Landscape Culture

a newsletter for cultural landscape stewards

Cultural Landscapes Program Summer 2021

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Using Survey123 for CARE Orchard Condition Assessments and Treatment Planning

Imagine your job is to take care of the largest NPS orchard system, with roughly 1,900 trees spread over 200 acres. Where do you begin to prioritize your work? Fritz Maslan, Horticulturist at Capitol Reef National Park (CARE) in south-central Utah, found himself in this position. The orchards are a living legacy of Fruita, a rural historic district along the banks of the Fremont River and Sulphur Creek where Mormon homesteaders first settled in 1879. Ten families planted more than 20 orchards, built homes and a one-room schoolhouse, and planted fields with sorghum, vegetables and alfalfa. Today, the orchards are part of the visitor experience, drawing locals and tourists for spring blossoms and the summer "U-Pick" harvest. The oldest trees date to the early 20th-century, and include the heirloom 'Capitol Reef Red' apple variety that originated in Fruita.

Fruita Rural Historic District in Capitol Reef National Park, dates to the 1880s and contains the largest orchard system in the national parks (NPS photo by Byron Harward).

When Fritz joined the park in 2018, CARE staff understood the total number of fruit trees had declined from a high of 3,000, but didn't have data on current patterns of deterioration. Fritz and his colleagues

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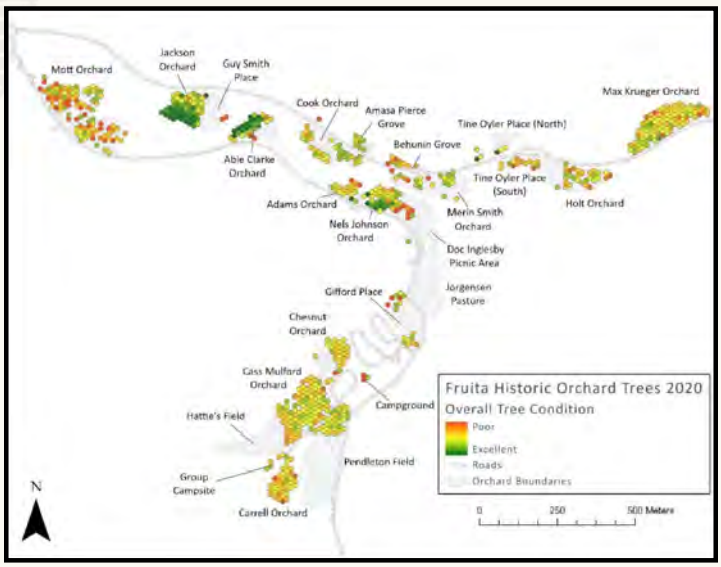
determined a comprehensive condition assessment was needed to understand the overall status. Fritz and Mara Rembleski, a Research Associate with the Great Basin Institute, designed a condition assessment using Survey123 for ArcGIS, a mobile app available to NPS through our ESRI license. They used Survey123 to create a sophisticated field form with drop-down menus, pick-lists and data fields, for capturing data and photos on a Samsung Galaxy tablet. Survey123 was used with ArcGIS Collector, a map-centric app that was preloaded with the park's existing orchard spatial data, enabling the team to accurately navigate to each tree.

Two sample pages within the Survey123 condition assessment form: left, the Tree Defects and Damages page with drop-down pick-lists, and right, the Overall Tree Health page with condition definitions and sample photos of excellent, good, fair, poor and dead tree condition (NPS/CARE, 2020).

Over several months of field work, Fritz, Mara, George Khoury, a volunteer, and Becca Dallas, an intern, assessed 1,889 trees, capturing essential data about each tree, its condition, overall health, defects and damages, work needed, and a set of photos. The 2020 Comprehensive Orchard Condition Assessment Report for the Fruita Rural Historic District outlines the process and their findings. A summary presentation highlights the map data derived from the assessment. Among the useful data were the exact number and location of trees by species, including apple, apricot, peach, pear, cherry, plum and walnut, and the variety of each tree, totaling 65 varieties. The data revealed the oldest trees were in the worst shape, but there were localized patterns of pests, diseases, wildlife damage, and deficiencies in irrigation and soil nutrients. They revealed a need for deadwood removal throughout the orchards, a stressor that affects tree vitality. When compared with former survey results, the data revealed the average mortality rate was 134 trees per year since 2015.

Fritz and Mara's Survey123 forms are available to any park seeking to implement a similar effort. CARE staff aim to repeat the comprehensive condition assessment every five years in the future, and annually for 180 trees, involving two weeks of field work. Since the assessment, Fritz has been pruning to remove deadwood, work that can be done at any time of year, and contributing to two other efforts: 1) a pilot replanting of two orchards, Guy Smith and Cook, where the trees have died, and 2) a long-range treatment plan for the phased rehabilitation of all orchards. The data derived from the condition assessment is informing both efforts. With support from the local community, cooperative extension agents, Denver Service Center, the Olmsted Center for Landscape Preservation and the WASO Park Cultural Landscapes Program, the park will begin implementation of the pilot in Fall 2021. It involves clearing and grubbing, regrading to correct surface irrigation issues, adding organic matter, establishing an orchard floor ground cover, and planting 75 trees that are historically compatible and suitable for the U-Pick operation. We'll share future updates on the pilot replanting, and the future rehabilitation plan. Fritz can be reached at Fritz_Maslan@nps.gov.



One of many products from the condition assessment is this map of the entire orchard system showing tree condition. At this scale, Jackson orchard is legible as having the best condition, while Mott has the worst (NPS/CARE, 2020).

DNA Testing Fruit Trees

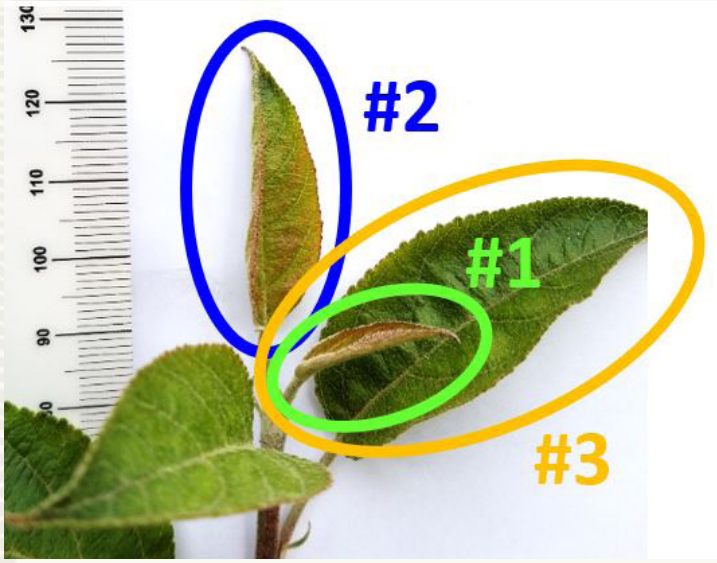
DNA testing is the most accurate method for identifying fruit tree varieties and is available by credit card purchase. A variety is a cultivated selection of a species, such as 'Red Delicious' for apple and 'Bartlett' for pear. Cultivar fruit trees are propagated through cuttings and grafted onto rootstock. As such, the upper portion of all trees of one cultivar is genetically identical. About 125 national parks contain old fruit trees, but many have not been evaluated as cultural resources. Knowing the variety can help us understand the history and significance of a fruit tree and its cultural landscape, and how we should manage the tree in the future.

In the US history of orchard fruit growing, varieties have come and gone over time. Thousands of varieties have become extinct through lack of propagation, and sometimes national parks are the last reserves of heirloom varieties as historic, living specimens. Multiple organizations share the NPS' interest in historic fruit trees and heirloom varieties, including the US Department of Agriculture's Agricultural Research Service, the North American Fruit Explorers, and regional groups such as the Home Orchard Society and California Rare Fruit Growers.

Tom Brown of Clemmons, NC, with some of the heirloom varieties he's collected since 1999 (photo courtesy of applesearch.org).

If your park has old fruit trees, we encourage you to find out whether they're already identified and documented in a Cultural Landscape Inventory (CLI) or a Cultural Landscape Report (CLR). Contact your park Cultural Resources Manager or your Regional CLI Coordinator for help finding existing documentation or obtaining new documentation for potentially historic trees.

DNA testing is available through various organizations. For apple variety testing, contact Cameron Peace (cpeace@wsu.edu) at Washington State University Horticulture Department. Cameron and his colleagues accept credit card payments, and currently charge $126/sample. For stone fruit varieties–olive, peach, apricot, almond, cherry, plum–and also pear, contact Jerry Dangl (gsdangl@ucdavis.edu) at Foundation Plant Services at University of California, Davis. The cost is $265/sample. For a large number of samples, a CESU Task Agreement should be used rather than a credit card. Contact us for guidance on preparing a CESU TA.



Preferred leaves for DNA testing. Testing sample should contain up to three "#1" leaves. Ruler is in millimeters (photo courtesy of WSU).

