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Chestnut

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PART 1
OF A
2-PART SERIES

Natural Range

OF THE AMERICAN CHESTNUT

By Sara Fitzsimmons, TACF Director of Restoration

During a career with the U.S. Forest Service (USFS) that spanned 34 years, Elbert Luther Little, Jr. was the chief dendrologist from 1967 – 1975. During that time, he published a six-volume series which would become the standard for range maps for tree species in the United States. Volume 4 contains the range map for *Castanea dentata* (Little 1977), a map which TACF uses regularly to illustrate the native range of the species (**Figure 1**).

The first published range map for American chestnut appears to be from Sargent in 1884 (**Figure 2**). Sargent was the first director of Harvard University's Arnold Arboretum, and his name can be seen often in historical botanical records in the mid- to late-1800s. In Sargent's map, there are a few things to note. First is that the U.S. species of *Castanea* are combined into a single map, and there is not a separate listing of *C. ozarkensis* in the list of trees and their ranges. Here are some excerpts from the text of that publication, outlining the ranges of the two listed species.

Sargent 1884, Pages 156-157:

Castanea pumila, Miller
Lancaster County, Pennsylvania, and the valley of the lower Wabash river, Indiana, south and southwest to northern Florida and the valley of the Neches River, Texas.

Castanea vulgaris, var. Americana, A. De Candolle, Southern Maine to the valley of the Winooski river, Vermont, southern Ontario and southern Michigan, south through the northern states to Delaware and southern Indiana, and along the Alleghany mountains to northern

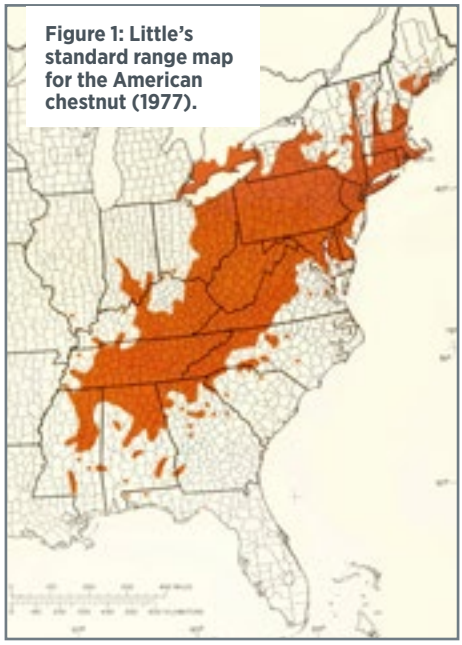

Figure 1: Little's standard range map for the American chestnut (1977).

