, Port Oneida, Tolman Sweet and Sutter Rd. Sample N.G.

Photo 61 Sleeping Bear Dunes, Norkronk & Stormer Rd. 2 apples

Photo 62 Sleeping Bear Dunes, Good Harbor

Photo 63 Sleeping Bear Dunes, Port Oneida, Pear

Photo 64 Sleeping Bear Dunes, Baker Rd. #1.

Photos taken by R. Ciurlino and W. Coli September 12, 1989

Photo 65 Devonshire Quarrendon

Photo 66 Calville Blanc

Photo 67 Wealthy

Photo 68 Doctor

Photo 69 Cole's quince

Photo 70 Cole's Quince

Photo 71 Cole's Quince, Half

Photo 182 North Cascades, Stehekin, Buckner site

Photo 183 North Cascades, Stehekin, Buckner site

Photo 184 Fort Vancouver, Wild area

Photo 185 Fort Vancouver, Wild area

Photo 186 Hampton NHS

Photo 187 Hampton NHS

Photo 188 Hampton NHS, Old Pear

Photo 189 Apple maggot traps in Historic Orchard IPM program

Photo 190 John Day Fossil Beds

Photo 191 John Day Fossil Beds

Photo 192 Nez Perce

Photo 193 Nez Perce

Photo 194 Nez Perce

Photo 195 Olympic, Lake Crescent

Photo 196 Olympic, Lake Crescent

Photo 197 Whitman Mission

Photo 198 Fort Clatsop

Photo 199 Fort Spokane, Hawk Creek campground

Photo 200 Valley Forge

Photo 201 Olympic, Anderson site

	section
Photo 72	Early Joe, (mealy and mushy)
Photo 73	Early Joe, Half section
Photo 74	Acadia, Storm beach cottage, #1. Mature seeds, mushy, WAL
Photo 75	Acadia, Storm Beach Cottage #1, half section
Photo 76	Acadia, Sand Beach #5. No stem depression
Photo 77	Acadia, Sand Beach #5. Half section
Photo 78	Acadia, Cadillac Mtn. #4. Wolf River? LM, AM, TPB, PC feeding, no AS
Photo 79	Acadia, Sommes Sound Residence, Rt. 198 PC, CM, TM, Immature seeds, unripe
Photo 80	Acadia, Seal Cove Rd. Exotic site #1. CM, Immature seeds, no stem cavity, little AS
Photo 81	Acadia, Sommes Sound Cemetery, fruit AS
Photo 82	Acadia, Otter overlook #1. Near Fabri Picnic Area. Immature seeds, leafminer
Photo 83	Acadia, Compass Harbor #1.
Photo 202	FDR Home orchard
Photo 203	Olympic, Dickey Bishop
Photo 204	Grape vine
Photo 205	Compass Harbor grape
Photo 206	Grafting
Photo 207	Grafting
Photo 208	Maiden's Blush
Photo 209	Maiden's Blush
Photo 210	Maiden's Blush
Photo 211	Fall Pippin
Photo 212	Kerry Pippen
Photo 213	Ribston Pippin
Photo 214	White Pippin
Photo 215	Fall Pippin
Photo 216	Ben Davis and McIntosh = Cortland
Photo 217	Ben Davis
Photo 218	Imperial Red McIntosh
Photo 219	Empire
Photo 220	McIntosh and Red Delicious = Empire
Photo 221	McIntosh and Golden Delicious = Spencer
Photo 222	Yellow McIntosh

	LM injury
Photo 84	Wildwood Stables #3. TPB, WAL, LM
Photo 85	Dorr Nursery #1.
Photo 86	Acadia, Conner Farm #1.
Photo 87	Acadia, Carroll Farm #2. AS, LM
Photo 88	Acadia, Bar Island #9. CER, PC
Photo 89	Acadia, Carroll Farm #1.
Photo 90	Acadia, Cadillac Mtn. #1. AS on fruit, CM
Photo 91	Acadia, Cadillac Mtn. #3. Wolf River? Foliar AS, CM
Photo 92	Acadia, Jordan Pond
Photo 93	Acadia, Sand Beach #4. Immature seeds, CM
Photo 94	Acadia, Otter Cliffs #2. Exotic site 26? Half section, Immature seeds
Photo 95	Acadia, Otter Cliffs #2. Whole
Photo 96	Acadia, Wildwood #2. Immature seeds
Photo 97	Bar Island #3 FEL, CM
Photo 98	Acadia, Sand Beach #1. Immature seeds
Photo 99	Acadia, Bar Island #10.
Photo 223	Wealthy
Photo 224	Wealthy
Photo 225	Porter
Photo 226	Porter
Photo 227	Sweet Bough
Photo 228	Sweet Bough
Photo 229	Golden Russet
Photo 230	Roxbury Russet
Photo 231	Pearmain Russet
Photo 232	High Top Sweet
Photo 233	Tolman Sweet
Photo 234	Sweet Russet
Photo 235	Ramsdell Sweet
Photo 236	Sweet Winesap
Photo 237	Acadia, Wolf River
Photo 238	Wolf River
Photo 239	Wolf River
Photo 240	Baldwin
Photo 241	Macoun
Photo 242	Starkspur Golden Delicious
Photo 243	Grimes Golden
Photo 244	Early Joe

LM, immature seeds, WAL

Photo 100 Acadia, Otter Cove #1. AS, CM, immature seeds

Photo 101 Acadia, Bar Island #1. AM

Photo 102 Acadia, Jordan Pond House #3 large geometrid, CM

Photo 103 Acadia, Seal Cove Rd. #1. IPM Exotic Site #9. Russetting, early lepidopteran injury

Photo 104 Acadia, Compass Harbor #4. crabapple

Photo 105 Acadia, Bar Island #8. FEL

Photo 106 Acadia, Compass Harbor #2.

Photo 107 Acadia, Carrol Farm #3.

Photo 108 Acadia, Sand Beach #2. Ridges, immature seeds

Photo 109 Acadia, Sand Beach #2. CER

Photo 110 Acadia, Bar Island #4.

Photo 111 Acadia, Seal Cove Rd #3. Exotic Site #10

Photo 112 Acadia, Jordan Pond House #4.

Photo 113 Acadia, Hardin Farm #1. FEL, AM, AS

Photo 114 Acadia, Bar Island #5.

Photo 245 Sheepnose

Photo 246 Chenango

Photo 247 Melrose

Photo 248 Lady

Photo 249 Rhode Island, Greening

Photo 250 Gravenstein

Photo 251 Lord's Seedling

Photo 252 Davey

Photo 253 Yellow Bellflower

Photo 254 Northern Spy

Photo 255 Wellington Bloomless

Photo 256 Sops of Wine

Photo 257 Alexander

Photo 258 American Beauty

Photo 259 Smokehouse

Photo 260 Washington Strawberry

Photo 261 Wagener

Photo 262 Duchess of Oldenberg

Photo 263 Esopus Spitzenberg

Photo 264 Primate

Photo 265 Twenty ounce

Photo 266 Mother

Photo 115	Acadia, Cadillac Mtn. #2.
Photo 116	Acadia, Wildwood #1.
Photo 117	Acadia, Bar Island #6. AS on fruit & foliage
Photo 118	Acadia, Compass Harbor #3.
Photo 119	Acadia, Bar Island #7.
Photo 120	Acadia, Sommes Sound, Cemetery, North #2. CM
Photo 121	Acadia, Otter Cliff Rd. Exotic Site 26 Otter Cliff #1
Photo 122	Acadia, Seal Cove Rd. #2. Exotic Site #10
Photo 123	Acadia, Sand Beach #6.
Photo 124	Isle Royale, Windigo A. Good taste
Photo 125	Isle Royale, Windigo B.
Photo 126	Isle Royale, Windigo C.
Photo 127	Isle Royale, Windigo D.
Photo 267	Spigold
Photo 268	Fameuse, also known as 'Snow apple'
Photo 269	Early Williams
Photo 270	Yellow Newton Aldermarle
Photo 271	Nodhead Jewett
Photo 272	Yellow Transparent
Photo 273	Hubbardston
Photo 274	Almata
Photo 275	Westfield
Photo 276	Blue Pearmain
Photo 277	Cole's Quince
Photo 278	Highley Crab

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* CER=Calyx End Rot; FEL=Frog Eye Leafspot; AS=Apple Scab; SB=Sooty Blotch; FS=Fly Speck; AM=Apple Maggot; LM=Leaf Miner; Codling Moth; SC=Scale; TM=Tussock Moth.

APPENDIX F. INTERIM REPORT #1, 1988

\NOT FOR PUBLICATION\

INVENTORY AND CONSERVATION OF GENETIC RESOURCES IN THE FORM OF HISTORICALLY SIGNIFICANT FRUIT AND NUT TREES IN THE NATIONAL PARK SYSTEM

INTERIM PROGRESS REPORT #1
JUNE 1988

THIS PROJECT IS BEING CONDUCTED UNDER A COOPERATIVE AGREEMENT BETWEEN THE UNIVERSITY OF MASSACHUSETTS, AMHERST, AND THE UNITED STATES DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE

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ABSTRACT

A survey instrument was designed and administered to 341 NPS sites in order to indentify those containing historic fruit or nut plantings. Data were confirmed from 337 units, with 210 responding negatively, and 127 positively. Historic plantings were identified in each of the NPS regions, with the Southeast having the largest number (22), and the National Capitol having the fewest (7). Although not all positive sites have original trees, site dates range from as early as 1752 (Wick Farm Orchard at Morristown NHP) to as recent as 1963 (Lyndon B Johnson NHS), and represent a complete history of orcharding in the US. Virtually every cultivated fruit or nut can be found in the NPS system; however, many sites report no complete inventory done, or unknown tree age and/or variety. Site management of trees also varies widely, from no management to commercial operation or lease.

INTRODUCTION

This project was undertaken to determine the number of National Park Service (NPS) units which have historically significant fruit trees and to determine the uniqueness of the varieties of those fruit trees. Over the past several decades, the trend in commercial fruit tree propagation has been towards specializing in a very limited number of fruit varieties; therefore the older historical varieties are being lost.

The loss of these historic fruit cultivars and the lack of system-wide and park-specific knowledge of orchards and fruit varieties was identified as a genetic resource preservation issue at the Historic Orchard Workshop sponsored by the North Atlantic Region (NAR) in cooperation with Natural Resources, Washington Office, in February 1987. NPS orchards date from as early as 1752 (Wick Orchard at Morristown NHP) to as late as 1963 (Lyndon B. Johnson NHS) and may represent virtually the entire history of orcharding in the United States. It is possible that the fruit trees present on some of the NPS historical sites are the last remaining examples of some older fruit cultivars. Thus, the NPS has a unique responsibility and an opportunity to conserve this genetic diversity of fruit types.

This 3-year project was initiated in June, 1987, and is being conducted under a Cooperative Agreement with the University of Massachusetts. Both the University and NPS staff are assuming responsibilities for specific project tasks.

OBJECTIVES

The objectives of this project are :

I. To conduct an servicewide inventory and develop a computerized data base of National Park Service sites that have historic fruit or nut trees, including remnant orchards of old homesites.

II. To identify and determine the uniqueness of the cultivars present, using site visits and other means.

III. To make management recommendations for conservation and propagation of unique genetic

and historical resources.

OVERVIEW OF PROCEDURES

Investigators met initially to plan operational procedures and an assistant was hired by the North Atlantic Regional Office (NARO). A survey instrument (Appendix A) was developed in the summer of 1987. The survey was sent by the NPS Director to all Superintendents and Regional Directors on November 3, 1987. Follow-up phone calls were made to sites which did not reply by the due date of December 15, 1987. Several meetings were held at NARO and at the University of Massachusetts, Amherst (UMASS) to review survey returns and identify those requiring clarification or additional information. Additional follow-up phone calls were made where needed.

A tentative prioritized list of sites requiring visits was developed using criteria such as: historic trees, unknown cultivars, and level of present management, and a site visit protocol was designed.

Concurrently, we have begun to collect reference materials (books, catalogs) and develop files of relevant information, including : sources of expertise in identification of old pome and stone fruit cultivars, existing fruit and nut germplasm inventories, locations of varietal reference collections and nurseries selling old cultivars. This information will be useful to determine the commercial availability of rare varieties in the NPS system, the management or other needs required to identify, propagate and maintain possible unique varieties, and the feasibility of NPS commercial sale of plant material.

INTERIM RESULTS-NOT FOR PUBLICATION, SOME INFORMATION REQUIRES FURTHER VERIFICATION

Historic orchard inventory:

Of the 341 NPS units authorized at the time of the survey, 337 responses have been confirmed. Four survey responses, 3 from Scenic Trail Parks and 1 from the Roosevelt-Campobello International Park, still need to be verified as negative responses. Of the 337 NPS units that survey information has been compiled from, 127 sites responded that there were fruit and/or nut trees on their sites, while 210 sites responded that there were not.

NPS sites replying positively contain virtually every domesticated fruit or nut in existence: Apple, apricot, avocado, cherry, coconut, fig, grapefruit, lime, olive, orange, noni bushes, paw paw, peaches, pears, pecan, persimmons, pomegranate, and walnut. Table 1. shows the breakdown of replies by region. A complete listing of positive site replies is in Appendix B

Table 1. Total responses to historic orchard survey by region.

	REGION									
	NA	MA	NC	SE	MW	SW	RM	W	PN	ARO	TOTAL
POS.	21	14	7	22	18	13	9	14	9	0	127
NEG.	16	17	24	31	13	24	32	30	7	16	210

Total Units 337

We developed a status nomenclature to classify the positive responses. Of the 127 positive replies, 78 units reported trees which date from the site's historic period (HISTORIC TREES), 18 reported reconstructed orchards (RECONSTRUCTED), and 8 reported trees which did not relate to the history of the site (NON-HISTORIC TREES). More information is needed on 22 of the sites before the status of the trees can be determined (categorized as UNKNOWN). This information is shown by region in Table 2, below, and by maps in Appendix C.

Table 2. Interim data on NPS orchard * status by region.

	REGION									
	NA	MA	NC	SE	MW	SW	RM	W	PN	TOTAL
HISTORIC	16	9	4	11	10	11	4	9	6	78
RECONSTRUCTED	0	3	2	3	6	0	2	0	2	18
NON-HISTORIC	2	0	1	1	0	1	1	1	0	8
UNKNOWN	3	2	0	7	2	1	2	4	1	22
TOTAL	21	14	7	22	18	13	9	14	9	127

* Some sites contain individual or scattered residual trees rather than orchards.

Survey results revealed a much larger number of historic orchards than had been anticipated. The culture of tree fruits and nuts is a common factor to sites as culturally diverse as Canyon de Chelly, Booker T. Washington, and Ellis Island. Some areas, such as the Great Smokey Mountains National Park and Shenandoah National Park, contain many abandoned home sites, some with hundreds of trees.

Many sites have not conducted a complete tree inventory, or are not sure which varieties are present or if trees date to the historic period for the site. A number of sites report that trees are managed in some way, and a few are presently working with University Cooperative Extension professionals to develop or refine management plans. However, many other sites

Extension professionals to develop or refine management plans. However, many other sites presently do not manage trees at all, and, in some cases, fruit trees are considered "exotic" to the site.

The survey also demonstrated the urgency of this research, since some unidentified fruit and nut trees have already been lost, and some are currently threatened. In some sites, maturing second growth forest is threatening many old, abandoned orchards and homesite trees. In other areas park practices, such as using old orchards as sites for parking lots or other park facilities, have resulted in removal of unidentified trees. Finally, many trees are dying due simply to old age, which can be accelerated by disease and other pest infestations in unmanaged orchards.

Computerized database

Information gained from the survey has been entered into a DBASE III+ file, which will be expanded to include additional site-specific information as it is acquired. Various means to query and report information in the database will be developed over the next several months. Investigators have had discussions with NPS data management specialists to ensure that the historic orchard database (HISTORC) is compatible with NPS computer systems and existing databases. The database is currently being used to develop the site visit priority list and to generate graphics such as in Appendix C.

SITE VISIT PLANNING

Establishing Priorities:

Given current project resources, it is not possible for project investigators to visit all sites. Therefore a priority system is being developed, based upon the historical value and/or the endangered status of the surveyed trees.

Sites with historically significant trees that are endangered will be given the first priority for identification. Sites which have unidentified historic trees and sites where the resource is in danger of being lost will also be given priority. Where cost-effective and feasible, investigators will visit lower-priority sites near higher-priority locations.

Varietal identification

NPS sites that replied positively contain a large diversity of domesticated fruit and nut trees including: apple, apricot, avocado, cherry, coconut, fig, grapefruit, lime, olive, orange, noni, paw paw, peach, pear, pecan, persimmon, pomegranate, and walnut. Most sites have not yet determined the varieties, ages, and in some cases, the locations of all their existing trees. The potential for identifying unusual cultivars is very high due to the nature of the NPS sites. Many of the NPS historic sites date from the mid-nineteenth to the early twentieth century, a time when a wide variety of now-rare cultivars were being grown. Orchards which were reconstructed prior to 1940 also may contain many significant cultivars.

Due to the large number of sites, the diversity of fruit and nut types, and the potential for finding unusual varieties, a much more extensive and complex identification process is needed than was originally planned. Sites with unknown cultivars demand a variety of strategies, as represented in Figure 1 and described in the following pages.

The optimal time for a site visit coincides with the presence of fruits on the tree of good quality and maximun physiological maturity. For those sites with fruit in good condition, samples will be collected during site visits, or NPS staff will be asked to mail specimens to the University or cooperating experts (such as those listed in Appendix D) for identification. Samples will be compared to reference texts, specimen collections and other resources for identification.

If fruit are not present, or are in poor condition, and if site research indicates the potential for rare or unique cultivars, and if fruit is not present, or in poor condition, a program of limited pest management will be developed. If successful, cultivar identification will be made the following season. If development of an orchard management program is neither feasible nor successful, arrangements can be made to propagate the tree so that it can be brought to maturity in a more controlled environment. The former option would probably require less time to produce fruit of a quality sufficient for positive identification, but this option may not be possible due to site or staff limitations. The latter option would require funding, but licensing arrangements could conceivably be made which would benefit the NPS, should several rare or unique varieties be identified.

The sheer number of priority site visits, and other time demands of the investigators, will make optimal timing of site visits impossible for all sites. It is possible , however, to collect useful data regardless of when a site is visited, since tree age, condition, management status, and, in some cases, cultivar, can be assessed. Potential site visits and their rationales are desscribed by region in Appendix E.

Planned site visits as of June 1, 1988:

Because the cooperators are located in Massachusetts, a number of priority sites in the North Atlantic, National Capitol, and Mid-Atlantic Regions are reasonably accessible, and these will be emphasized in 1988. Additional sites will be visited during the 1989 and possibly the 1990 growing season. When beneficial to the project and logistically possible, non-NPS historic plantings nearby will also be visited.

To coincide with attendance by Coli at the International Congress of Entomology, July 3 - 9, 1988, in Vancouver, BC Canada, Six priority sites in the Pacific Northwest Region will be visited July 9 - 21. Planned visits are to: Coulee Dam, San Juan Island, Nez Perce, Fort Vancouver, North Cascades, and John Day Fossil Beds.

SITE VISIT PROTOCOL

All sites to be visited will be contacted in advance to make arrangements. On site, investigators will clear up any remaining uncertainties in the survey. When varieties or tree age are unknown, investigators will take a coring to determine tree age, using an increment borer, will measure tree caliper, will take fruit samples where available, and will make notes concerning tree growth habit, leaf and bark characteristics and other pertinent information. Tree condition will be assessed, and any visible pest or pest injury will be noted. A sample data sheet for site visits is shown in Appendix C. If trees are managed, the management plan will be copied for reference. Any historic documents (diaries, articles, site staff research, etc.) pertaining to the orchard will be examined for information useful to the project. Emphasis will be given to archival information discussing the significance of the planting in site history, so as to provide more information for site interpreters.

SITE MANAGEMENT AND GENETIC CONSERVATION RECOMMENDATIONS

Work on this component of the project has only begun; and the extent and direction will depend, to some extent, on the findings of the cultivar identification process. Even so, some background research has been completed.

We have begun to collect reference materials (books, catalogs), information on existing fruit and nut germplasm inventories and collections, and locations of varietal reference collections of old cultivars (see Bibliography). For sites which do not have historical varieties, but wishing to renovate or replant orchards, we are developing a list of sources of old cultivars (Appendix E). This information is also necessary to determine the uniqueness of the NPS plant material and the commercial availability of rare varieties. Additional research on licensing and patents will provide a basis for evaluating the management options for off-site propagation of unique varieties and the feasibility of NPS partnerships for commercial sale of germplasm material.

A wide range of present management practices was noted in the survey returns. Some parks are presently working with University Cooperative Extension professionals to develop or refine management plans. For example, the project's investigators have recommended the developement an implementation of an orchard IPM plan at Adams NHS and Morristown NHP, and a heightened management program at the home of Franklin D. Roosevelt NHS. A heretofore unidentified apple at Adam will be examined in 1988, now that tree and fruit quality have improved. The tentative identification of 'Sterling' apples at ROVA will be tested again if improved tree pruning and management result in good quality fruit this year. Bud wood taken from two varieties at ROVA has been sent to Roaring Brook Nurseries, Monmouth, Maine, for propagation. If successful, trees will need to be maintained in a nursery, and protected from deer and other pests for several years. When growth is sufficient, the orchard can be replanted at the site.

Some sites do not manage their trees at all. In some parks which are managed as natural areas and which have as management objectives the restoration of native ecosystems, fruit trees are considered "exotics" and have been removed or allowed to die. Many of these decisions have been made without reference to the value or rarity of the unknown cultivars.

Through the survey, we have also noted a variety of past and present dispersal practices of potentially rare and commercially valuable germplasm. For example, cuttings of trees from NPS sites have been removed and propagated. In lieu of clear NPS policy concerning this issue, decisions have been, and are continuing to be, made on individual site levels.

These findings illustrate the need for additional guidancew to parks on strategies for conservation within park sites, ans for propagation practices in cooperation with organizations outside of the NPS. The final report for this project will address such issues through specific policy and program recommendations for conservation of historic germplasm resources.

Appendix A. Survey Form

INVENTORY AND CONSERVATION OF GENETIC RESOURCES OF HISTORICALLY SIGNIFICANT FRUIT AND NUT TREES

QUESTIONNAIRE

Please fill in the blanks or circle appropriate answer.
Name_____Title_____
Park_____Phone No._____ Name
Org. Code

1. Do you have any fruit and/or nut trees on your site? YES NO If YES, please complete survey. If NO, please return survey, with NO circled.

2. What type of orchard trees are growing on your site? (ie. apple, pear, pecan, cherry, etc.)? How many trees, and of what type? Do you know which variety/cultivar? Please list below.

Tree Type	# of Trees	Variety/Cultivar OR Fruit Color

3. What is the historic period of your site (year/range of years)?
4. Do any of your orchard trees date from this historic period?
YES NO UNKNOWN.

5. Have additional orchard trees been planted since NPS acquired the site?
YES NO UNKNOWN.

6. If YES, how many trees have been planted? Which varieties? Do you know which root stock was used? Please list below.

# of new trees	Variety/Cultivar	Rootstock

7. Do you have an historic base map ? YES NO UNKNOWN (OVER)

Park Org. Code ____

8. If YES, Are orchard trees shown on this base map?
YES NO UNKNOWN.

Source of map?_____

Date of map?_____

9. Has any historical research been done, specific to your orchard?
YES NO UNKNOWN.
If YES, please describe _____

_____

10. Has any management reseach been done, specific to your orchard?
YES NO UNKNOWN. If YES, please describe_____

_____

11. Is there any material <u>at the site</u> which documents the fruit/nut trees? If so, please describe briefly_____

_____

12. Name of person to contact re: History of fruit/nut trees_____

Management of orchard_____

13. In your orchard do you currently:

-prune the trees? YES or NO -use pesticides? YES or NO
-monitor pests? YES or NO -fertilize the trees? YES or NO -monitor weather? YES or NO

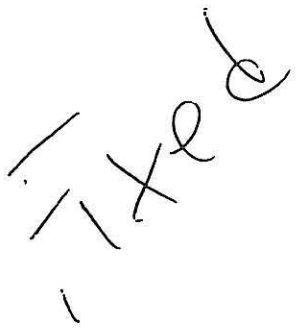
Do your trees produce a crop? YES or NO. Annually? YES or NO If YES, how is the fruit used? Please circle whichever apply:

Sold Given Away Harvested and Discarded Other

14. Do you have any other comments?_____

_____

Please feel free to attach any additional relevant information. THANK YOU. Please return this questionnaire to: Nora Mitchell
North Atlantic Regional Office
National Park Service
15 State Street



APPENDIX B. Initial Survey replies by region

INFORMATION ORIGINALLY CONTAINED IN THIS APPENDIX CAN NOW BE FOUND IN APPENDIX K. OF THE FINAL REPORT

Appendix C. Individual and organizational Sources of Assistance for Cultivar Identification

UPDATED INFORMATION INITIALLY CONTAINED IN THIS APPENDIX CAN NOW BE FOUND IN APPENDIX A. OF THE FINAL REPORT

Appendix D. Commercial Sources of Historic Apples

UPDATED INFORMATION INITIALLY CONTAINED IN THIS APPENDIX CAN NOW BE FOUND IN APPENDIX B. OF THE FINAL REPORT

Appendix E. Sources of Assistance For Crop and Pest Management

UPDATED INFORMATION INITIALLY CONTAINED IN THIS APPENDIX CAN NOW BE FOUND IN APPENDIX C. OF THE FINAL REPORT

Appendix F: List of NPS potential site visits.

North Atlantic Region

Acadia NP - Inventory, ID and date Carroll Farm orchard
Adams NHS - ID unknown variety, assist with IPM program
Boston NHP - ID and date 2 apple, 3 pear at commandant's house, Navy yard
Cape Cod - Inventory, ID and date remnant orchards
Edison NHS - Two historic apple trees
Ellis Island - ID, Inventory and date apple trees
Fire Island - ID, inventory and date remnant orchard
Martin Van Buren NHS - ID and date sweet cherry
Morristown NHP - Review orchard plan
Minute Man NHS - ID and date apples at old home sites
Sagamore Hill NHS - ID, confirm "Greening" apples
Saint-Gaudens NHS - ID, date apples
Saratoga NHP- Inventory, ID, date apples
Roosevelt/ Vanderbilt - Confirm 'American Beauty' apple
Women's Rights NHP - Inventory, ID, date old orchard remnants

Mid Atlantic Region

Delaware Water Gap - Inventory, ID, date cultural landscapes and leased orchards
Eisenhower NHS - Inventory, ID, date fruit at old Redding Farm, consult with Univ. Maryland staff developing management plan
Hampton NHS - ID and date fruit, nuts
Hopewell Furnace NHS - Resource visit, review management plan
Valley Forge NHP - Inventory, ID, date historic orchards
Friendship Hill NHS - ID and date pears, old orchard (1800's)
Fredericksburg and Spotsylvania NMP - ID and date 5 old apples at historic site
Gettysburg - Apples at Bryan orchard est. as 40+ years old, several small young orchards around site
Shenandoah NP - Inventory, ID, date 1000+ apples at old homesites
New River Gorge - Exotic apples, Richmond Farm remnant orchard
Richmond - Old orchard sites ID and date 9 peach trees, review documents
Booker T. Washington -Inventory, ID, date 10 NPS trees, review map and documents

National Capitol Region

Antietam - Inventory, ID, date apples in pasture, review proposal to reconstruct historic orchard at Piper Farm
Catoctin Mountain Park - Determine when NPS planted ornamental landscape fruit trees
C. and O. Canal NHP - Orchards presently leased, review management
Manassas - ID and date pre-1940 fruit trees at old farmsites
National Colonial Farm - Historic apple varieties reconstruction
Oxon Hill Farm - Resource visit
Prince William Forest - ID and date fruit trees at old homesites (1860-1920)

Southeast Region

Andersonville NHS - Thirty-two unknown pecan trees

Biscayne NP - Only lime grove in NPS system
Blue Ridge Parkway - Inventory farmsites, Moses Cone estate
Canaveral National Seashore - ID, date oranges, grapefruit
Cowpens - ID, date peaches
Cumberland Gap - Inventory, ID and date 20 older remnant trees
Cumberland Island National Seashore - Olive grove remnants
Fort Matanzas - ID, date Japanese plum, persimmon, pecan
Ocmulgee National Monument - ID, date, review management of 3 apple, 2 fig, 2 pear, 2 pecan
Mammoth Cave NP - Inventory, ID and date old homesites
Great Smokey Mountains - Remnant orchards, Cherokee orchard, 'Shockley' apples
Big South Fork River - Inventory, ID, date hundreds of apples and pears
Fort Donelson NB- ID and date apple and pear trees
Natchez Trace Parkway - ID and date fig, pecans, pear
Fort Frederica - Date fruit, nuts, "Vegetation History of Fort Frederica"

Midwest Region

Apostle Islands - ID apple and plum, old homesteads and farmsites
Cuyahoga Valley NRA- Inventory, ID pears, apples
Effigy Mounds - Inventory, ID 200 apple, plum, nut trees
Fort Scott NHS - ID fruit, determine significance re: landscape plan
George Washington Carver - Reconstruction, ID fruits and nuts
Herbert Hoover - Reconstruction, ID dozen apple trees
Indiana Dunes - ID fruit at old homesteads
Isle Royale - ID apples at old homesites
Ozark Riverways - Inventory, ID, date apples at old farmsites
Pictured Rocks - 200 apples, 6 plum, 6 cherry
Sleeping Bear Dunes - 2 commercial cherry orchards, old farm sites, ID fruit
St. Croix Riverway - Inventory, ID old farms, homesites
Lincoln Home - Copy historic grounds report
Pipestone NM - Adjacent Superintendent of Indian School with 2 old apples

Rocky Mountain Region

Bighorn Canyon NRA - Inventory, ID and date remnant orchards
Capitol Reef NP- Resource visit, review management plan
Dinosaur NM - ID, date fruit
Glacier NP - Inventory, ID and date remnant orchards at various sites
Glen Canyon NRA - Date trees
Pipe Spring NM - Reconstruction, old varieties
Wind Cave NP - Remnant ranch orchard with 14 unknown apples
Zion NP - Inventory, ID and date trees on old farm sites

Southwest Region

Bandelier NM - ID and date remnant orchard
Big Bend NP - No survey, inventory, ID, date 2 dozen or more fruit trees
Buffalo River - ID and date fruit at old homesteads
Canyon de Chelly - Inventory, ID, date Navajo orchards

Fort Davis NHS - ID, date 3 apple, 3 pear, 3 apricot, 1 fig
Guadelupe Mountains NP - 14 pecan trees circa 1900
Hubbell Trading Post - ID plums, confirm apple as 'Spencer Seedless'
Jean Lafitte NHP - Pecan grove

Western Region

Chiricahua NM - Inventory, ID, date fruit, copy documents
Grand Canyon NP - ID 1 apple, 3 peach, determine historic significance
Great Basin NP - ID and date historic orchard remnants. Respond to request for assistance with grafting and nursery work
Hawaii Volcanoes NP - about 6 pre-1940 apples
Joshua Tree NM - Old unmaintained orchard at Keys Ranch
Eugene O'Neill - Historic orchard, oranges, limes, almonds ?
Organ Pipe Cactus NM - Proposed propagation of pomegranates, figs
John Muir NHS - confirm fruit ID
Santa Monica Mountains - ID and date fruit, confirm 'Beverly Hills red' apple
Whiskeytown NRA - ID and date remnant historic orchard, homesites

Pacific Northwest Region

Coulee Dam NRA - confirm apple ID, ID plum, apricot, 2 remnant orchards
Fort Clatsop - One old apple tree, unknown cultivar
Fort Vancouver NHS - Reconstruction, review historic documents, resource visit
John Day Fossil Beds NM - Historic orchard at Cant Ranch, confirm ID, review interpretation
Nez Perce NP - ID, date scattered trees
North Cascades NP - Review documentation, visit Buckner homestead
Olympic NP- Inventory, ID, date trees at old homesteads
San Juan Island NHP - Historic orchard, ID, date, see photos

Appendix G. Interim report #2, 1990

Inventory and Conservation of Genetic Resources in the Form of Historically Significant Fruit or Nut Trees in the National Park System

Interim Progress Report #2
June, 1990

--- Not For Publication Without Author's Permission ---

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This Project is being conducted under a Cooperative Agreement between the University of Massachusetts, Amherst, and the United State Department of the Interior, National Park Service

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A. PROJECT OVERVIEW

ABSTRACT

Since completion of the servicewide questionaire (Interim Progress Report #1), a significant number of activities have been initiated or completed, including: Site visits conducted to 31 NPS units in 6 regions; linkage with the US Forest Service Laboratory in Durham, NH for assistance with tree age estimation studies; linkage with the USDA Apple and Nut Germplasm Repositories; linkage with faculty and staff at the New York State Agricultural Experiment Station, Department of Horticulture, Geneva, NY, and others for assistance with cultivar identification; securing of space at the University of Massachusetts Horticultural Research Center for growing out trees propagated from NPS sites; and, further design, development and entry of data from this study into a DBASE 3+ database format.

Interim results indicate that many NPS sites have fruit or nut trees 100 years of age or older. Visits have confirmed that many parks (Olympic, Shenandoah, Great Smokies, Delaware Water Gap, etc.) have multiple fruit or nut containing sites, the majority of which consist of individual trees or groups of trees at old homesites or scattered orchard remnants rather than large blocks of trees. Although not all NPS trees can be considered historic (pertaining to the primary historic period for the site) the growing of fruit and nut trees is a pervasive "common thread" shared by a large number of otherwise unrelated parks.

A substantial amount of information is available about the resource and its role in the history of certain parks, and more could likely be developed by NPS site-specific research to enhance future site interpretation. Many parks contacted which are mandated as "natural" or "wilderness" areas continue to view fruit trees established by settlers as undesirable exotic plants, and no attempt has been made to screen existing specimens for potential value to genetic diversity conservation.

Overall, NPS tree and fruit condition is poor, except at sites with well-developed IPM plans and the resources and personnel to implement such plans. Most parks, however, do not have sufficient on-site expertise or adequate resources to enhance present levels of management. In many parks, tree restoration by pruning and fertilization is still possible, but the majority of unmanaged trees seen to date are highly stressed by shading, nutrient deficiencies, and pests, and will ultimately die. Although collection of suitable bud wood for propagating individual trees would often be difficult, in most cases, it would still be possible.

Identification of NPS trees to cultivar continues to be a daunting problem due to poor tree and fruit condition, lack of site-specific records, lack os useful keys to old cultivars, lack of any molecular techniques for determining parentage, and the fact that a significant number are open pollinated seedlings rather than named cultivars.

Development of the architecture of a computerized database of information gained during this study, is well underway. All programming in DBASE 3+ is completed for entry of survey data, and data entry of survey responses is completed for three NPS Regions, and in progress for the

remainder. Programming for input of site visit information is completed except for detailed information about trees themselves.

Site specific management/conservation recommendations have been completed for the majority of sites visited to date, and a number of sites have embarked on enhanced management of fruit trees as a consequence. In other cases, recommendations have yet to be carried out due either to lack of staff expertise, limits of available resources, or staff disinterest. A number of options for resource conservation are presented, including in park maintenance, collection of valuable NPS specimens for maintenance at suitable regional NPS sites, and addition of NPS specimens to USDA Germplasm Repositories.

Plans for the last field season call for completion of prioritized site visits in the North Atlantic, Mid-Atlantic, National Capitol, Southwestern, Western and Southeastern regions, collection of fruits and nuts by NPS staff from previously-visited sites for identification, and collection of bud wood from unique trees, highly stressed trees, or those with substantial age which have not fruited on-site, and which consequently can not be identified as to cultivar.

OBJECTIVES

The objectives of this project are:

1. To conduct a servicewide inventory and develop a computerized data base of National Park Service sites that contain historic fruit or nut trees, including remnant orchards at old homesites.
2. To identify and determine the uniqueness of the cultivars present, using site visits and other means.
3. To make management recommendations for conservation and propagation of unique genetic and historical resources.

INTRODUCTION

Early in the conduct of this study, it became apparent that confusion over the word "orchard" in the original survey may have caused inaccurate survey replies in some cases, and follow-up telephone calls were used to resolve remaining questions. We gave careful consideration to whether NPS site staff could carry out a detailed tree inventory and sample collection, and report on tree condition beyond that requested in the survey. However, in order to reduce variability of data collection and for other technical reasons, we decided that it was important for an individual with extensive pomological training and experience (the principal investigator) to conduct the majority of site visits.

Although available funding and time constraints limited the number of visits which could be made by the investigators to parks submitting a positive survey reply (n=127), a series of site visits was decided upon to complete the inventory and collect other appropriate data. After

considering available resources, number, distribution and potential importance of positive replys, imminent danger to the resource, and importance of the resource to genetic divesity or to the site, we decided to initially concentrate on collecting samples and data from as many priority sites as possible in 5 NPS regions: Pacific Northwest, Midwest, North Atlantic, Mid Atlantic, and National Capitol, with additional site visits to the Southeast, Southwest and Western regions to come later. Separate reports and management/conservation recommendations have been written for all site visits conducted to date (Site Visit Report #1, Site Visit Report #2, Site Visit Report #3) that provide greater detail on findings of the study. Here we report on overall study progress and results, and on plans for carrying out the last year of this 4-year NPS funded project (Final report due June, 1991).

PROCEDURES

Since completion of the servicewide survey and submission of Interim Report #1, the NARO liaison (Mitchell) and the UMASS investigator (Coli) have met periodically to review progress and problems and to plan future activities. Coli presented a seminar on the project to Director Mott and staff at the Interior Building, October 6, 1988. A verbal presentation on interim results and future plans was given by Coli to Mitchell and Mr. John Dennis (Natural Resources, WASO) in the Fall of 1989, at the NARO office in Boston.

Planned site visits were arranged with site staff in advance, and arrangements made for collecting permits. The site visit protocol developed earlier was used, and all the investigators notes were taped for later transcription. Site specific reports and recommendations have been written for sites in the Pacific Northwest, Midwest, North Atlantic, Mid Atlantic and National Capitol Regions.

Networking with others interested in old fruit and nut cultivars continued, and this resulted in 2 requests for presentations on the Historic Orchard Project, one given to the Annual Meeting of the Northern Nut Growers Association, at Ste. Catharines, Ontario, and the other to the annual meeting of The Northeast Apple Society, at Stratton, Vermont. A working relationship was established with The US Forest Service Lab. in Durham, New Hampshire, for assistance with reading tree cores; with the USDA Apple and Nut Germplasm Repositories to determine which cultivars are currently in the collection, and the extent of USDA interest in acquisitions from NPS; and, with experts in the identification of old cultivars at the Cornell University Department of Horticulture at the New York State Agricultural Experiment Station, Geneva, NY.

A part time DBASE programmer was hired to work on development of the computer database, which, when complete, will contain data on: Survey results, site visit results down to the tree level, lists of resource people knowledgeble about crop and pest management, sources of historic cultivars, and a bibliography.

B. RESOURCE INVENTORY INTERIM RESULTS

SITE VISITS CONDUCTED

A total of 89 sites in 31 parks have been visited by investigators to date. Table 1 contains a summary of site visit assessments regarding the significance of the resource to the primary historic period of the site. \Historic\means a site had trees that date to the primary period;\Cultural\means that trees are not historic, but that they have cultural resource value;\Other\refers to trees deemed by us to have little or no cultural resource value due to their condition or some other factor, NPS or other newer trees, planted or seedling, and sites which had no trees or which can not yet be classified. To date, we have classified 36% of sites as Historic, and an additional 24% as Cultural based on information from printed matter or from site staff concerning the primary interpretive focus of the park or site.

We consider these classifications to be conservative and tentative, as in the case of the Ryder House at Cape Cod National Seashore which unconfirmed oral history indicates may contain trees salvaged from the wreck of the tall ship Franklin, and the Noah Brooks Tavern in Minuteman NHS which contains an orchard of trees greater than 30 in. diameter, potentially 150-200 years old (now listed as Cultural, but potentially historic). A detailed summary of site classifications is found in Appendix I.

In all instances, while we attempted to be careful and thorough, time that could be spent researching each site was limited. Although very few sites have good base maps, we are confident that much additional information concerning cutivars of fruit present, dates of planting, and importance to the site, can be uncovered by site-specific research.

A good example of the kind of follow-through and detail acquisition which is impossible for the principal investigators to conduct, but which greatly add to the completeness and accuracy of the study is the survey of orchards within the Cape Cod National Seashore conducted by Bernadette Anderson in 1988 in response to the original survey questionnaire (Appendix II.).

Another example is the complete tree inventory conducted at Valley Forge by site staff under the direction of Brian Lambert (Appendix III.) after a site visit we conducted in October 1988. Although the majority of trees at Valley Forge do not appear to date to the primary period, plans have been developed to conduct an extensive collection of tree cores in order to more precisely date larger specimens.

Table 1. Site visit assessment of tree status relative to the primary historic period.

	Site Classification		
	Historic	Cultural	Other
Pacific Northwest	5	11	7
Midwest	** 18	3	19
North Atlantic	5	4	3
Mid Atlantic	3	3	6
National Capitol	0	0	1

Southeast		1	0	0
	Total	32	21	36

** At 9 of these sites, creation of the landscape is the primary period, but successive agriculture to which trees date, is an important aspect of the park.

TREE AGE

For the most part, NPS site staff have access to little or no information about age of fruit or nut trees found in the park, however, some parks have sufficient resource information, including oral histories, maps or photographs, to enable approximate dating of trees. For example, Hampton NHS has a 19th century map showing an orchard at the location of 2 large remnant pears. Where no such documentation exists, an attempt to determine tree age was seen an an important component of the site visit protocol. Foresters have substantial experience with estimating tree age from tree caliper, especially for certain softwoods. No comparable experience appears to exist for fruit trees, and what is known of annual growth of fruit trees is drawn from commercial orchard situations where trees are grown in the open and under good fertility and moisture management.

Where possible, investigators attempted to estimate tree age by taking a core with a 3/8 in increment borer. Although fruit and foliage samples are temporal, increment cores are mounted on wood blocks to be examined with a dendrochronometer, and hence are more permanent. Data from Forest Service readings are contained in Appendix IX., and is summarized in Table 2. Results indicate that a number of sampled trees from Olympic NHP in the Pacific Northwest region are old enough to date to the primary settlement period. The oldest confirmed sample in this region is a 115 year old pear from San Juan Island NHP collected from a non-documented site tentatively ascribed to an individual named Hoffmeister. The age of the tree puts this and several other comparable trees at the same location within the primary period for the park.

Table 2. Location, species, caliper (in.), core length (in.), and age (Dendrochronometer and calculated) of tree corings from the Pacific Northwest Region, 1988

			AGE		
Location	Plant Type	Caliper	Core	Dendr.	Calc.
SAN JUAN ISLAND					
Garrison Bay	Apple	20.0	10.0	76	87
Garrison Bay	Pear	17.0	8.5	83	83

Garrison Bay	Cher.	18.5	----	26	38
Hoffmeister	Pear	----	----	24	----
Hoffmeister	Pear	23.0	12.0	115	----
Hoffmeister	Cher.	18.5	6.0	63	97
Hoffmeister	Pear	13.0	5.5	81	91
Hoffmeister	Apple	----	----	67	----
American Camp	Cher.	----	----	36	----
OLYMPIC					
Anderson	Apple	12.5	4.5	40	60
Anderson	Cher.	9.75	2.0	39	78
Bunch	Apple	----	----	26	----
Bunch	Apple	----	----	25	----
Bunch	Apple	----	----	45	----
Dickey Bishop	Apple	15.5	6.5	66	85
Haas	Apple	15.0	5.0	56	88
Haas	Apple	19.0	6.8	61	86
Higley	Apple	23.5	7.0	58	73
Higley	Pear	----	----	40	----
Higley	Apple	----	----	40	----
Yurkis	Apple	----	----	51	----
Spruce Trailhead	Apple	10.5	4.0	46	61
Lake Crescent					
Lake Ozette	Apple	20.5	10.0	57	61
Elwah	Apple	20.5	6.5	40	50
COOLEY DAM	Apple	18.0	6.5	57	81
Fort Spokane					
Fort Spokane	Apple	----	----	33	----
Hawk Creek	Apple	12.8	4.5	49	92
Hawk Creek	Apple	----	----	81	----
NEZ PERCE	Apple	----	----	59	----
Core #1					
Core #2	Apple	17.5	4.0	33	49
FORT CLATSOP	Apple	17.0	7.0	52	58
Core #1					
Core #2	Plum	----	----	23	----
Core #3	Plum	----	----	23	----
	Apple	----	----	37	----

In many cases the collection of complete cores was not possible and the largest, presumably the oldest, trees at NPS sites typically yielded very small intact cores. Due to twisting and breaking of some cores, and presence of dry rot in others, some readings can not be considered reliable. Where only a partial core was obtained, an estimated age of the tree was developed by dividing the radius (1/2 of caliper) by the mean ring increment determined by the dendrochronometer

operator. Estimates of this sort may overestimate the age of the tree somewhat, because fruit trees typically make less and less average annual growth when left unmanaged. Calculated tree ages are included in Table 2. From a limited sample of cores from two NPS regions, we attempted to develop a rule of thumb to estimate apple tree age from tree caliper, based on a linear regression of the two parameters. The analysis indicates only a weak predictive value for this model likely because of the small number of samples at our disposal. Further development of this regression model would require collection and reading of a much larger sample set, from a number of different regions. Based on our analysis and consultation with others, we suggest a tentative formula for estimating apple tree age as about 100 years for each 18 inches of caliper at 36 inches above ground.

Based on the dendrochronometer readings and this rule of thumb, the oldest trees identified to date on NPS land are in Delaware Water Gap NRA, on the Roberts Farm site in New Jersey. The largest tree at this site is in excess of 40 inch caliper, and could approach 200 years of age. Other large trees can also be found at Roberts Farm, and other comparably large specimens have been reported at DEWA, but have not yet been located and measured.

Even when absolute tree age can not be determined, the rule of thumb can help to indicate when trees are not original. This was the case at Women's Rights NHS, where two pear trees were deemed to be too small (young) to be those mentioned growing at her home in Seneca Falls in the papers of Elizabeth Cady Stanton.

TREE AND FRUIT CONDITION

In general, fruit trees in the NPS system receive little or no maintenance, the exceptions being sites such as Adams NHS, Morristown NHP, Oxon Hill Farm, and Fort Vancouver, where trees are an important component of site interpretation. Commonly seen pests attacking the tree are: Vertebrates, wood rotting fungi, apple scab, black rot, cedar apple rust, internal borers, white apple leafhopper, apple leafminers, and aphids. As a consequence of low maintenance, condition of trees in the majority of sites visited is poor to fair. Tree restoration by pruning and fertilizing is still possible in many instances, but the majority of trees seen to date are highly stressed by shading, nutrient deficiencies, and pests, and will ultimately die. Most trees are not in immediate (1-3 years) danger of death, although the cumulative effect of shading and pests will ultimately reduce the numbers and diversity of the resource. Although collection of bud wood for propagating trees would often be difficult, in most cases it would still be possible.

Commonly seen pests attacking fruit are: apple scab, codling moth, apple maggot, leafrollers, fruitworms and plum curculio. When fruit are present at all, condition is often too poor to have any value in cultivar determination due to pest injury, and the effects on fruit color and size of nutrient deficiencies and shading. The large trees at the Roberts Farm in Deleware Water Gap have not fruited in either 1988 or 1989, obviously making cultivar identification impossible.

CULTIVAR IDENTIFICATION

The positive identification to cultivar of fruit specimens collected in national parks continues to be a daunting problem for a number of reasons. Fruit and nut trees may either be propagated vegetatively, by cuttings, budding or grafting, or reproductively, by growth of seeds. For most fruits, vegetative propagation is the only way to insure that progeny are identical to parents. Although budding and grafting of fruit trees pre-date settlement of North America, the majority of NPS trees are likely to be reproductively produced "own-rooted" seedlings.

For example, the apple trees bought to the Whitman Mission by Mrs. Narcissa Whitman would have fallen in this category, as she is known to have planted apple "sprouts" she collected at Fort Vancouver. Others which are likely to fall in this category include: at least some of the apple trees now growing in Apostle Islands NHP, where a lighthouse keeper was known to have planted and distributed hundreds of seedling apple trees he propagated, and trees growing on Isle Royale NHP, in association with old mining and fishing sites.

Selection in this manner of chance mutations or open-pollinated seedlings is believed to be the way all of the estimated 5,000 to 6,000 named apple cultivars (with about 22,000 synonyms) came to be identified. In some instances, site visits have revealed the presence of a graft union which would indicate vegetative propagation. However, even in such cases where grafting is evident, it may be impossible to determine conclusively if fruit were named cultivars bought from commercial sources or propagated from a locally favorite tree. Ultimately, it may prove impossible to identify unknowns from many NPS sites due to problems with fruit and tree conditions noted earlier, because certain trees on NPS sites may be seedlings and not necessarily named cultivars, and because the majority of once-named cultivars received only limited description and are not contained in the USDA apple germplasm repository (contains under 3,000 specimens).

Very few "keys" to old fruit cultivars exist, and these are limited in size and utility. Most of what information exists about old fruits is in the form of botanical descriptions, such as those of Beach, and of F.C. Bradford from Maine. While such sources often include descriptors which are genetically-based, such as stem length or lenticel size and distribution, identifications are done primarily from aspects of fruit which can be influenced by level of care and pest injury, such as size, shape, color, and skin appearance.

To consult with us on identification of unknown specimens collected by us or sent by cooperating NPS staff, we elicited the cooperation and assistance of Drs. Robert Lamb and Roger Way, Professors Emeritus and Mr. Ken Livermore, Dr. Way's Technical Assistant, at the Cornell University Agricultural Experiment Station, Geneva, NY. In 1989, we screened a total of 46 samples collected from the Midwest Region, and were able to arrive at a number of tentative identifications, such as the apple collected from the Ransom site on Isle Royale which, due to its distinctive shape, is thought to be related to the old cultivar Black Gilliflower. However, even the expertise of the individuals who initiated and are most familiar with the contents of the USDA apple germplasm repository, could not make positive identification in a majority of cases, as fruit condition and sample size was inadequate. We contacted Dr. Elwood Fisher of James Madison University, a recognized expert in the identification of old fruit cultivars. Unfortunately,

due to other committments, Dr. Fisher declined to collaborate with this study.
No molecular techniques for determining fruit parentage currently exist. Clonal material and other aspects of DNA fingerprinting of fruits are not currently available, although a number of sophisticated labs, including the USDA Clonal Germplasm Repository, Geneva, NY, are working on the problem (Kresovich,1989). A number of old cultivars in the USDA collection have been screened by isozyme analysis (Weeden and Lamb 1985) as a way to determine similarities in composition of important enzyme systems. However, this approach is still not well enough developed to be used as a means to screen large numbers of samples for positive cultivar identification.

A number of sites previously visited were contacted by telephone in 1989 and asked to collect additional specimens of interest for positive identification. These included the small plum from Nez Perce NHP which may have been moved to the site by a missionary wife, the early-ripening pear from San Juan Island, the ridged apple from Olympic, and additional fruit and wood samples from 3 sites in the Midwest Region. Since some samples were not received, current plans call for hiring an assistant during summer 1990 to mount an intensive collecting effort via frequent mail and telephone contact with NPS staff.

DATABASE DEVELOPMENT

The following outlines current work and progress on the NPS database.

The Survey: All programming has been completed for input of the survey data, and data entry for the Pacific Northwest (PN), Midwest (MW), and North Atlantic (NA) regions is complete. Data entry for these regions was accomplished quickly and is currently in progress for the other regions.

The Site Visits: Programming for input of site visit information has been completed except for detailed information about the trees themselves. Programming is in progress with regard this "tree level" class of information. Site visit data supplements, and in some cases has conflicted with, data returned on the survey form. For this reason a capacity to mark park and subsite records as being derived from the survey questionnaire or from site visits has been implemented.

The following appendices outline the current status of project development.

Appendix 1 contains some of the latest PN data entry .

1.0 parks database.
1.1 subsites database.
1.2 resources database.
1.3 comments database.

Appendix 2 shows the data entry and window screens for editing and easily accessing data for view.

2.0 Parks screen.

2.1 Subsite screen
2.2 Resource screen with comment.
2.3 An example of a help box.
2.4 Window to LSCAPE.DBF.

Appendix 3 is a list of the current Dbase-III database structures.

3.0 parks.dbf, subsites,dbf
3.1 resource.dbf, comments.dbf
3.2 trees.dbf, treename.dbf, fruit.dbf
3.3 treechar.dbf, treecond.dbf, treeinfs.dbf, treemang,dbf
3.4 rela_nps.dbf

Appendix 4 is a brief abstract of some of the LSCAPE system database information which can be currently windowed in from the ORCHARDS subsites screen. We have not currently added any records to the LSCAPE database. The example used is that of Adams NHS in the North Atlantic region.

4.0 Fields of interest from lscape.dbf.
4.1 More lscape fields with the index relation circled.
4.2 Lscape function.dbf
4.3 Lscape Impacts.dbf
4.4 Lscape Category.dbf

Appendix 5 The tree level screen, currently in progress.

5.0 Tree level screen example. (11/21/89 version)

C. CONSERVATION PLANS

MANAGEMENT RECOMMENDATIONS

Given the diversity of sites visited to date, most management recommendations are site specific (see Site Visit Reports). In most instances, various resources (Integrated Pest Management manuals, pest identification fact sheets, names of University experts, sources of historic fruit cultivars, pruning and fertilization guidelines, etc.) have been offered to site staff. Some parks, for example, Adams NHS, Morristown NHP, and Roosevelt/Vanderbilt NHP have made substantial progress toward enhanced management of historic orchards by site staff in consultation with the Principal Investigator and other Land Grant College staff. In other cases, management recommendations made during site visits or in site visit reports have yet to be carried out, due either to lack of appropriate staff expertise, limits on available resources, or staff disinterest.

Without a significant committment of additional staff and other resources by the Park, Regional, or National offices, it is unreasonable to expect that most parks, even those where fruit/nut trees are seen to be significant cultural resources, will ever receive enhanced management. Even where

such resource reallocation may occur, periodic reassignment of NPS staff to new locations and/or duties appears to be a potential organizational barrier to enhanced management and interpretation of historic fruit/nut plantings. Even so, we will continue to make available to interested staff, the educational information needed to pursue improved management strategies, and to recommend enhanced management for significant sites or trees (e.g., Moses Cone Estate, Saint-Gaudens NHS, Hampton NHS, John Day Fossil Beds NM, etc.).

CONSERVATION RECOMMENDATIONS

There is some disagreement among experts on the potential value to genetic diversity of old, named cultivars. Some believe that the most likely source of genetically diverse germplasm with the potential to improve resistance to pests will prove to be native crabapples, such as\Malus floribunda\a parent of all commercially available disease-resistant apple cultivars selected to date. These individuals would argue that all previously named cultivars are descended from a rather narrow gene pool and hence would add little to the conservation of genetic diversity.

Others say that while this may be the case with the present state of knowledge, some as yet unidentified aspect of an obscure specimen, may prove to be important to plant breeding programs of the future. A good comparison would be with taking a conservative approach to the conservation of native endangered plants which currently have no known economic or other value. Margery Oldfield, in her book *The Value of Conserving Genetic Resources* observes that..."while many of us would save endangered wildlife or crop and livestock gene resources for historical interest or love of wildlife or esthetics...their most important value is their hidden potential for enhancing the quality of life for present or future generations."

In either case, NPS may make a contribution to conserving genetic diversity. According to Dr. Philip Forsline (in charge of maintaining the USDA apple germplasm repository at Geneva, NY) specimens showing unusual aspects are of interest to USDA. To date from this study, these include: an apple from Acadia NHP which had no stem cavity, an apple from Effigy Mounds NHP which had only four seed cavities instead of the normal four, an apple from Olympic NHP which has deep ridges characteristic of apples of Asian origin, a small Seckel-type pear from San Juan Island NHP which ripens on the tree (not typical for pears) and in July (early), and several seedling apples from Isle Royale NP which set fruit annually despite severe winter temperatures (-40 F).

A potentially important contribution to genetic diversity is the tentative location at the Moses Cone Estate in Blue Ridge Parkway NHP of the cultivars 'Magnum Bonum', 'Carmack Sweet' and 'Gragg', none of which are currently in the USDA Gerplasm Repository. The Moses Cone Estate is primarily focused on the extensive network of carriage roads, and a history of orcharding on a large scale going back to before the turn of the century. The site has the benefit of a series of detailed maps of the orchards done in 1900 which enabled the location of specific trees, some apparently unique, during a site visit in 1989 with Dr. Elwood Fisher and Dr. Ian Firth.

More comprehensive recommendations will be made in this project's final report. However, in

this interim report we offer some observations and an initial discussion of several possible conservation strategies for the NPS. For some parks, on-site conservation is possible, although redundant maintenance may be desirable, especially for unique specimens. In many cases, maintenance of genetically-valuable resources in place at the park is not feasible for reasons cited earlier. Known rare cultivars can be made available to USDA for inclusion in the appropriate repository. Although it is desirable to maintain some redundancy of specimens in order to guard against possible catastrophic loss of unique specimens by wind or ice storm, USDA does not currently do this.

NPS administration should consider the establishment of regional sites within the NPS system where unusual (or unknown) specimens could be propagated, screened, and maintained or discarded. The Moses Cone Estate is seen as one such possible center, given the scope of existing plantings, and the significance of fruit culture to the park. Other possible NPS sites include: Fort Vancouver NHS, Hopewell Furnace NHS, Oxon Hill Farm, National Colonial Farm, and Capitol Reef NP. In addition, a number of University sites, such as the University of Massachusetts Horticultural Research Center could be considered for this purpose as well, should NPS staff and equipment resources prove insufficient.

Exclusive of any contribution NPS fruit or nut trees may make to genetic diversity, a strong case can be made for conservation of these resources due to their cultural or interpretive value. Many sites visited already recognize this potential, however, a significant number of others do not. The author's experience has been that parks with a predominantly "natural" or "wilderness" mandate, such as Olympic or Great Smokies, continue to view fruit trees as undesirable "exotics" to be actively removed or benignly neglected until they succumb to natural mortality factors. Robert Melnick, in his manual *Cultural Landscapes:Rural Historic Districts in the National Park System* makes the points that, "...any landscape is a product of various factors as they evolve through time to produce various forms", and that "...the factors of a natural landscape may be climatic or vegetational, resulting in forms such as topography, vegetation, sea, and coast." Further, "In a cultural landscape, the factor is culture as it interacts, over time, with the medium of the natural landscape to finally result in the landscape we see and experience." Hence, even parks with a natural or wilderness mandate contain within their boundaries sites which have significant value as a cultural landscape resource worthy of conservation.

Similarly, in the August, 1989 issue of the NPS magazine Courier, Ian Firth argues that, although the criteria for inclusion in the National Register "...were developed with buildings and structures in mind....they need to be extended to apply to biotic cultural resources." The example he cites of the orchards at the Moses Cone Estate is important in this context, but also because of the presence of apparently unique genetic material as noted earlier in this report. We strongly concur with Melnick's and Firth's position that rural cultural landscapes are an often overlooked factor in evaluating and registering "historic districts" in the National Register, and believe that many of the cultural landscapes we have visited, with their associated fruit and nut trees, are suitable candidates for inclusion in submissions to the National Register.

D. SITE VISIT AND OTHER PLANS, 1990

SITE VISITS

A number of parks returning positive survey replys will be visited in 1990, in the Southeast, Southwest, North Atlantic, Mid Atlantic, and National Capitol Regions. Site visits have been prioritized to emphasize those which have historic trees, those where trees are of unknown age or origin, but which are possibly historic, those which are tentatively thought to be of value to maintenance of genetic diversity, or those where the resource is endangered.

Sites planned to be visited during summer and fall 1990 are: Boston NHP, Fire Island NS, Ellis Island NHS, Roosevelt Vanderbilt NHS, Delaware Water Gap NRA, Eisenhower NHS, Fredericksburg and Spotsylvania NMP, Antietam NB, C & O Canal NHP, Biscayne NP, Great Smoky Mountains NP, Buffalo River, Hot Springs NP, Pea Ridge NMP, Jean Lafitte NHP, Fort Davis NHS, Guadalupe Mountains NP, Carlsbad Caverns NP, Lyndon B. Johnson NHP, Bandelier NM, Canyon de Chelly NM, Hubbell Trading Post NHS, and possibly Zion NP and Pipe Spring NM.

INTENSIVE FRUIT AND SCION COLLECTION

A Critical Needs form and job description have been developed for a summer assistant to help conduct an extensive collection of tree cores, and of fruit and scion wood for further attempts at cultivar identification, to propagate genetically or culturally valuable specimens, and to grow out unknowns under controlled conditions. Fruit and tree cores will be collected from sites visited by investigators in 1990.

Sites previously visited from which collections are planned with NPS stff support include: San Juan Island NHP, Fort Spokane NHS, Olympic NP, Nez Perce NHP, Effigy Mounds NM, Acadia NP, Blue Ridge Parkway (Moses Cone Estate), Delaware Water Gap NRA, Hampton NHS, John Day Fossil Beds NM, Saint-Gaudens NHS, Edison NHS, Adams NHS, Indiana Dunes NRA (Chellberg Farm), Minuteman NHS (Noah Brooks Tavern), Roosevelt/Vanderbilt NHS, Cuyahoga Valley NRA (Frizee House) and Valley Forge NHP. Additional collections will be added in response to interest from USDA Germplasm Repository staff (see below).

USDA GERMPLASM REPOSITORIES

Investigators have contacted directors of the USDA Nut and Pear Germplasm Repositories to determine the extent of their interest in acquiring samples from NPS sites. A description of specimens of interest to Apple Germplasm Repository staff is contained above. R.L.Grauke, of the Nut Germplasm Repository has expressed a high degree of interest in receiving specimens of old pecan cultivars that may exist in NPS units, and has agreed to screen any specimens which he is sent in order to indentify those which are unknown to investigators. This will be pursued further in 1990 with support of NPS site staff whose cooperation in collecting nuts at or near maturity (Oct.-Nov.) will be essential. N. Mitchell will investigate NPS policy issues associated with releasing NPS samples to such repositories.

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Appendix I. Site Visit assessments of tree historical or cultural status by NPS Region.

REGION	HISTORIC	CULTURAL	OTHER
Pacific Northwest	San Juan Is. "Hoffmeister" Site North Cascades Buckner Homestead Coolee Dam NRA Fort Spokane Nez Perce NHP Spaulding Mission John Day Fossil Beds Kant Ranch	Olympic NHP Yurkis Site Higley Site Bunch Site Haas Site Lake Ozette Rosemary Resort Bovee's Meadow Spruce Trailhead Elwah San Juan Island NHP Garrison Bay Coulee Dam NRA Hawk Creek	Olympic NHS Dickee-Bishop Anderson Site Port Angeles San Juan Is. NHP American Camp Whitman Mission Fort Vancouver Fort Clatsop
Midwest	Isle Royale NHP Windigo Siskiwit Bay Daisy Farm Camp Chippewa Harbor St. Croix NSR Geidel Site Sleeping Bear Dunes Nine sites Apostle Islands NRA McCloud-Brigham Site Michigan Island Indiana Dunes NRA Chellberg Farm Cuyahoga Valley NRA Frizee House	Effigy Mounds NM County Road Indiana Dunes NRA Goodfellow Camp Cuyahoga Valley NRA Stanford Hostel	Effigy Mounds NM Breckner Site Rattlesnake Hill Apostle Is. NRA Hermit Island St. Croix NSR Deeter Site Foster Site Glen Brae Site Horton Farm Northview Wescheche Site Indiana Dunes NRA Bailey Homestead Horse Trail Cuyahoga Valley NRA Headquarters Vaughn Site Knapp Homestead Brookside Road Gleason Farm Boston Mills Rd.(3)
Mid Atlantic	Delaware Water Gap NRA Roberts Farm Minisink District Hampton NHS	Valley Forge NHP Huntington's Qtrs. Maxwell's Qtrs. Lafayette House	

This is
Fixed to
line up properly

			Prince William F. P.
			CCC Camp
North Atlantic	Edison NHS	Morristown NHP	Parking lot E
	Adams NHS	Wick Farm	Taylor Farm
	Acadia NP	Cape Cod NS	Shenandoah North
	Carroll Farm	Ryder House	Appalachian Trail
	Saint-Gaudens NHS	Minuteman NHS	Bean's Gap
	Roosevelt NHS	Noah Brooks Tavern	Hog Wallow Flats
	FDR Home		
	Val-Kil		Cape Cod NS
			Palmet Rd
National Capitol			Isaiah Doane House
			Saratoga NHP
			Women's Rights NHP
Southeast	Blue Ridge Parkway		
	Moses Cone Estate		
			Antietam NB

Appendix II. Survey of historic orchards in Cape Cod NS North District.

Appendix III. Inventory of fruit trees in Valley Forge NHP

Appendix IV. Servicewide questionnaire data

Appendix V. Data entry and window screens

Appendix VI. Current database structures

Appendix VII. Abstract of LSCAPE database information

Appendix VIII. Tree level data screen

Appendix IX. USFS tree core readings, Pacific Northwest Region

Appendix X. Description and identification of Midwest region fruit samples

Acknowledgements: We wish to sincerely thank all the NPS staff who have been so helpful to the conduct of this study, especially Alice Bojanowski and Bill Hopkins; Ms Kathleen Leahy, Mr. Joe Lyons and Dr. Craig Hollingsworth for technical and other assistance at the University of Massachusetts; technical staff at the US Forest Service Laboratory, Durham, NH for reading tree cores; Dr. Roger Way, Dr. Bob Lamb, and Mr. Ken Livermore of the Department of Horticulture at the New York State Agricultural Experiment Station, Geneva, NY for help with identification of unknown apple specimens and their thoughts on genetic diversity; Dr. Steven Kresovich and Dr. Phil Forsline of the USDA Apple Germplasm Repository, Geneva, NY for a tour of the facility, and references to molecular screening techniques; Dr. Elwood Fisher for sharing information on old cultivars; and, Dr. Ian Firth for organizing the site visit to the Moses Cone Estate.

Appendix H. Site visit report on ROVA, MORR and ADAM, 1987

A REPORT ON SITE VISITS TO NATIONAL HISTORIC ORCHARDS AT HYDE PARK, NEW YORK, AND MORRISTOWN, NEW JERSEY AUGUST 13 AND 21, AND DECEMBER 23-24, 1987 AND QUINCY, MASSACHUSETTS, APRIL-SEPTEMBER, 1987

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Acknowledgements: I wish to thank the National Park Service for funding this project. Special thanks and appreciation to Nora Mitchell, Resource Management Specialist, North Atlantic Region NPS, whose ideas, enthusiasm and hard work in support of this work were of great value.

Several site visits and consultations with NPS staff were made in furtherance of Amendment #20 to Cooperative Agreement CA1600-4-0005 between the National Park Service and the University of Massachusetts, Amherst. Project objectives were: to conduct site visits to North Atlantic Region historic orchards at Adams, N.H.S., Morristown N.H.P., and Roosevelt-Vanderbilt N.H.S.; to provide appropriate NPS personnel with a working knowledge of, and hands-on experience in current integrated pest management (IPM) practices for orchards; to develop site-specific IPM recommendations for the 3 sites consistent with NPS policies, and; to provide written evaluation of NPS implementation of recommendations.

This document is intended to provide a summary report of site visits conducted in 1987, and to present my final recommendations to each site at the termination of the grant period (Dec. 30, 1987).

ROOSEVELT HOME (ROVA) ORCHARD SITE VISIT - AUG. 13, 1987

I met with Henry Van Brookhoven and Ron Galente, and discussed the role of the orchards in the overall site management plan, as well as plans to propagate the original varieties prior to removing the old trees, which are in severely deteriorated condition. We came to agreement that at least a few of the more healthy original trees would remain until the success of the propagation attempt was determined. Samples of bud wood were collected from trees of both original varieties, and sent to Roaring Brook Nurseries, Monmouth, Maine, for propagation.

GENERAL ORCHARD CONDITION

Aug. 13 - Younger trees appeared to be growing reasonably well, and the orchard had been mown at least once as of the visit. Fruit were few, and those of poor quality, showing evidence of the pest complex identified in an earlier report. No lime or fertilizer and no pesticides have been applied in 1987. Pruning of young trees performed in February, 1987 has improved tree structure. No pest monitoring or attempts at intensified orchard management have been performed by site staff due to the demands of a large grounds to maintain.

Dec. 24 - A serious early snowstorm in October caused substantial injury to trees at the Val-Kil Cottage, and about 30% of the trees were removed.

ROVA VISIT - DEC. 24, 1987

I met again with Henry VanBrookhoven and Ron Galente, and we discussed the impending conclusion of the Cooperative Agreement. I discussed my timeline for submitting a final report, and we noted areas which should be covered in the report. I presented examples of different management plans, and we discussed the merits and liabilities of each.

We agreed that although production of fruit for any purpose other than maintaining the historic scene is of no importance at this time at ROVA, it is possible that more positive identification of old varieties present may require a greater level of management for one or 2 seasons at some future time. I agreed to submit sample management plans as soon as possible for NPS staff to choose from prior to the Feb. 1 due date for pesticide use requests to NPS Regional Office (See Appendix 1-4).

We spent a substantial amount of time accessing and demonstrating the UMASS INFONET computer bulletin board, a potential source of useful orchard and pest management information. The site is well equipped for telecommunication, including file upload and download capacity, and key staff are computer-literature.

RECOMMENDATIONS

Due to the demands of site grounds, it does not seem feasible to recommend a significant increase in level of orchard management unless such is compatible with changing site plans. Nonetheless, a minimum of maintenance should be undertaken to sustain existing or yet to be planted trees. Specific recommendations are:

1.) Continue an annual or semiannual program of light pruning of young trees to maintain proper structure and bearing wood surface.

2.) Maintain proper fertility and soil pH based on soil and leaf analyses.

3.) Apply a minimum of fungicides at key tree phenological stages (Appendix I) and/or by environmental monitoring (Appendix III) during primary scab season to protect trees from apple scab and black rot pathogens. Since the action threshold for fungicide sprays will likely

be exceeded annually in the Hudson valley, this program should be built into the total management plan for the site. No monitoring program or control actions are recommended against plum curculio, codling moth, apple maggot fly or other arthropods unless site needs change. Apply a delayed-dormant oil spray annually to protect against mites and scales.

4.) Retain all original trees until the results of propagation are known. If the red apple variety is in fact "Sterling", ROVA represents only the second site in the world known to have budwood available (USDA germplasm inventory, 1981). As propagated trees reach suitable caliper, staff can remove and replant older trees over time with propagated specimens of original varieties in original locations and relative numbers. Due to problems with apple replant disease, planting holes should be fumigated or roots dipped prior to planting.

5.) Protect young trees from deer with repellants or fences, and from vole injury by frequent mowing and maintenance of wire trunk guards.

6.) Develop contacts with specialists such as Jim Van Kirk, Rick Weires and Dave Rosenberger at the Cornell Univ. Hudson Valley Fruit Experiment Station at Highland, NY. Request their tree fruit newsletter, or that of other neighboring states. Access INFONET or the New York SCAMP system on a regular basis for orchard information.

WICK FARM ORCHARD SITE VISIT, AUG. 21, 1987

I met with John Donahue, Dan Dearborn, Lynn Whiteman and other site staff at the orchard. Also present was Mr. Van Starner, a graduate student at Rutgers University, who has been performing orchard monitoring at the site which he has reported on separately. We examined the orchard and discussed problems with IPM program implementation in 1987 and plans for future seasons.

GENERAL ORCHARD CONDITION

Aug. 21. - Structure of both newer and older trees appears significantly improved due to last winter's pruning. A single semi-dormant oil spray was applied in 1987, and trees were fertilized. Because no other pest management was performed, however, fruit were few and of generally poor quality. Virtually 100% showed damage from one or more direct pests, with Plum Curculio and Codling moth damage predominant. Difficulty securing a spray contractor to maintain the trees undoubtedly contributed to reduced foliar and fruit quality, although canopy condition and terminal growth were reasonably good.

In addition to 'Yellow Bellflower', fruit on some older trees appeared to be 'Baldwin' although lack of fruit quality and maturity made positive identification impossible. Grass inside wire deer fences had been trimmed recently, although several young trees appeared to be dying, apparently from pine vole injury to the roots.