Young leaves are used for testing, as they yield high quality DNA. These can be collected between spring and mid-summer. The photo shows the best leaves for DNA testing in priority order. One sample consists of approximately three leaves, and three young, tender "#1" leaves are preferred. After collecting, the leaves are placed in a Ziploc bag with a moist towel, labeled, and shipped overnight to the lab. Before mailing, the leaves can be stored in a refrigerator for several days. Use an identification number to label samples that matches a metal tree label and GIS metadata.

DNA testing can shed light on more than just the variety. It can help us date the period of the fruit tree, its genetic parentage, its kinship to other trees in the orchard or park, the historic use of the orchard and the cultural heritage of the people that planted the tree. New research is also revealing that different fruit varieties of the same species vary considerably in their nutritional value. All of this information can enrich interpretive programs as well as inform facility and resources management.

Employee Spotlight

Michelle Richardson working in the canopy at CARI (NPS photo).

Name: Michelle Richardson
Position: Maintenance Worker
Park: Cane River Creole National Historical Park in Natchitoches, LA

How long have you worked for the NPS? I started working seasonally in 2013 and took a permanent position in 2017

What is your background? My work background is in construction but, when I left that field and took a job at a small family orchard for a year, I found that I had a previously unknown love for trees. My new interest was furthered when I took a seasonal position on trails in Great Smoky Mountains NP. Having grown up in the inner city of Chicago, I was being exposed to new species and varieties of trees and plants on every trail and my appetite for knowing the life surrounding me grew. Later, when I moved to Louisiana, I had a difficult time adjusting and making this place home. I decided to use my interest in trees and vegetation to connect with the land and hoped, in turn, to connect with the culture and the people. As it turns out, one is not separate from the other, so that plan worked. I'm now in the Arborist Training Program working towards becoming a Consulting Arborist with intentions of going as far as I can in this field.

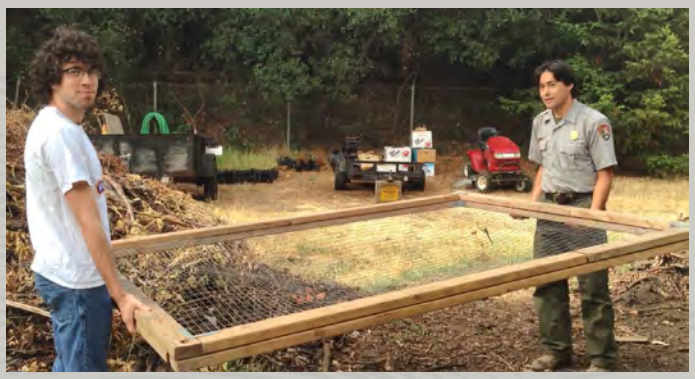
What is your favorite maintenance task? I DO love a good 10-hour day of mowing, however, nothing beats working on an individual tree for me. Whether I'm up in the crown pruning or weeding around the base, if I can walk away feeling that I've left that tree with a better future, I'm gratified.

What was the most inspiring project you have worked on? I had the good fortune of being assigned to work with a couple of members of the Arborist Incident Response Team on a tree pruning project that focused on our live oaks. The work was immensely satisfying, I learned many new skills and techniques, daily repetition helped to improve my aerial lift, chainsaw and tractor operations and it opened the door for me to join the AIR Team as ground support and equipment operator on projects at other parks from Statue of Liberty to Channel Islands. That initial two-week project on a dozen live oaks has been the foundation for meeting a network of amazing mentors, improving myself through knowledge and gained experience and sparked my decision to apply for the Arborist Training Program. In short, I believe it may have changed the trajectory of my career.

What inspired your interest in cultural landscapes/historic sites? I've always had an interest in history. That the park nearest where my husband and I settled is an historical park with an interesting cultural landscape is coincidental and very convenient.

Richardson in the field at CARI (NPS photo).

Tool of the Moment: DIY Compost Screen



Large compost screen fabricated at JOMU (NPS photo).

At John Muir National Historic Site (JOMU), we compost all of our green waste on site in large piles that are turned by a tractor and irrigated by a sprinkler. Often our compost retains many larger un-decomposed plant parts that need to be separated from the compost manually or mechanically before being spread throughout the orchards and grounds.

During the summer of 2011 our Youth Conservation Corps (YCC) helped create a large mesh screen for sifting out the woody chunks and other debris from our compost. Ten years later that same screen is still in service! The following lessons learned may help other parks create their own compost screen.

Plant material decomposition is a natural process that requires moisture, oxygen, insects, microbes, and time. Composting is the art of accelerating decomposition under controlled conditions. However, not all compost is created equally. Under optimal conditions it is possible to compost plant materials very quickly (weeks or months, rather than years under natural conditions) into a light, tilthy texture that resembles potting soil. But when a compost pile is not watered or aerated frequently, the decomposition process happens at a much slower rate.