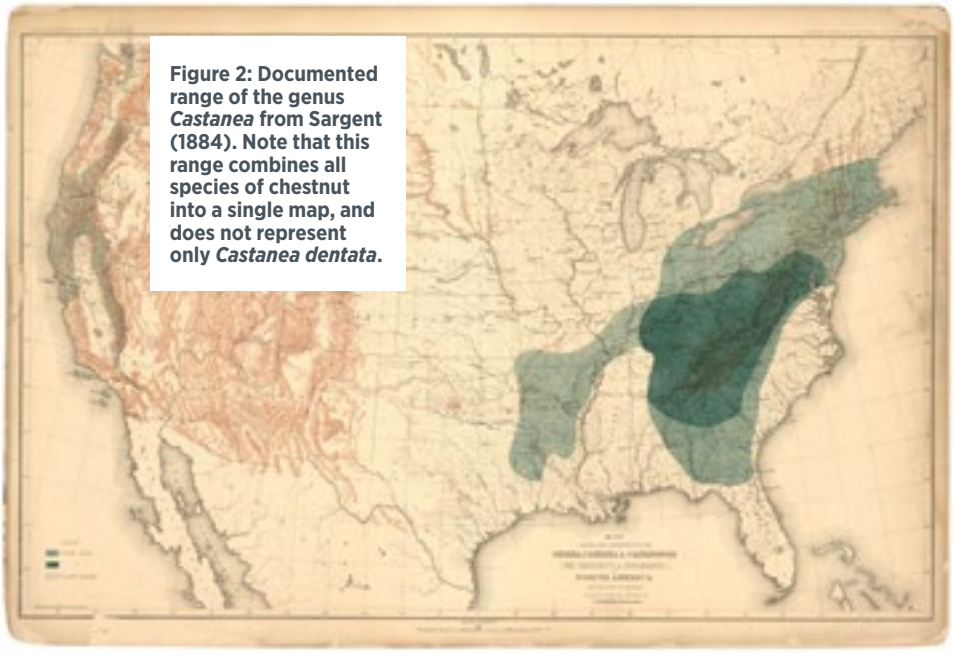

Figure 2: Documented range of the genus *Castanea* from Sargent (1884). Note that this range combines all species of chestnut into a single map, and does not represent only *Castanea dentata*.

Alabama, extending west to middle Kentucky and Tennessee.

Similarly, in **Figure 2**, notice the straight line drawn along the 44th parallel at the northern edge of the range. According to Little (1951), those who worked on these range maps often used geographic limitations to draw boundaries.

Following the publications of maps and a census of forests in the U.S. by Sargent in 1884, then Chief Dendrologist for the USFS, George Bishop Sudworth embarked on updating the maps and range information. Sudworth and his team of W. H. Lamb, Georgia E. Wharton, and Mary C. Gannett, surveyed lands on mule (**Figure 3**), used locations of herbarium specimens, and talked with foresters in every state to mark known locations of tree species on maps in their offices at the USFS Section of Forest Distribution (1951). In a 1916 issue of the *Journal of the New York Botanical Garden*, there is a note stating:

"Miss Georgia Wharton, of the branch of research, Forest Service,

Figure 3: Sudworth and assistant on mules in Hassic Meadow, Middle Tule, Sierra Forest Reserve, 1901. Photo courtesy of Forest History Society, Durham, NC.

Figure 4: Digitization of map created by Sudworth and his team through the early 1900s to document the range of American chestnut. (uwdc.library.wisc.edu/collections/econatres/fplatlas/)

Washington, has been at the Garden examining specimens in the herbarium for data to be used in compiling maps of tree species; and in the preparation of a check list of West Indian trees and important shrubs."

Unfortunately, these maps were never formally published and were used only in text publications from the USFS, one published in 1898 and then in 1927. Excerpts below:

Sudworth's Checklist of the Forest Trees of the United States 1898:

Range. *From southern Maine to northwestern Vermont (Winooski River), southern Ontario, and southern shores of Lake Ontario to southeastern Michigan; southward to Delaware and southeastern Indiana, and on the Allegheny Mountains to central Kentucky and Tennessee, central Alabama, and Mississippi.*

Sudworth's Checklist of the Forest Trees of the United States 1927:

Range. *From southern Maine to northwestern Vermont (Winooski River), Southern Ontario, and southern shores of Lake Ontario to southern Michigan; southward to Delaware and Ohio, southern Indiana and Illinois (Pulaski County), and on the Appalachian Mountains to central Kentucky and Tennessee, northern Georgia, western Florida, central Alabama, and Mississippi.*

Recently, those maps were unearthed and digitized by the University of Wisconsin as part of a larger compilation called, "Forest Atlas of the National Forests of the United States" (**Figure 4**).

One of the more interesting details in the maps digitized from the Sudworth expeditions is the deliberate removal of American chestnut from higher elevation areas in West Virginia, Virginia, and western North Carolina. While chestnut is typically not found on these balds or areas dominated primarily by fir and spruce, there are no similar omissions of the range in locations also unlikely to support American chestnut, such as larger swaths throughout the Adirondacks or large wetland or urban areas.

In 1938, Edward Munns, Chief within the USFS Division of Forest Influences used the maps and findings from Sudworth's expeditions in his publications (**Figure 5**). One can see the similar removal of high elevation areas from Munns' maps.

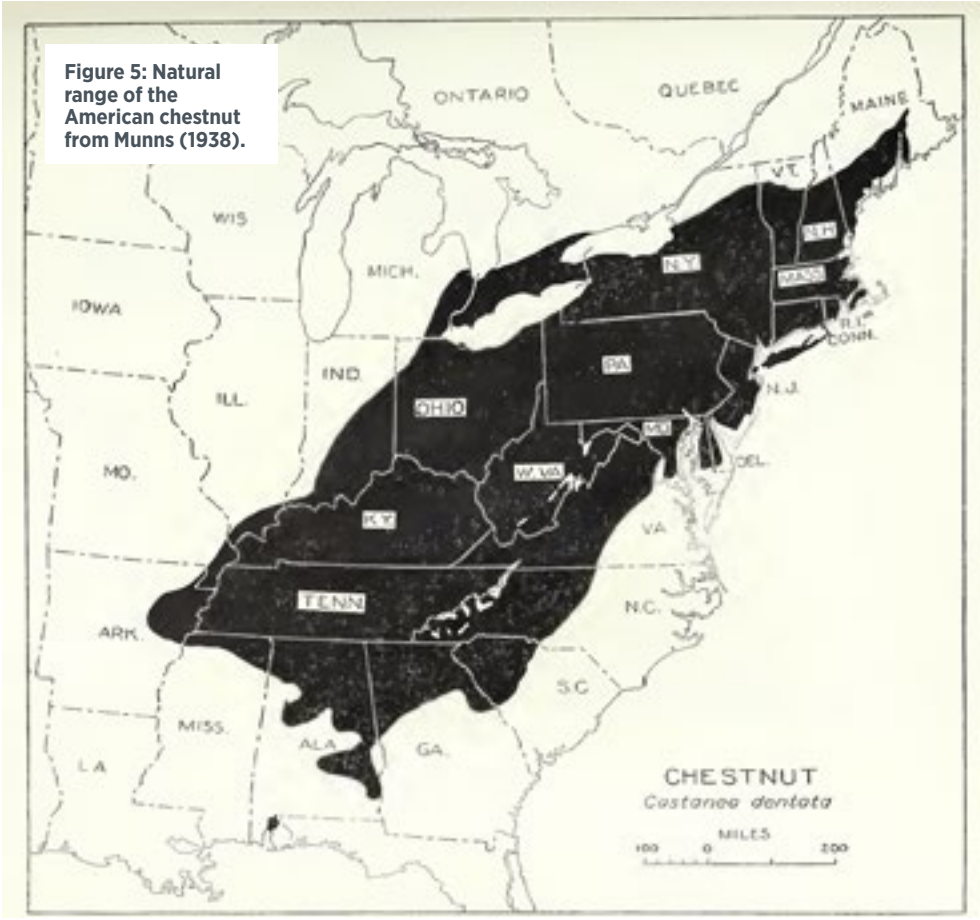

Figure 5: Natural range of the American chestnut from Munns (1938).

Munns' publication was one of "Important Forest Trees." By 1977, the American chestnut had been downgraded, as Little didn't publish its range map until Volume 4 of his maps titled, "Minor Eastern Hardwoods." Little's range maps from the 1970s have largely become the standard when discussing natural ranges for tree species in the United States, but still isn't without its flaws. In his introductions to the volumes of his Atlas, Little noted that there would be mistakes and that these ranges would likely shift over time.

These maps all showcase efforts to document native ranges for the use by natural resource professionals and enthusiasts, but also illustrate the difficulty in embarking on such a mission. This article, the first in a two-part series, serves largely to showcase the beauty of these historical maps and show the groundwork created for subsequent mapping efforts. In Part II, the focus will document the challenges associated with creating these maps and will showcase a more modern look at the range of American chestnut.

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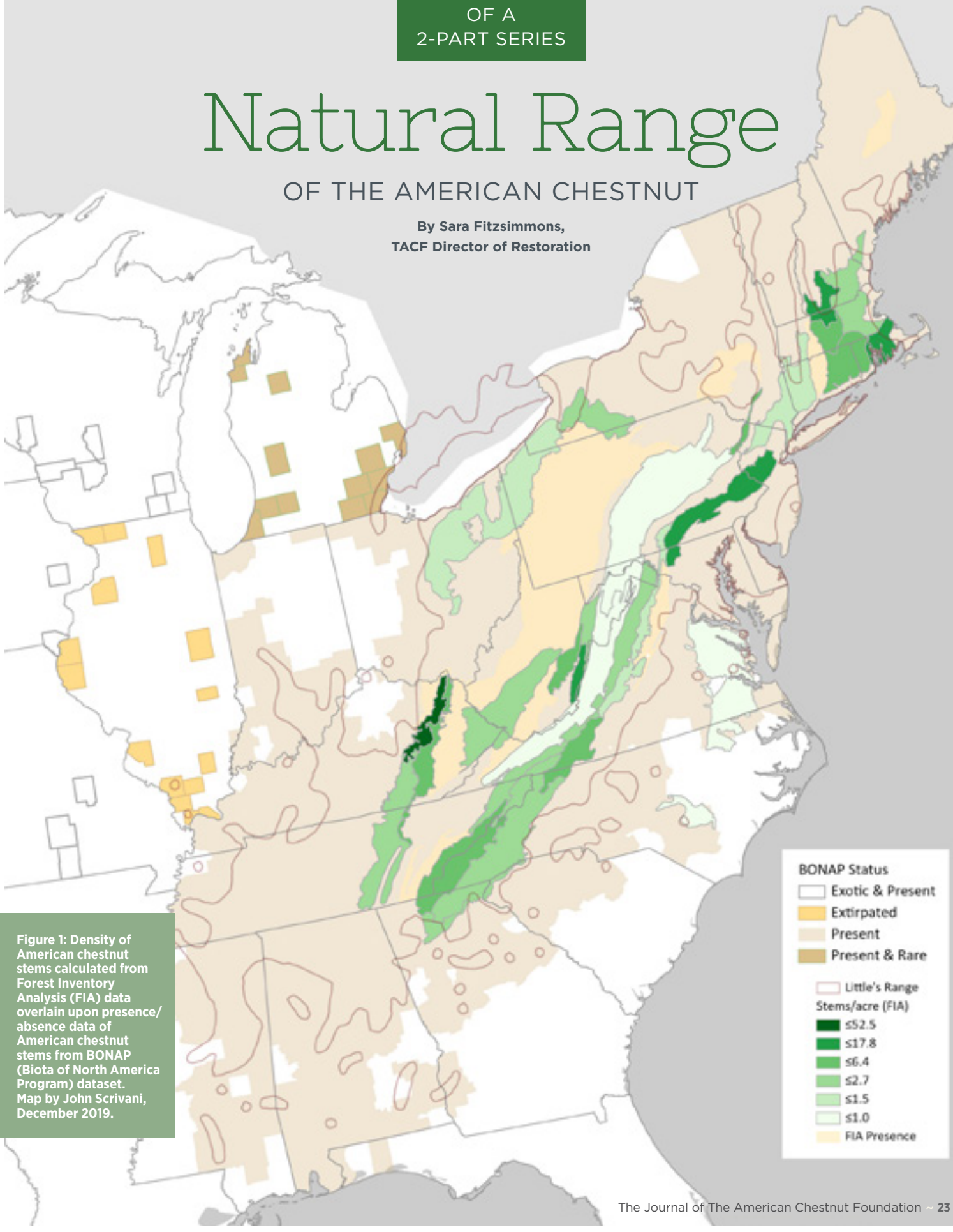

Figure 1: Density of American chestnut stems calculated from Forest Inventory Analysis (FIA) data overlain upon presence/absence data of American chestnut stems from BONAP (Biota of North America Program) dataset. Map by John Scrivani, December 2019.