Eight or ten relatively tame deer were resident in the orchard during our entire time there,

and they were not hesitant to take apples knocked from trees or thrown toward them. Their presence will place practical limits on tree structure and shape as they consume lower branches and fruit.

Dec. 23 - We did not actually visit the orchard, but discussed that several of the trees that appeared to be dying at my earlier visit had died, apparently from vole injury, although string trimmer damage was also noted.

WASHINGTON HEADQUARTERS SITE VISIT, DEC. 23, 1987

I met with John Donahue, Lynn Whiteman, Paul Labounty, and Dan Dearborn and discussed my report from the August orchard visit and my preliminary recommendations. We discussed an appropriate level of management for the orchard, and agreed that a program to maintain tree growth and vigor but not to produce higher quality fruit was appropriate. I agreed to submit sample management plans for staff to choose from.

RECOMMENDATIONS

Site staff are knowledgeable in IPM concepts, and horticultural techniques, including pruning, so that the site has an excellent opportunity to implement a successful IPM program with available resources. Specific recommendations are:

1.) Continue an annual program of light pruning of young trees, and moderate pruning of older ones.

2.) Maintain proper soil fertility and pH based on soil or leaf analysis. Van Starner may be able to provide leaf analysis data from samples he took this season. Perform mineral analysis annually, and correct deficiencies as needed.

3.) Apply a minimum number of fungicides during primary scab season (Appendix I) against apple scab and black rot, both known to be important pathogens at the site, based on weather monitoring and use of a Mill's chart. Since the action thresholds for pathogens will likely be exceeded annually at the site, horticultural and pest management plan. No insecticides are recommended due to the nature and use of the site, and since high quality fruit production is not a primary consideration. Should higher fruit quality be desired, use of Dipel* sprays, insecticidal soap, codling moth pheromone-impregnated wicks as a mating-deterrent program, and use of red sphere traps for apple maggot fly could be incorporated into the IPM program at a later date. Should the selected spray program fail to provide control of black rot, due to a large potential inoculum at the site, a program of injection therapy combined with pruning and orchard sanitation should be considered.

4.) Replant trees as they die with appropriate varieties, and document the planting plan for future resource managers.

5.) The whitetail deer population at the site is unusually high due to the cover and browse

provided by the Park and adjacent acreage. Continue to protect trees from deer with wire fences and repellents.

6.) Maintain contact with fruit specialists at Rutgers Univ. for updates on pest problems, IPM training sessions, newsletters, etc. Subscribe to other state (Massachusetts, New York, Connecticut) Extension Newsletters for more pest management information.

ADAMS NHS, QUINCY, MA

GENERAL ORCHARD CONDITION AND IPM IMPLEMENTATION

The Adams NHS orchard IPM program is well developed at this point, inasmuch as staff have been emphasizing orchard management directions for about 3 years. Trees have been pruned annually under my direction and instruction, according to techniques that foster tree openness and fruit-bearing surface. Fertilization management appears to be meeting tree needs. A low-input pest monitoring and management program is in place, implemented by Ron Catudal and Gene Gabriel. Red sphere apple maggot traps have been purchased, and staff are knowledgeable in their positioning and use. A hygrothermograph has been purchased and modified, and a weather shelter constructed to allow weekly weather monitoring.

Either Kathleen Leahy or myself visited Adams on several occasions during critical times in the 1987 growing season, to assist staff with orchard pest monitoring, sprayer calibration, etc. Most spraying occurred in the early season, directed at plum curculio and various plant pathogens. Appendix V. contains the 1987 spray record for the site, a program which gave excellent control of apple scab and black rot, as well as acceptable control of arthropod pests. Two sprays applied in summer against apple maggot fly may be able to be avoided in the future, if staff time allows extensive use of red sphere apple maggot traps. In an occurrence seen elsewhere in the state this year, powdery mildew fungus infection was evident, although this may not be an annual problem.

The 1987 season saw the best fruit quality of any recent year, although some trees have yet to bear a sizable crop. In harvest surveys, total fruit injury averaged about 5%, with most of that caused by plum curculio. Nonetheless, enough fruit of reasonable quality were produced to allow apples to be given to local charities or nursing homes.

RECOMMENDATIONS

1.) Continue a program of light annual pruning of all trees, taking care to not remove excessive fruiting wood via "heading" cuts, emphasizing rather removal of vigorous watersprouts, or dead, dying drooping or crossing branches via "thinning" cuts.

2.) Continue to maintain adequate fertility and pH by semi-annual soil and/or foliar analysis.

3.) Continue to use well-positioned apple maggot visual traps (in combination with odor baits to improve trap efficiency) as a direct control.

4.) Continue low-input IPM program, emphasizing monitoring of weather and protection of trees and fruit from pathogens, with minimal number of insecticides against plum curculio (Appendix IV). Staff should remain on Cooperative Extension mailing lists to receive weekly pest alert IPM newsletters.

Appendix I. Site visit report on ROVA and MORR, 1987

A REPORT ON SITE VISITS TO
NATIONAL HISTORIC ORCHARDS
AT HYDE PARK, NEW YORK, AND MORRISTOWN, NEW JERSEY

OCTOBER 29-31, 1986 AND FEBRUARY 18-19, 1987

SUBMITTED BY: WILLIAM M. COLI

INTRODUCTION

On consecutive days in late October and again in mid February, I visited the Roosevelt/Vanderbilt National Historic Site and The Morristown National Historic Park, as a component of a cooperative agreement between the National Park Service and University of Massachusetts, Cooperative Extension entitled "Integrated Pest Management for Historic Orchards" (OGCA #87A0328).

At the sites, I met with resource management, curatorial and grounds maintenance staff and evaluated general orchard condition, planting history, previous and present management levels and needs, available NPS resources and plans, and management alternatives. With NPS staff, I began design of an appropriate IPM program for the sites, in accordance with NPS Management Policies handbook (1978), to be implemented by NPS staff. During the February visit, I instructed staff in techniques of orchard pruning and participated in the pruning of existing trees. The following is a detailed report of the visits, and includes preliminary plans and recommendations.

ROOSEVELT HOME ORCHARD SITE VISIT, OCT. 29-30

GENERAL ORCHARD CONDITION

The orchard is sited on about 3 acres of sloping land below the rear of the home, and can be viewed from a vista point used by interpreters on the lawn facing West toward the Hudson. About 2/3 of the orchard has been replanted since 1980, but remaining trees are believed to be original. The older trees have not received significant management for some time, and are overgrown, weak, and growing poorly. It was not possible to examine their fruit were collected from the ground beneath older trees and were tentatively identified.
The newer trees are well grown although in need of pruning, and some bore yellow 'Golden Delicious' fruit, some of which had good size and quality. Overall fruit quality was variable, but tended to be only fair, and a large proportion were small and/or badly damaged by pests. Trees

were still in leaf, although leaf quality was poor. Disease lesions on foliage, fruit, and wood were readily found, with apple scab (Venturia inaequalis), black rot (Physalosopora obtusa), and cedar apple rust (Gymnosporangium juniper-virginia) the predominant pests. Some older trees bore signs of wood-rotting fungi, and much rotten wood was evident.

No arthropods were found, but a few empty mines, probably caused by the tentiform leafminer (Phyllonorycter blancardella) were seen. A few fruit showed evidence of injury by codling moth (Cydia pomonella) and apple maggot fly (Rhagoletis pomonella), but the predominant injury was caused by two generations of plum curculio (Conotrachulus nenuphar). Some trees were badly damaged by buck deer rubbing and deer are frequently in the orchard. I saw no sign that deer were eating tree buds and wood. I also saw no evidence of vole injury.

PLANTING HISTORY

The orchard was planted during the 1930's, and originally consisted of about 60 trees on seedling rootstock, including a yellow, late-season cultivar, possibly 'Golden Delicious', and a red, late-season fruit tentatively identified as "American Beauty', also known as 'Sterling'. From the condition of the older trees, which had lost many limbs over the years, it was impossible to accurately tell what system of training/pruning was originally employed.
The younger trees are 'Golden Delicious' and 'Red Delicious' on seedling rootstock, planted in 1981-82 in the original planting holes, as 2.5 inch caliper, balled trees.

PREVIOUS AND PRESENT MANAGEMENT

I was able to determine little about historical management of the site other than the fact that grass and brush was cut. Gardener records show that lead arsenate and nicotine sulfate were purchased and I presume these were used on the orchard. The family reportedly enjoyed picking fruit and giving some of it away, but this does not reveal whether quality was maintained in any way. Another site visit with curatorial staff may reveal more information in this area.
Present management still involves mowing the orchard groundcover at least twice each year.

Trees have had dead branches removed, and 2/3 of the trees have been replaced, but apparently no other pruning or training has been done to date. No pesticides have been used against pathogens or insect pests except as a component of treating a larger area for a pest such as gypsy moth, and no fertilizer or lime has been added to the site in several years.

AVAILABLE SITE RESOURCES AND NPS PLANS

Grounds staff numbers appear adequate for the additional work that would be required by intensified orchard management. Should spraying be required, the site has an air-blast sprayer with more than adequate capacity to provide coverage. Although the site lacks an IPM Coordinator, skilled horticultural staff have experience in needed areas, and required tools are available. Staff asked to receive training in pruning of apple trees, and one tree was done as a demonstration with more planned in late winter.

The remaining old trees are scheduled to be replaced in the near term, but the level of importance that managing the orchard holds in the overall grounds maintenance program must be further clarified.

PRELIMINARY RECOMMENDATIONS

1). A program of pruning for the newer trees is needed to remove competing wood in the canopy, and to develop strong branch angles which will resist breakage from ice storms and increasing crop load. I made arrangements to return to the site in late winter to instruct staff and help with pruning the young trees. This visit, in concert with a similar workshop at Morristown, is described later in this report.

2). Proper fertility and soil pH should be achieved based on soil test results. Although newer trees show adequate terminal growth, application of needed amendments in the spring of 1987 will improve tree vigor and productivity.

3). In 1987, the site should be mowed more often than presently to deter pine and meadow voles, and wire or plastic mouse guards should be installed on all trees now lacking them

4). Some attempt should be made to deter deer, possibly by a regular program using such repellants as human hair and bars of soap. Use of electric or other fences does not appear to be practical.

5). In my opinion, the old trees are not worth saving in their present condition. If NPS plans call for removing and replanting the remaining original trees, budwood can be taken from existing trees, and propagated by a commercial nursury. Alternatively, if, after identification, present varieties are found to be commercially available, the originals can be replaced more rapidly and at less cost than by custom budding. If attempting to maintain originality is not desired, purchase of disease-resistant cultivars will eliminate the need for fungicide sprays in the future.

6). Selected grounds staff should attend the IPM training conference in February, 1987 at the University of Massachusetts, Amherst. After this, further plans can be made in concert with site staff and the regional office, to implement an IPM program at the orchard.

7). A "soft" fungicide spray program using least-toxic, broad-spectrum materials is suggested to protect tree foliage and bigour, with sprays applied according to results of weather monitoring on site. Such a program should also provide a good measure of fruit protection from diseases as well. If NPS requires higher quality fruit than at present, minimum numbers of soft insecticides in combination with insect traps can be used.

VALKILL COTTAGE ORCHARD SITE VISIT, OCT. 29

GENERAL ORCHARD CONDITION

Trees are seedling rootstocks which have received little or no management in several years. Most are original, although at least one chance seedling may have replaced an original tree. Varieties appear to be the same as at the Roosevelt home, although no samples were taken for positive identification. Fruit quality overall is poor. Although I had no soil map and did no soil test, the orchard soil appears to be shallow and of low fertility, and trees at Valkill are not

growing vigorously. Several of the trees can probably be brought back with appropriate care. Pest injury as described above was also evident at Valkill, although I saw no sign of deer injury.

PLANTING HISTORY

This orchard was planted by Eleanor in the 1930's. Further research may reveal if trees were propagated from the home orchard or bought from a nursery. No replanting has yet been done.

PREVIOUS AND PRESENT MANAGEMENT

I was able to determine little on historical management of the site. In recent years, trees have had some dead branches removed but no systematic pruning, and no fertilizer or lime has been applied in several years. No pesticide sprays are presently applied except incidentally to controlling other pests.

AVAILABLE SITE RESOURCES AND NPS PLANS

Same as described above. There are no current plans to replant the orchard.

PRELIMINARY RECOMMENDATIONS

Same as 1, 2, 6 and 7 above.

MORRISTOWN NATIONAL HISTORIC PARK ORCHARD SITE VISIT, OCT. 30-31.

GENERAL ORCHARD CONDITION

The orchard is located at the Wick Farm, and covers about 8 acres behind the farmhouse. The site contains about 160 trees, 100 of which are less than 5 years old. Several of the old trees are in poor condition, and only about 1/3 are "original". Some old trees are in excess of 50 years old, but only one, which is completely rotten in its center, could potentially date to the Revolution. Some of the older trees bore fruit of good size and quality, which were collected and identified as 'Yellow Bellflower', and (tentatively) 'Jewett Red'.

Younger trees bore no fruit, but are growing well, although in need of pruning and training. Excellent deer protection in afforded by individual, woven wire fences around the young trees. Mowing and pasturing evidence of meadow of pine vole injury or burrows was uncovered after careful examination at 2 places in the orchard.
The predominant pest problems are the pathogens causing apple scab, black rot and cedar apple rust, although codling moth, apple maggot and plum curculio injury to fruit were also found. Mines of an unknown leafminer were observed, as were a few fruit-infesting scale insects, but identification was not possible. No other signs of foliar feeding arthropods were noted during a non-rigorous examination.

PREVIOUS AND PRESENT MANAGEMENT

Determining historical management will require research using site documents or other sources. More recent management has included mowing, erecting and maintaining deer fences, and removing dead wood. No pesticide sprays are presently applied, and trees receive little training, regenerative pruning or fertilization.

AVAILABLE SITE RESOURCES AND NPS PLANS

The site Resource Management specialist has a strong background in orchard management, horticulture and IPM, and, with ground maintenance staff, should be able to accommodate a somewhat higher level of management at the site with little difficulty. No suitable sprayer is available, although an older machine recently used for leaf removal is scheduled for replacement.

There are no immediate plans to remove and replant old trees except as needed due to losses. Staff expressed a need to receive assistance and instruction in pruning apple trees, and plans were made for a late winter pruning workshop, described below.

PRELIMINARY RECOMMENDATIONS

1.) A program of fertility and pH management should be begun as soon as possible, based on soil test results.
2.) Old and young trees should be pruned annually, beginning this winter, to develop and maintain good tree structure and vigor.
3.) Continue to deter deer in any way possible. Young trees are large enough to justify trial removal of some fences and use of deer repellants in their place.
4.) No additional mowing of the orchard is needed. However, if deer fences are retained, the area within fences should be mowed once or twice a year to reduce competition, and eliminate cover for vertebrate and other pests.
5.) Selected staff should attend the February IPM training conference at UMASS, after which the Resource Management specialist will likely prepare an appropriate-scale IPM plan for the site.
6.) Some level of disease management should be implemented in 1987, based on weather monitoring at the site. Fruit quality desired by NPS would dictate the need for insect management, but, replacement of the present inoperative sprayer is essential. At least three sprayer options and their prices from a Massachusetts supplier have been provided to site staff. None of the likely options will be suitable for leaf removal, so separate provision for this practice is needed.

ON-SITE PRUNING WORKSHOPS, FEB. 18-19, 1987

ROOSEVELT HOME ORCHARD

Four grounds staff were presented a 20 minute classroom session on general concepts of orchard pruning and training to achieve a desired structure. Afterwards, we spent about 4 hours pruning the younger trees which had received no pruning or training since planting. All trees lacked a distinct central leader, as several vigorous, upward-growing shoots had developed into competing leaders in each tree. I demonstrated how to decide where to begin in such cases, and pruned 2 trees with site staff asking questions as I pruned. The group then began another tree each under my supervision. Staff were asked to give their plan for pruning the tree, and the pros and cons of each potential cut were discussed.

By the end of the session, about two rows of trees had been completed, and pruned trees were restored to a reasonably good structure. Staff appeared to have assimilated enough to be able to continue pruning on their own. No attempt was made to prune the large trees at the Home or at the Valkill cottage, due to their height and advanced deterioration.

MORRISTOWN SITE

The site Resource Management Specialist and four rangers/grounds staff were presented a similar general discussion of tree training and pruning as at ROVA. Because of John Donahue and Dan Dearborn's previous orcharding and pruning experience, they both participated actively in the workshop, and helped train less experienced staff. Consequently, over the course of about 5 hours, we were able to prune a large percentage of the smaller trees, which were in a condition similar to those described at ROVA. Many of the trees were restored to a reasonably good structure after pruning and spreading of upright-growing branches. Three of the larger trees were also pruned so as to demonstrate what would be needed to lower them and open up tree centers to light and spray penetration.

Because the site has so many deer, it is still desirable to leave the deer fences in place, in spite of their historical inappropriateness. However, we did discuss the need to better control weeds and grass inside the wire, and possible use of deer repellants on a limited, trial basis. Repellants, however, would not deter the horse pastured at the farm from also damaging unprotected trees.

GENERAL RECOMMENDATIONS FOR BOTH SITES

Pruning should be performed annually at both sites from now on to maintain tree structure. If staff time permits, summer pruning (early August) to remove watersprouts from this year's pruning cuts would be highly desirable.

FURTHER PLANS

I plan to return to each site at least one more time this season to assist staff with program development and collect further fruit and pest samples. Further, staff have been notified that I am available via the telephone to respond to problems as they arise.

Appendix J. Description of Midwest Region fruit collection

Description and identification of NPS fruit samples
Conducted by Ken Livermore, notes taken by William Coli
New York Agricultural Experiment Station, Geneva, NY

St. Croix, North View, apple #1. Likely Astrachan; 70% striped; round oblate; stem short; September ripening; very tart; calyx tube short; flesh near white. Photo 48.

St. Croix, Glenbrae, single apple. Not Northern Spy, possibly related to Newton Pippin; scarf skin, green in stem cavity; greenish flesh; late October apple. Photo 47.

St. Croix, North View, apple #2. Very tart, possibly Grimes. Photo 49.

Indiana Dunes, Chellberg farm, apple #1. Like Fameuse; good taste; white flesh; round oblate. Photo 17.

Cuyahoga, Vaughn, apple. Similar to Calville Blanc.

St. Croix, Glenbrae, apple. Green with little blush; oblate; sweet taste; stem medium, cavity medium with brown russett; open core; calyx tube short.

St. Croix, Geidel, apple. 30% striped; short stem; round conic; both with Codling Moth injury. Photo 51.

St. Croix, Geidel, apple #2. Non stripey; scab legions; 40% blush on yellow green ground; round oblate; medium stems, cavity medium to shallow; small shallow basin; white flesh. Related to McIntosh, possible Fameuse lineage seedling. Photo 52.

Sleeping Bear Dunes, Port Oneida, apple #1. Wagener lineage; 40% pink orange blush; round oblate, ribbed; stem short to medium; cavity medium to shallow; russetted basin, shallow furrowed; white to yellow fleshed; small seeds. Photo 57.

Sleeping Bear Dunes, apple #3. Along Rt. 22, round; green scarfskin, slight red stripe; stem short to medium; cavity shallow; basin very shallow, puckered, furrowed; calyx small, protruding; cream flesh; closed core; calyx tube medium; June drops didn't fall. Photo 54.

Sleeping Bear Dunes, Baker Rd. apple #2. Possible Baldwin or Hubbardston; green, round; shallow cavity, short stem; white lenticels; yellow flesh; basin very shallow; closed core; oxidizes quickly.

Sleeping Bear Dunes, Baker Rd., apple #1. Not Fameuse; stem small, short, shallow cavity; picked early, 30% red; basin very shallow; calyx protruding, sepals reflexed; flesh

greenish yellow. Photo 64.

Sleeping Bear Dunes, Baker Rd. old house, apple. Stem medium to long, coarse; cavity shallow, broad; apple round oblate, ribbed; depressed lenticels, 40% striping; slight lobing at base; calyx shallow, sepals reflexed & large; flesh cream.

Sleeping Bear Dunes, Port Oneida, apple #2. Not Wagener; stems medium to short, coarse, cavity shallow; 30% light red striping; basin shallow, small; sepals recessed, small, fly speck, bitterpit; cream flesh. Photo 59.

Sleeping Bear Dunes, Norcronk/Stormer Rd., apple #5. Stem medium, cavity shallow, russetted; depressed lenticels, some russetted; calyx medium to shallow; numerous white dots at basin; oblate shape; close to maturity. Photo 61.

Effigy Mounds, South Brechner, apple #1. Flesh sweet, white. Photo 18.

St. Croix, North View, crabapple. Resembles *Zumi calocarpa*, but a little too large. Resembles Manchurian also, but often M. has more red. Photo 50.

Effigy Mounds, South Brechner, apple #4. Meets many descriptive characteristics of Transcendent Crab. Stem cavity narrow, shallow; calyx, flattened, somewhat ribbed; skin thin, yellow with red cheek; calyx tube conical; flesh yellow, crisp juicy, somewhat astringent. Photo 21.

Effigy Mounds, County Rd., apple #1. Dark purple fruit. Likely seedling. Photo 1, 11/7/89 photo 162.

Effigy Mounds, County Rd., apple #5. Green fruit, no blush; sooty blotch, fly speck; likely seedling. Photo 5, 11/7/89 photo 161, 161a.

Effigy Mounds, County Rd., apple #2. Short stem; 70% striped; round-conic; tart; near white flesh. Photo 2, 11/7/89 photo 163.

Effigy Mounds, County Rd., apple #3. Haloed lenticels; flesh firm, cream colored; 90-100% red, lightly striped; roundish oblate or oblate. Photo 3, 11/7/90 Photo 160.

Effigy Mounds, South Brechner, apple #3. Slight red-flesh; Antonovka type; conic; 100% Dark Red striping; stem medium to short; cavity acute, deep; calyx tube, short; anthers median. Photo 19.

Effigy Mounds, location unknown, apple. Calyx basin very large, broad; sepals large, ribbed; 50% red color; oblate; greasy skin, scalding, bitter rot; calyx tube funnel shaped; flesh yellowish, very dry.

Effigy Mounds, County Rd., apple #4. Golden Delicious type; very short stem; small narrow cavity; near white fine flesh; very long calyx tube; round; yellow green, 5% red blush; apple maggot injury. Photo 4.

Effigy Mounds, apple #1. Similar to last, possible Golden Sweet, not Tolman Sweet, Bough Sweet, or Bailey Sweet; sweet; stem short; cavity narrow, deep, abrupt; flesh white, oxidizes quickly; russet in cavity; calyx tube fairly short; conical; median stamens; slight scarf skin.

Effigy Mounds, South Brechner, apple #2. Stem medium to short; cavity russetted, narrow, medium deep; 50% splashy red stripe; surface rot; flesh near white, dry, subacid; internal codling moth, scab. Photo 20.

Effigy Mounds South unit, apple. Green fruit; obliquebanded leaf roller injury, scarf skin; shape oblate; basin shallow; stem cavity shallow; possible Grimes. Photo 10.

Effigy Mounds, South Unit, apple #1. Possible Wagener, based on ribbing, color pattern, shape. Photo 8.

Indiana Dunes, Goodfellow Camp, apple. Antonovka type; flesh white; core open, relatively large; flavor tart, similar to Yellow Transparent or Lodi (Antonovka family). Photo 14.

St. Croix, North View, apple near homesite. Flesh dry, mealy, near white, quick oxidation; stem short; cavity russetted, narrow, medium deep; calyx broad, shallow; sepals large, reflexed; calyx tube very short; anthers basal;, 10% pink on yellow green ground; skin greasy. Photo 45.

Cuyahoga Valley, Russet apple. Resembles Hudson Gold; stem long; 100% russet; shape similar to Golden Delicious; flesh greenish, good taste. Photo 11.

Isle Royale, Ransom, apple #1. All could be Black Gilliflower seedlings. Photo 30.

Sleeping Bear Dunes, Port Oneida, apple. Confirmed as Tolman Sweet. Apple ribbed; cavity dark green; basin shallow. Photo 60.

Apostle Islands, McCloud Brigham, apple #2 along trail. Not cultivated. Photo 24.

Indiana Dunes, Goodfellow South, apple #3. Possible seedling; flesh green. Too early to ID, late apple. Photo 16.

Indiana Dunes, Goodfellow South, apple #1. Trace of Wagener, possible Ben Davis or seedling of Ben Davis; very late apple, tree caliper 28.5 in; Skin covered by fly speck and sooty blotch; 30% striping; cavity medium, russetted; stem medium, slender; basin rather shallow and small; sepals small; flavor dry, flat.

Sleeping Bear Dunes, Port Oneida Comm. Club, apple. Likely seedling. Photo 58.

Isle Royale, Windigo, apple. Likely seedling. Photo 29.

Isle Royale. All green. May be *Malus iloensis* (native crab) or something crossed with *Malus iloensis*. Definitely not a named cultivar

Sleeping Bear Dunes, Baker Rd., apple #2. Possible Baldwin or Hubbardston.

Sleeping Bear Dunes Baker Rd., apple #1. Possible Fameuse.

Sleeping Bear Dunes, Norcronk Rd. apple #5. Possible Porter.

Sleeping Bear Dunes, Port Oneida, apple #2. Possible Wagener, Northern Spy, Idared. Photo 59.

Sleeping Bear Dunes, Baker Rd. old house, apple. Similar to above. Photo 64.

Sleeping Bear Dunes, Miller Rd. apple. Most likely not a named cultivar. Photo 55.

Columns that don't line up are already fixed

Appendix K. Initial survey replies by NPS region

North Atlantic Region

Acadia National Park P.O. Box 177 Carroll Farm Bar Harbor, ME 04609	Apple: 50-100 trees remnant orchard at Carroll Farm. Obtain exotics map	Historic
Adams NHS 135 Adams Street Quincy, MA 02269	Historic apple orchard:pears, cherry, nut trees, grounds report	Historic
Boston NHP Charlestown Navy Yard Boston, MA 02129	Ornamentals: 2 apple, 3 pear trees at commandant's house	Unknown
Cape Cod National Seashore South Wellfleet, MA 02663	Apples: 14-20 trees, 2 old farmsites	Historic
Edison NHS Main Street and Lakeside Ave. West Orange, NJ 07052	2 historic apple trees, pear, butternut, chinese chestnut	Historic
Ellis Island c/o Statue of Liberty NM Liberty Island New York, NY 10004	Apples. Contact Richard Wells	Historic
Fire Island National Seashore 120 Laurel Street Patchogue, NY 11772	Apples: Historic orchard, 17 trees found plus 1 peach	Historic
Martin Van Buren NHS P.O. Box 545, Route 9H Kinderhook, NY 12106	1 sweet cherry, butternut	Historic
Minuteman NHS PO Box 160 Concord, MA 01742	Apples: old home sites, grounds report	Historic
Morristown NHP Washington Place Morristown, NJ 07960	Historic apple varieties, 185 apple trees, base map	Historic

Sagamore Hill NHS Cove Neck Road, Box 304 Oyster Bay, NY 11771	Apples: 37 McIntosh, 31 Red Delicious, 2 Greening	Historic
Saint-Gaudens NHS RR #2 Cornish, NH 03745	apples: 5 historic trees, base map	Historic
Salem Maritime NHS Custom House 174 Derby St Salem, MA 01970	NPS plantings: apple, cherry, pear. Base map	New trees
Saratoga NHP R.D. 2, Box 33 Stillwater, NY 12170	Apples: old farm sites. Base map	Historic
Saugas Iron Works NHS 244 Central St. Saugas, M<A 01906	Old cherry tree	Unknown
Springfield Armory NHS 1 Armory Square Springfield, MA 01105	3 pear trees	Unknown
Theodore Roosevelt Inaugural NHS 641 Delaware Ave. Buffalo, NT 14202	1 NPS planted pear tree	New trees
Women's Rights NHP P.O. Box 70 Seneca Falls, NMY 13148	Apples, pear, black walnut, old orchard remnants	Historic
Eleanor Roosevelt NHS 249 Albany Post Rd. Hyde Park, NY 12538	Apples: old remnants	Historic
Home of F.D. Roosevelt NHS 249 Albay Post Rd. Hyde Park, NY 12538	Historic orchard remnants. 78 apple trees	Historic
Vanderbilt Mansion NHS 249 Albany Post Rd Hyde Park, NY 12538	Old fruit trees	Historic

already fixed

Mid Atlantic Region

Delaware Water Gap NRA Bushkill, PA 18342	Apples, pears, peaches; privately owned orchards: maintained cultural landscapes	Unknown
Hopewell Furnace NHS R.D. 1, Box 345 Elverson, PA 19520	Historic apples; reconstructed orchard, obtain base map	Reconstructed
Valley Forge NHP Valley Forge, PA 19481	remnant historic orchard, overgrown apple and pear	Historic
Friendship Hill NHS R.D. 2, Box 528 Farmington, PA 17325	Historic orchard remnants: 2 existing pear trees	Historic
Eisenhower NHS c/o Gettysburg NMP Gettysburg, PA 17325	Old farm site: apple, peach, pear, pecan, nectarine. Obtain base map	Historic
Gettysburg NMP Gettysburg, PA 17325	Remnant apple orchard, and NPS trees. obtain photos	Historic
Hampton NHS 535 Hampton Lane Towson, MD 21204	Pecans, black walnuts, 2 pears; historic garden	Historic
Fredericksburg & Spotsylvania NMP P.O. Box 679 Fredericksburg, VA 22404	Old Homesite plus NPS plantings; 5 apple trees at Chatham Manor	Historic
Shenandoah NP Route 4, Box 292 Luray, VA 22835	Apples; 1000+ trees; old homesites	Historic
George Washington Birthplace Washington's Birthplace, VA 22575	Reconstructed orchard: apple, peach, pear, plum, cherry. Confirm ID.	Reconstruction
New River Gorge NR P.O. Drawer V Oak Hill, WV 25901	Apple: old farm sites. Historic Richmond Farm	Historic

