REMNANT AMERICAN CHESTNUT (*CASTANEA DENTATA* (MARSH.) BORKH.; FAGACEAE) IN UPLAND FORESTS OF NORTHWESTERN NEW YORK

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Abstract

The American chestnut (*Castanea dentata* [Marsh.] Borkh.; Fagaceae) was an historically important hardwood species in eastern deciduous forests of the United States and Canada prior to being nearly eradicated by chestnut blight (*Cryphonectria parasitica* (Murr.) Barr). Several remnant populations have been identified persisting across fragmented parts of the historical range. The identification and characterization of remnant *C. dentata* populations is important for breeding and conservation efforts, as they may represent potential genetic sources of local adaptation or blight resistance, but much of the historical range remains unsurveyed. Here, I report the locations, blight infection status, and reproductive status of remnant American chestnut in upland forested areas of western New York, finding several reproductive/potentially reproductive trees.

The American chestnut (*Castanea dentata* [Marsh.] Borkh.; Fagaceae) was an historically important hardwood species in eastern deciduous forests of the United States and Canada. Once ranging from southern Maine and Ontario to southern Georgia, and west to the Mississippi River (Peattie 1950; Russell 1987), often in monotypic stands, *C. dentata* was prized for its suitability as a rot-resistant construction material and for its edible seeds prior to its near-eradication by the fungal chestnut blight (*Cryphonectria parasitica* (Murr.) Barr) in the early 1900's (Brooks 1937; Jacobs et al. 2013). Intensive surveys have revealed several fragmented, remnant populations in parts of Connecticut (Stephens and Waggoner 1980; Paillet 1982, 2002), Massachusetts (Paillet 1988, 2002), Virginia (Stephensen et al. 1991), Ohio (Schwandron 1995), and southern Ontario (Tindall et al. 2004). However, significant parts of the historical range that may harbor remnant populations of *C. dentata* have not been surveyed.

The identification and characterization of remnant *C. dentata* individuals and populations throughout its formerly native range is important as they may represent potential genetic sources of local adaptation or blight resistance (Steiner 2006). Although active efforts are underway to identify and breed blight-resistant stocks for re-introduction (Bauman et al. 2012; Jacobs et al. 2013), the current ecological status of wild, remnant populations of *C. dentata* throughout the native range remains poorly known. Here, I present results from casual field surveys throughout parts of northwestern New York State (Monroe, Steuben, and Tompkins Counties) where I have identified remnant individuals and small populations of *C. dentata*.

Materials & Methods

From 2008-2011, several woodland and forest parcels in western New York were casually surveyed for the presence of *C. dentata*. Most of the surveys were focused on remnant woodlands in Monroe County including: woodlands on the campus of the University of Rochester, East Irondequoit Park/Abraham Lincoln Park, Lynch Woods Park, