Workshops

Emily Beckman Bruns,[1*] Tony Gurnoe,[2] Patrick Thompson,[3] Amy Byrne,[1] Sean Hoban,[1] Silvia Alvarez-Clare,[1] Abby Meyer,[4] and Murphy Westwood[1]

Exploring a Conservation Gap Analysis Methodology: Overview of Our Progress and a Space for Adaptation and Application

1. The Morton Arboretum, Lisle, IL, USA / 2. San Diego Botanic Garden, Encinitas, CA, USA / Donald E. Davis Arboretum, Auburn, AL, USA / Botanic Gardens Conservation International-US (BGCI-US), Huntington Botanical Gardens, CA, USA/ * corresponding author: *ebeckman@mortonarb.org*

Resources, be it funding or specialized support, available for conservation efforts are often not sufficient for the actions required. Therefore, prioritization helps identify species, populations, and ecosystems most in need. For seven years, The Morton Arboretum has been exploring prioritization for conservation, using *Quercus* and other important tree genera. The *Conservation Gap Analysis of Native U.S. Oaks** presented results and conservation recommendations for 28 species of conservation concern, as well as a methodology that can be used by others.

Photo 1/ The Conservation Gap Analysis of Native U.S. Oaks (Beckman et al., 2019) helped inform San Diego Botanic Garden's collecting efforts for *Quercus cedrosensis*.

This workshop provided an opportunity for IOS members with varying levels of experience with gap analyses to 1) become familiar with (a) the purpose of a conservation gap analysis, (b) the components of the *Conservation Gap Analysis of Native U.S. Oaks*, (c) our continuing gap analyses for oaks and other genera, and (d) ways the methodology may be developed further (presentation by Emily Beckman Bruns); 2) hear examples

of how the oak gap analysis informed targeted conservation efforts for *Q. cedrosensis* (presentation by Tony Gurnoe) and *Q. boyntonii* (presentation by Patrick Thompson); and 3) participate in a discussion to direct future development and use of our conservation gap analysis methodology. Discussion topics included the most and least useful aspects of the gap analysis process or outputs, and preferred ways to interact with the gap analysis process and results. Everyone contributed useful ideas, even participants with very little prior gap analysis experience. Areas of future work include: comparing the geographic gap analysis method to real genetic data, creating software tools, increasing stakeholder involvement, and assessing duplication of accessions across gardens. We thank all participants for their energy and ideas, and hope future conservation gap analyses can further benefit the community.

* Beckman, E., A. Meyer, A. Denvir, D. Gill, G. Man, D. Pivorunas, K. Shaw, and M. Westwood. 2019. *Conservation Gap Analysis of Native U.S. Oaks*. Lisle, IL: The Morton Arboretum

Acknowledgments/ Funding was provided by the Institute of Museum and Library Services (award #MA-30-18-0273-18) and the USDA Forest Service (Cooperative Agreement 16-CA-11132546-045)

Hendrik Brand

The Use of Acorns as a Staple Part of Our Diet

hendrikbrand@gmx.com

This workshop focused on how to use acorns as modern food. Traditional acorn mush or crumbly bread is not appealing to many people, but there are various ways of using acorn flour to prepare dishes we are familiar with such as cornflakes, zaatar flatbread, steamed muffins, tortillas, noodles and pizza. Preparing these dishes with acorn flour rather than with grain flour requires different techniques. Lacking in gluten, acorn flour does not have the elasticity of wheat flour, so, for example, a pizza base has to be pre-baked, as do noodles or pasta.

The workshop focused only on the preparation of food with ready-to-be-used acorn flour, and did not include a demonstration of leaching acorns to remove the tannins that make them bitter. The flour, made from *Quercus rotundifolia* and *Q. suber* acorns, came from Portugal, and acorn starch from Korea was on display as an example of acorn products available on the market.

The dishes prepared during the workshop necessitated the use of a tortilla press, an electric tortilla baker, as well as a rice cooker with a steamer element. During the preparation of the individual dishes, participants had a close look at each step to evaluate the properties of the acorn flour and how to work with it. When the food was ready, it was tasted by the participants and evaluations were exchanged.