The concept for the JOMU compost screen originated from gardens and nurseries I'd seen that use a screen to fit over a wheelbarrow for moving compost. Scaling this up to the size of a truck bed was easy to do and could be accomplished with relatively few materials and at low cost (see materials list). Our prototype was originally designed to be placed over an 8-foot-long truck bed, so that compost could be scooped by a tractor bucket, placed on the screen, and sifted into the bed of the truck for transport. As our fleet of trucks has changed so has the bed size, yet the screen still works for our new shorter (6-foot long) bed, we just turn the screen sideways to provide the most stability.

A front-end loader drops coarse organic material onto a large screen that is designed to fit over a truck bed (NPS photo).

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Volunteers and staff manually sift the organic material (NPS photo).

After sifting, fine organic material falls through the screen and into the truck bed for use as nutrient-rich compost (NPS photo).

Screen construction:

Construction of the compost screen was straightforward and the only material that took time to procure was the welded wire. We chose a 1x2-inch welded wire mesh screen, as it was durable and could withstand the weight of a bucket-full or two of compost, yet would still allow the compost to fall through with relative ease. This size mesh has worked well for our needs in the orchards, but it still lets some chunky material through. If finer screening is desired for a more ornamental application, consider a 1x1-inch mesh. However, the smaller the mesh, the slower the sifting process.

A bottom frame was constructed out of 2x4 lumber sized to match the truck's bed, then the wire mesh was laid atop the frame. A second top 2x4 frame was placed atop the mesh and screwed down to sandwich the mesh between the two frames. Lag screws were used that were long enough to penetrate the bottom frame but not long enough to protrude out and become a hazard. Bolts could also be used if the bolt head and nut are recessed into the 2x4 frames. Be sure to capture the welded wire mesh with the screws so that it does not pull out from the frames. Lastly, metal braces were added to the inside frame corners for added rigidity.

The frame has served us well and provides an excellent opportunity for our YCC cohorts to help sift and distribute compost while learning about the natural processes of decomposition and how to accelerate composting. Early on, we explored several methods to speed the sifting process: we considered driving the truck back and forth and hitting the brakes (it didn't work); we also considered putting metal pipes between the truck and frame to roll or jostle the compost through (it didn't work either). Ultimately, we settled on just sifting manually with gloved hands and or square-point shovels. When all the smaller compost has been sifted into the truck bed, the larger pieces left are simply dumped onto a second compost pile for additional decomposition, so nothing is wasted.

Sifting compost using our home-made compost screen has become an unexpectedly fun and educational hands-on group activity for the YCC, volunteers, and staff. This tool enables us to spread greater quantities of compost throughout our landscape and back around the same trees from which the raw materials came, completing a cycle that returns valuable nutrients to the soil for plant uptake.

Large organic material is returned to the compost pile for further decomposition (NPS photo).

Materials List:

» Welded wire screen (1x2 inch, or 1x1 inch if finer screening is desired)

» 2x4 lumber (Long enough for the frame to rest securely on four sides of the truck bed, including the tailgate)

» Metal corner braces or similar hardware for structural rigidity

» Lag screws or lag bolts (3/8" x 3" minimum, or as long as needed)

Video Corner

Soil Excavation and Aeration with an AirSpade®

Do you have historic trees suffering from soil compaction in your park? This is more common than you might think. Check out this instructional video on air spading to learn how to identify soil compaction, plan an air spading project, and extend the life of historic trees in national park cultural landscapes.

This video is part of the Trades Alive! Historic Preservation Video Series on the Common Learning Portal and can also be found on the Park Cultural Landscapes Program YouTube channel as part of the Horticulture Tools and Techniques Video Series.

Upcoming Training Opportunities

Rehabilitative Pruning
University of Washington Botanic Gardens
Professional Horticulture Series
Virtual, Aug. 19, 12:30 PT, 2 hrs

Plant CSI: What's Wrong with my Apple Tree?
University of Washington Botanic Gardens
Professional Horticulture Series
Virtual, Aug. 26, 12:30 PT, 1 hr 45 min

Plant CSI: What's Wrong with my Conifer?
University of Washington Botanic Gardens
Professional Horticulture Series
Virtual, Nov. 4, 9:00 PT, 2 hrs

Urban Forestry: Basic Training Workshop
Morton Arboretum and Chicago Region Trees Initiative
In-person, Sept. 1, 8:30-3:15 CT; Sept. 2 8:30-1:30 CT

Announcements & Publications

» US/ICOMOS recorded webinars. Catch up with the latest presentations on world heritage.

» Preservation Matters: Landscape Maintenance - Protecting Historic Trees During Construction. From the National Center for Preservation Technology and Training (NCPTT).