The mission of The American Chestnut Foundation (TACF) "is to return the iconic American chestnut to its native range." I've spoken with several members regarding their skepticism at the validity of Little's range map, some issues of which he notes in his own writing regarding those maps (Little 1951). Those issues can have significant repercussions, which brings me to the primary reason of embarking on these articles: to where do we restore the American chestnut?

Figure 2: This photo was taken in the West Salem stand during TACF's 2002 Annual Fall Meeting in WI. (L-R) Former president and CEO, Marshall Case; former board member, Cameron Gundersen; and a meeting participant who lived in the area.

Looking at **Figure 1** on the previous page, if we use only Little's map to strictly delineate that range, there are several areas where American chestnuts are currently or have historically been found which would be excluded from consideration. For the most part, these eliminated areas are on the outskirts of the range.

The edges and extremes of species' ranges are notoriously difficult to document. One of TACF's members, Roger Willby, splits his time between Maine and Georgia. To the south, Little's map omits potentially important locations for restoration such as the greater Atlanta metropolitan area. Up north, it eliminates central Maine, where several known populations of American chestnut are thriving.

Brian Smith of the VA-TACF Chapter has sleuthed many herbaria of Virginia, West Virginia, and surrounding states looking for historical records of American chestnut in the tidewaters of Virginia. He first found incidences of these trees at the herbarium of his alma mater, Longwood University, which showed instances of American chestnut not covered by Little's range map (Cope 2015).

Looking again at Little's outline in **Figure 1**, there are dozens of disjunct pockets of American chestnut populations through the southeastern U.S. These pockets most likely arise due to the species being largely eliminated from the region by *Phytophthora cinnamomi* (Crandall, Gravatt, and Ryan 1945; Russell 1987), also known as ink rot disease or Phytophthora root rot (PRR). While Little's outline has these pockets, the extrapolated Forest Inventory and Analysis (FIA) densities show low but consistent populations across the area. PRR still exists in large swaths of the southeastern U.S. and will hinder establishment of restoration populations.

Moving westward, there are large regions within the Little boundary, but in which FIA data show no occurrence. For close to 30 years, the IN-TACF Chapter has looked far and wide for American chestnut stems throughout southern Indiana, but few to none have been found. They certainly were there, as documented by Weir (1916). American chestnut reached its prominence in 15 counties of southeastern Indiana, and was present in another seven.

Today in Indiana, most American chestnut populations are found in the north and those southern populations have all but disappeared. Weir (1916) suggests northern incidences of American chestnut were planted, but founding IN-TACF Chapter president Bruce Wakeland suggests otherwise. Wakeland was northern Indiana's first consulting forester, and sees how well American chestnuts grow in northern Indiana (Wakeland 2019). He hypothesizes that the vast Kankakee Marsh kept surveyors from finding pockets of American chestnut further north along the Valparaiso Moraine, home to several known stands of the species today.

Some of the largest trees studied by TACF and other researchers were planted in Michigan and at the West Salem stand (**Figure 2**) in southwestern Wisconsin. The largest American chestnut trees in the United States are in the west coast (Gillis 2017), far from what would likely be considered the native range of this species and known to be planted. What role, if any, would these locations play in restoration?

That brings us to a big, almost philosophical question: What is a native range, anyway? Most literature limits a native range or species to geographic ranges where it was self-established, i.e. not planted. The influence of humans on distribution of American chestnut, however, cannot be denied. Russell (1987) and Ruffner (1999) suggest that trade among Native American populations contributed

to the species' spread. Most reviews of American chestnut distribution note the influence of European settlement on the species' expansion. The American chestnut was not always as widely or densely growing as it was just before the chestnut blight was introduced. Faison and Foster (2014) document how chestnut was not extensively distributed in pre-colonial times. From a study of witness tree and other documentation, 19th Century logging is likely the primary reason American chestnut reached its dominance where it did.

This brings us to another limitation of using historic or even current documentation of species to delineate the geography for restoration: the effects of climate change. Many short-lived vegetative species have already increased their northward ranges, and it is likely that American chestnut would find suitable habitat in novel locations such as the Adirondack Mountains or the Upper Peninsula of Michigan as the climate warms.