Basic acorn-flour dough recipe

Ingredients

50 g (1/2 cup) acorn flour (the exact quantity needed to form a non-sticky dough that can be rolled may vary according to the acorns used to make the flour)

2 tbsp. water

1/4 tsp. baking powder

Pinch of salt

Method

Combine all the ingredients and knead the dough to form a smooth ball. Leave to rest for 10 minutes, covered in a cool place. Pat the dough into a flat disk on a flour-dusted sheet of baking paper.

For pizza

Roll out the dough to a thickness of 3 mm (1/8 in). Bake in a preheated oven at 160 °C (320 °F) for 5 minutes. Remove from the oven and add the toppings. Return to the oven for 10 minutes.

Photo 2/ Pizza with an acorn-flour crust.

For flatbread:

Roll out the dough to a thickness of 3 mm (1/8 in). Bake in a preheated oven at 160 °C (320 °F) for 10 minutes.

For two large tortillas:

Split the dough in half before rolling out to the desired thickness.

For a zaatar flatbread:

Roll out the dough to a thickness of 3 mm (1/8 in). Bake in a preheated oven at 160 °C (320 °F) for 5 minutes. Mix 1.5 tbsp. of olive oil with 2 tsp. of zaatar. Remove from the oven, brush the mixture onto the flatbread and return to the oven for 3 minutes.

For acorn flakes:

Roll the dough out very thinly. Cut into squares. Bake in a preheated oven at 160 °C (320 °F) for 7 minutes.

For noodles:

Omit the baking powder when preparing the dough. Roll the dough out to a thickness of approx. 1 mm (1/16 in). Cut into thin strips with a knife or tagliatelle cutter. Bake in a preheated oven at 160 °C (320 °F) for 5 minutes. For *al dente* noodles, boil for 7 minutes.

Emily Griswold,[1] Murphy Westwood,[2] and Amy Byrne[3]

Climate Adaptation Planning for Your Oak Collection

1. UC Davis Arboretum and Public Garden, Davis, CA, USA / *ebgriswold@ucdavis.edu* / 2. The Morton Arboretum, Lisle, IL, USA / *mwestwood@mortonarb.org* / 3. The Morton Arboretum, Lisle, IL, USA / *abyrne@mortonarb.org*

Climate change poses unprecedented challenges to managing a collection of trees in the 21st century. With global temperatures on the rise, we are encountering new stressors and disturbances that affect our ability to grow diverse oak collections. Examples include drought and water scarcity, increased pest and disease pressures, wildfire and smoke, and increased storm severity. Climate adaptation planning is a process of adjustment to the impacts of climate change; this includes identifying actions to reduce negative impacts and to take advantage of emerging opportunities.

Workshop participants were introduced to a five-step climate adaptation planning framework developed by the USDA Forest Service Northern Research Station.* This framework is the basis for a new toolkit intended to help plan for climate adaptation in public gardens that is being co-created by North American public gardens in collaboration with the USDA California Climate Hub. Workshop participants used custom worksheets to go through the process of identifying management goals, assessing climate impacts, evaluating risk, and identifying and prioritizing adaptation tactics to ensure the long-term health and resiliency of their oak collections. Four breakout groups were clustered by geographic region and climate type to discuss the climate adaptation process and region-specific threats, risks, and solutions.