Richmond NBP 3215 East Broad St. Richmond, VA 23223	Old orchard sites: 9 peach trees. Base map	Historic
Colonial NHP P.O. Box 210 Yorktown, VA 23690	Historic homesite: apple, cherry	Reconstruction
Booker T. Washington NM Route 1, Box 195 Hardy, VA 24101	Apple, peach, pear, plum. 10 NPS trees	Reconstruction

National Capitol Region

Antietam NB Box 158 Sharpsburg, MD 21782	12 apple trees, 2 peach, 1 pear. Historic orchard remnants (apples in pasture	Historic
Catoctin Mountain Park Thurmont, MD 21788	NPS plantings: Ornamentals, apple, cherry	New trees
Chesapeake & Ohio Canal NHP Box 158 Sharpsburg, MD 21782	Red and Yellow delicious leased orchard, plus 180 unknown apples	Historic
Manassas NBP P.O. Box 1830 Manassas, VA 22110	Old farm sites: 8 apple and 2 pear trees	Historic
Prince William Forest Park P.O. Box 209 Triangle, VA 22172	Old homesites (c.1869-1920): 2 pear, 1 persimmon, 3 plum, 188 apple	Historic
National Colonial Farm c/o National Capital Parks-east 1900 Anacostia Drive, S.E Washington, DC 20020	Historic apple varieties, reconstructed orchard (Piscataway Park)	Reconstruction
Oxon Hill Farm c/o National Capital Parks-East 1900 Anacostia Drive, S.E. Washington, DC 20020	Historic apple varieties, reconstructed orchard (Piscataway Park)	Reconstruction

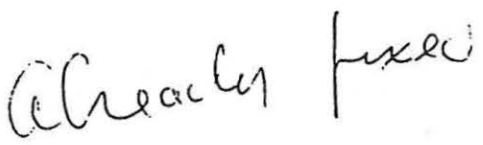
Southeast Region

Andersonville NHS Andersonville, GA 31711	32 pecan trees	Historic
Blue Ridge Parkway 700 Northwestern Bank Building Asheville, NC 28801	Old farmsites, including the Moses Cone Estate. Apple, pear, plum, peach, Cherry	Historic
Chickamauga & Chattanooga NMP P.O. Box 2128 Fort Oglethorpe, GA 30742	Reconstructed orchard, Yates apple	Reconstruction
Cumberland Island NS P.O. Box 806 St. Marys, GA 31558	Olive grove remnants	Historic
Fort Frederica NM Route 9, Box 286-C St. Simons Island, GA 31522	NPS Seville Oranges, Vegetation History report, pear, pecan, persimmon	Unknown
Cowpens NBP P.O. Box 308 Chesnee, SC 29323	10 peach trees non fruit-bearing	Historic
Kennesaw Mt. NBP P.O. Box 1167 Marietta, GA 30061	1 NPS pear tree	New tree
Ocmulgee NM 1207 Emery Highway Macon, GA 31201	Apple, fig, pear, pecan. Review management of trees	Unknown
Ninety six NHS P.O. Box 496 Ninety Six, SC 29666	Pecans and walnuts	Unknown
Biscayne National Park P.O. Box 1369 Homestead, FL 33090	Lime grove	Historic
Canaveral NS P.O. Box 6447 Titusville, FL 32782	Orange and grapefruit grove	Historic

Fort Matanzas NM c/o Castillo San Marcos NM 1 Castillo Dr. St Augustine, Fl 32562	Persimmon, pecan, japanese plum	Unknown
Mammoth Cave NP Mammouth Cave, KY 42259	Old homesites, apple	Historic
Cumberland Gap NHP P.O. Box 840 Middlesboro, KY 40965	Old orchard remnants: 28 apple trees, NPS trees	Historic
Carl Sandburg Home NHS P.O. Box 395 Flat Rock, NC 28731	Reconstructed orchard, apple, black walnut	Reconstruction
Great Smoky Mountains NP Gatlinburg, TN 37738	Old orchard remnants: Shockley apple. Old farm sites, Cherokee apple orchard	Historic
Andrew Johnson NHS P.O. Box 1088 Greenville, TN 37744	1 Historic pecan, plus NPS apple, pear, cherry and pecan	Historic
Big South Fork NR P.O. Drawer 630 Oneida, TN 37841	Many apple and pear trees	Unknown
Fort Donelson NB P.O. Box 434 Dover, TN 37058-0434	Apple, pear, persimmon, walnut	Unknown
Shilo NMP Shilo, TN 38376	Reconstructed orchard: peach, apple	Reconstruction
Natchez Trace Parkway R.R. 1, NT-143 Tupelo, MS 38801	Fig, pecan, black walnut, pear	Historic
Fort Pulaski NM P.O. Box 98 Tybee Island, GA 31328	Fig, pecan, persimmon	Unknown

Midwest Region

Cuyahoga Valley NRA 15610 Baughn Road Brecksville, OH 44141	apples and pears	Unknown
William Howard Taft NHS 2038 Auburn Ave. Cinncinati, OH 45219	1 old pear tree	Historic
Indiana Dunes National Lakeshore 1100 N. Mineral Springe Rd. Porter, IN 46304	old homesites: apple, pear, cherry; Chellberg Farm orchard	Historic
Lincoln Boyhood National Memorial Lincoln City, IN 47552	Reconstructed orchard: apple, plum, peach, cherry some NPS trees	Reconstruction
Lincoln Home NHS 426 S. Seventh Street Springfield, IL 62701	NPS apple, peach, cherry Historic Grounds Report	Reconstruction
Isle Royale National Park 87 North Ripley Street Houghton, MI 49931	old homesites: apple trees	Historic
Pictured Rocks National Lakeshore P.O. Box 40 Munising, MI 49862	200 apples, 6 plum, 6 cherry trees, red, yellow 'transparent'	Historic
Sleeping Bear Dunes National Lakeshore 400 Main Street Frankfort, MI 49635	2 commercial cherry orchards; old farm sites: apple, pear, apricot, cherry	Historic
Apostle Islands National Lakeshore Route 1, Box 4 Bayfield, WI 54814	old farm sites: 100 apple, 30 plum trees. site & field maps	Historic
Saint Croix National Scenic Riverway P.O. Box 708 Saint Croix Falls, WI 54024	old homesites and farms: apple, plum	Historic



Pipestone NM P.O. Box 727 Pipestone, MN 56164	old apples on adjoining site one NPS apple tree; some walnuts	Historic
Effigy Mounds NM P.O. Box K McGregor, IA 52157	20 apple trees, 200+ nut trees also plum, wild apples	Historic
Herbert Hoover NHS P.O. Box 607 West Branch, IA 52358	English walnut, 12 NPS apple,	Reconstruction
George Washington Carver NM P.O. Box 38 Diamond, MO 64840	persimmon, walnut, plum, cherry, hickory, paw paw. Base map	Reconstruction
Ozark National Scenic Riverways P.O. Box 490 Van Buren, MO 63965	old homesites: apple trees	Historic
Wilson's Creek NB Postal Drawer C Republic, MO 65738	Reconstructed orchard	Reconstruction
Fort Scott NHS Old Fort Boulevard Fort Scott, KS 66701	Persimmon, plum, pear, peach, walnut, hickory. NPS trees	Reconstruction
Homestead National Monument of America Route 3 Beatrice, NE 68310	walnut, cherry	Unknown

Rocky Mountain Region

Bighorn Canyon NRA P.O. Box 458 Fort Smith, MT 59035	100 apple trees	Historic
Glacier National Park West Glacier, MT 59936	Old homesites: apple, cherry trees	Historic
Wind Cave National Park Hot Springs, SD 57747	Remnant orchard: 14 apple trees	Historic
Dinosaur National Monument P.O. Box 210 Dinosaur, CO 81610	3 apple, 5 apricot, 6 plum, 2 walnut	Unknown
Capitol Reef NP Torrey, UT 84775	Reconstructed orchard	Recontruction
Glen Canyon NRA P.O. Box 1507 Page, AZ 86040	54 peach, 8 pear, 15 apricot, 12 plum	Unknown
Zion National Park Springdale, UT 84767	Old farm sites: old fruit varieties	Historic
Pipe Spring National Monument Moccasin, AZ 86022	Reconstructed orchard: old varieties	Reconstruction
Colorado National Monument Fruita, CO 81521	2 apricot trees (1 is dying)	Unknown

Southwest Region

Buffalo River P.O. Box 1173 Harrison, AR 72601	Old homesites: apple, pear, plum, peach, cherry trees	Historic
Hot Springs NP P.O. box 1860, Hot Springs National Park, AR 71901	peach, pecan, walnut, persimmon, cherry	Historic
Pea Ridge National Military Park Pea Ridge, AR 72751	one very old pecan tree	Historic
Jean Lafitte NHP and Preserve U.S. Customs House 423 Canal St., Room 206 New Orleans, LA 70130	Pecan grove historical study in progress	Historic
Big Bend NP Big Bend National Park, TX 79834	Pomegranate, fig, apricot, apple, peach trees National Register site	Unknown
Fort Davis NHS P.O. Box 1456 Fort Davis, TX 79734	1 fig, 3 apple, 3 pear, 3 apricot	Historic
Guadalupe Mountains NP 3225 National Park Highway Carlsbad, NM 88220	14 pecan trees, circa 1900	Historic
Lyndon B. Johnson NHP P.O. Box 329 Johnson City, TX 78636	Pecan orchard active IPM program	Historic
Bandelier National Monument Los Alamos, NM 87544	Old orchard remnants: apple, pear, plum, peach trees	Historic
Carlsbad Caverns NP 3225 National Parks Highway Carlsbad, NM 88220	NPS apple, apricot, plum, pear, pecan, plus grove of wild plums c. 1962	Historic (?)
Pecos National Monument	2 apple trees	New

P.O. Drawer 11 Pecos, NM 87552	New trees	
Canyon de Chelly NM P.O. Box 588 Chinle, AZ 86503	Navajo Indian fruit orchards 1600 peaches planted c. 1986	Historic
Hubbell Trading Post NHS P.O. Box 150 Ganado, AZ 86505	7 Spencer Seedless apples, 3 plum trees	Historic
Southwest Regional Office Post Office Box 728 Santa Fe, NM 87504	1 apple, 1 pear, 31 apricot trees	Unknown

Western Region

John Muir NHS 4202 Alhambra Avenue Martinez, CA 94553	Muir-Strentzel farm, orchards: apple, lemon, pear, fig, orange, grapes	Historic
Joshua Tree NM 74485 National Mon. Dr. Twentynine Palms, CA 92277	old orchard: 8 pear trees Keys Ranch site (not maintained)	Historic
Santa Monica Mtns. NRA 22900 Ventura Boulevard Suite 140 Woodland Hills, CA 91364	Beverly Hills Red apples; plum, orange, avocado, walnut	Unknown
Whiskeytown-Shasta-Trinity National Recreation Area P.O. Box 188 Whiskeytown, CA 96095	Camden House orchard historic orchard remnants: apple, pear, cherry and walnut trees	Historic
Coronado NM Rural Route 1, Box 126 Hereford, AZ 85615	Native walnuts	Unknown
Chiricahua NM Dos Cabezas Route Box 6500 Willcox, Arizona 85643	10-30 persimmon, plus a few pear, plum, and peach trees	Historic
Grand Canyon NP P.O. Box 129 Grand Canyon, AZ 86023	3 peach, 1 apple tree	Historic
Organ Pipe Cactus NM Route 1, Box 100 Ajo, AZ 85321	10 fig, 5 pomegranate trees project proposal w/Desert Botanic Garden	Unknown
Tumacacori NM P.O. Box 67 Tumacacori, AZ 85640	NPS pomegranate, fig, apricot, olive	New
Kalaupapa NHP c/o Pacific Area Office National Park Service 300 Ala Moana Boulevard	non-NPS citrus and tropical fruits: orange, mango, papaya	Historic

Honolulu, HI 96850		
		Unknown
Pu'uhonua o Honaunau National Historical Park P.O. Box 128 Honaunau, Kona, HI 96726	Coconuts, Indian mulberry	
		Historic
Hawaii Volcanoes National Park Hawaii National Park, HI 96718	About 6 apple trees, pre. 1940	
		Historic
Great Basin National Park Lehman Caves National Monument Baker, NV 89311	Historic orchard remnants request assistance re: grafting, etc.	
		Historic
Eugene O'Neill NHS 4202 Alhambra Avenue Martinez, CA 94553	Oranges, limes, almonds	

Pacific Northwest Region

Coulee Dam NRA P.O. Box 37 Coulee Dam, WA 99116	Historic orchard remnants: apple, plum and apricot trees base map & documents	Historic
Fort Vancouver NHS Vancouver, WA 98661-3897	Reconstructed orchard; review management plan	Reconstruction
North Cascades NP 800 State Street Sedro Woolley, WA 98362	Historic commercial orchard remnants: Common Delicious apples (Lake Chelan unit)	Historic
San Juan Island NHP P.O. Box 429 Friday Harbor, WA 98250	Historic orchard remnants: 80 apple, plus pear, cherry and plum, photos of original orchard	Historic
Whitman Mission NHS Route 2, Box 247 Walla Walla, WA 99362	Reconstructed historic orchard; review management plan draft	Reconstruction
Nez Perce NHP P.O. Box 93 Spalding, ID 83551	10 apple, 1 cherry, 2 apricot, 1 plum; large old cherry located in Arboretum	Unknown
Fort Clatsop NM Route 3, Box 604-FC Astoria, OR 97103	one old apple tree	Historic
John Day Fossil Beds NM 420 West Main Street John Day, OR 97845	Remnant historic orchard: 10 apple, 6 pear, 1 apricot, 1 plum at Cant Ranch site	Historic
Olympic National Park 600 East Park Avenue Port Angeles, WA 98362	Old homesites: apples	Historic