To account for those changes, a habitat suitability index can help prioritize sites for reintroduction and restoration. Through a review of 26 historical documents covering the site conditions of American chestnut literature, Irwin et al (2010) created an index of site metrics which were used to grade the suitability of

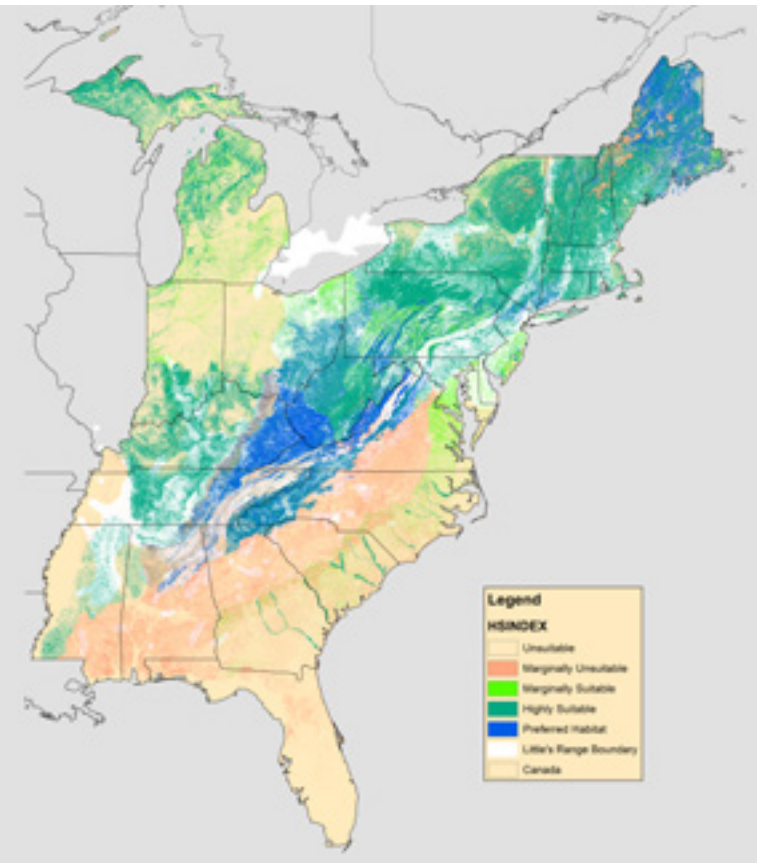

Figure 3: First approximation for suitable habitat of the American chestnut using documented preferred site parameters merged with Geographic Analysis Program (GAP) ecosystems.

Geographic Analysis Program (GAP) ecosystems in the eastern U.S., delineated through extensive geographic parameters as outlined through the U.S. Geological Survey (USGS). Based on that application of an index, there are an estimated 131 million acres of highly suitable habitat available for planting American chestnuts (**Figure 3**).

Range maps like those produced by Elbert Little are a great starting place for analysis. Little's series of maps are available for virtually every endemic species to the U.S. allowing for modelling across them all. For the purposes of American chestnut restoration, however, the Little map should not and will not be used to strictly delineate where restoration will occur.

Priority areas should be those where habitat is suitable, within or near to historically known locations of American chestnuts, and those which have knowledgeable collaborators willing to install and maintain a restoration planting. When it comes to restoration, looking back at these historic maps is the first step. To complete the analysis, we can hybridize our current knowledge, bringing in land-use history, habitat suitability, and estimates of density. As climate shifts, land use and ownership patterns change, and biotic influences transform ecological interactions, the geographic boundaries for American chestnut reintroduction and restoration will shift. For that reason, TACF and its partners should regularly evaluate and update its plans for American chestnut restoration.

ACKNOWLEDGEMENT:

For much of this article, I have referred you to Figure 1, a map created by VA-TACF Chapter member John Scrivani. He produced this map as part of an article he published with Dalgleish et al (2014) documented the current status of American chestnut in the wild. I owe many thanks to him for making his map available for reprinting and in this article.

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