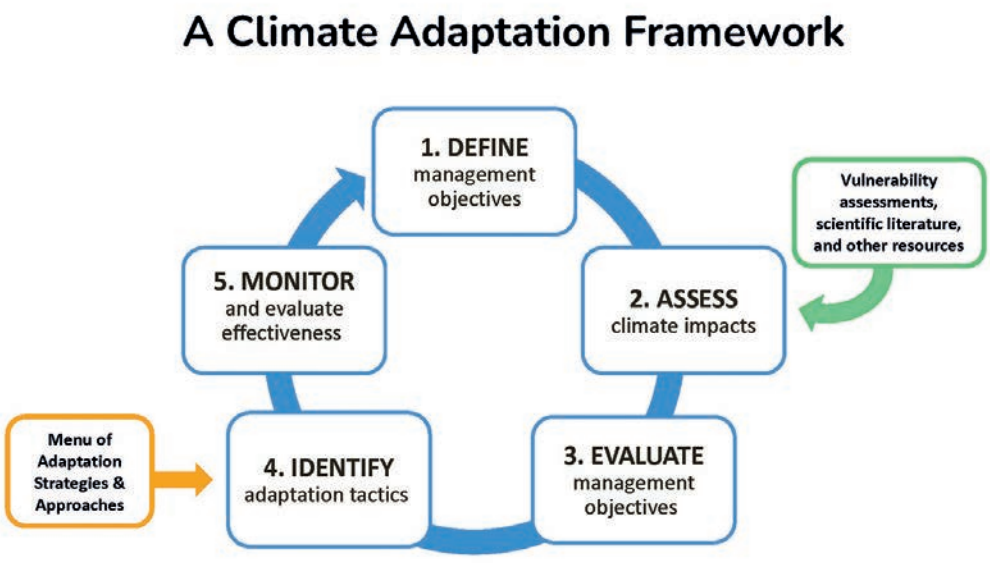


Figure 1/ Based on the Adaptation Workbook process developed by Swanston et al. (2016)

Several networks, tools, and resources are emerging to support climate adaptation planning for public gardens and tree collections. The Climate Change Alliance of Botanic Gardens is a worldwide network founded by the Royal Botanic Gardens Victoria,

Melbourne Gardens that has been actively developing tools for climate adaptation. The Global Conservation Consortium for Oak (GCCO) is another network that focuses on the conservation of oak diversity in climate-resilient ex-situ metacollections (coordinated collections distributed over multiple sites). Participants left the workshop with new tools and approaches for preparing their oak collection for climate change, and an expanded network of peers to support this effort.

* Swanston, C.W., M.K. Janowiak, L.A. Brandt, P.R. Butler, S.D. Handler, P.D. Shannon, A. Derby Lewis, et al. 2016. *Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd ed. Gen. Tech. Rep. NRS-GTR-87-2*. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. https://doi.org/10.2737/NRS-GTR-87-2

Chuck Cannon,[1*] Oliver Brendel,[2] Keiko Kitamura,[3] and M. Isabel Loza[1,4]

Evolution and Adaptation of Fagaceae and Nothofagaceae

1. Center for Tree Science, The Morton Arboretum, Lisle, IL, USA / 2. INRA, UMR 1137 "Ecologie et Ecophysiologie Forestières", Champenoux, France / 3. Hokkaido Research Centre Forestry and Forest Products Research Institute, Hokkaido, Japan / 4. Global Tree Conservation Program, The Morton Arboretum, Lisle, IL, USA / *corresponding author: *ccannon@mortonarb.org*

The International Union of Forest Research Organization's (IUFRO) working group on the "Evolution and Adaptation of the Fagaceae and Nothofagaceae" holds virtual, international meetings with experts across the globe. We strongly encourage students and early-stage professionals to participate. We thank the International Oak Society for their support and for allowing us to hold our meeting during the 10th International Oak Society Conference.

Photo 3/ *Notholithocarpus densiflorus* var. *densiflorus*

While *Quercus* may be the most well-known genus in the family Fagaceae, other genera, like *Lithocarpus* and *Castanopsis*, contribute substantial diversity and ecosystem services in tropical Asian forests. In the family Nothofagaceae, the genus *Nothofagus* (southern beech) is widely distributed in South American and Australasian forests. Our group strives to understand the ecological and evolutionary processes that drive diversification and adaptation in these two important families and how this understanding can serve applied conservation initiatives.

During this meeting, four

researchers contributed work on Fagaceae.

Austin Koontz (The Morton Arboretum, USA) quantified the effectiveness of different genetic markers in capturing important conservation metrics, particularly for rare wild alleles. Different interpretations emerge from different markers and the conservation of rare alleles requires collecting from many individuals.

Nelly Pacheco (UNAM, Mexico) uses *Q. macdougallii* as a study species because of its low genomic but high allelic diversity. Unique alleles may provide an advantage in coping with a changing environment.

Domitille Coq-Etchegaray (Université de Bordeaux, France) presented her research on the genetic architecture of leaf-specialized metabolites in *Q. petraea*, suggesting that specialized metabolites are not locally adapted.

Chuck Cannon (The Morton Arboretum, USA) presented initial results from comparative analysis of the *Notholithocarpus densiflorus* (tanoak) genome and how this relates to genomic diversity in species-poor, narrowly distributed, endemic lineages (*Notholithocarpus*), and species-rich, broadly distributed lineages (*Quercus*), especially in relation to resistance to sudden oak death.

Together, these advances point towards a better understanding of the evolution of Fagaceae and their long-term management and conservation.

Maricela Rodríguez-Acosta[1] and Amy Byrne[2]

BGCI's Global Conservation Consortium for Oak (GCCO); efforts in Mexico and Central America

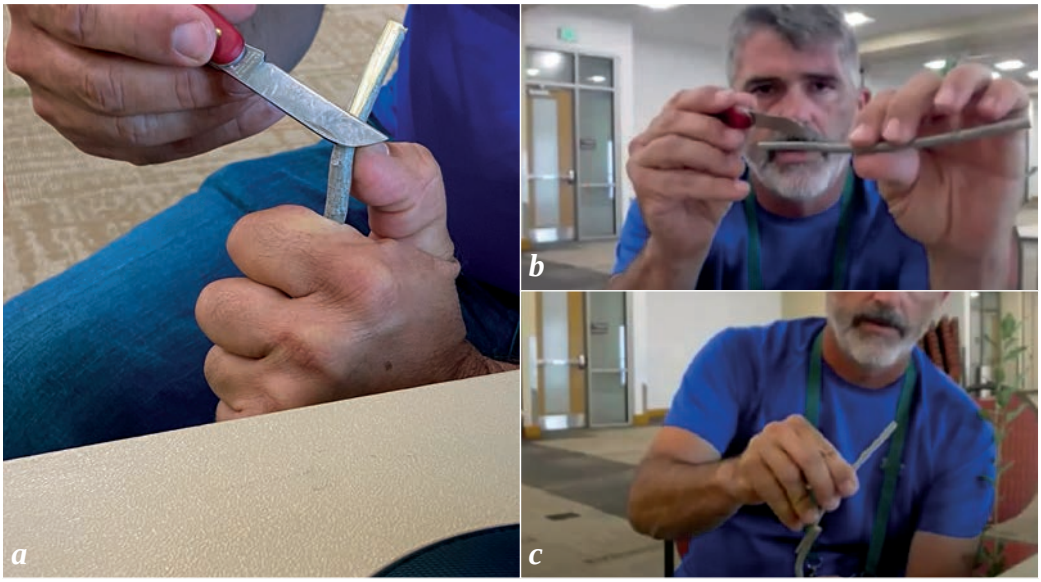
1. GCCO-Mexico and Central America Coordinator / *maricelarac@gmail.com* / 2. GCCO-US Coordinator, The Morton Arboretum, Lisle, IL, USA

During the 10th International Oak Society Conference in New Mexico, the Global Conservation Consortium for Oak (GCCO), led by The Morton Arboretum (Illinois), provided a workshop to share tools and information with our Latin American members and strengthen collaboration between US and Mexican/Central American partners. The workshop was given in Spanish and English, so all our members could have a good understanding of the process. The main points of the workshop were to:

- demonstrate propagation techniques for commercial purposes;
- encourage commercial oak propagation in Tropical America;
- increase participation in the stewardship of priority oak species;
- demonstrate oak grafting; and,
- explain how to become a Species Steward, a role within the GCCO.

Over 60 people were in attendance and many were interested in learning about oak propagation through grafting, a highly skilled technique used to propagate priority species when plant material is scarce. Many questions were asked about the tools used and where one could purchase them. It was pointed out that a key factor in successful grafting is choosing the correct material from the mother plant.

Equally, many participants were interested in becoming a Species Steward, showing their enthusiasm in the discussions throughout the presentation as well as with



Photos 4/ Ryan Russell demonstrating (a) the angle the knife is held at and explaining the advantage of a longer cut; (b) how to align the cambium layer with the scion; (c) a test fit to show how the whip and tongue method holds the pieces together firmly.

the questions posed at the end of the workshop.

We hope to organize more workshops with the purpose of encouraging the vegetative propagation of oaks.

Photographers. Title page: Alexis Ducousso (*Quercus petraea*). Photo 1: Tony Gurnoe. Photo 2: Hendrik Brand. Photo 3: Guy Sternberg. Photos 4a-c: Amy Byrne.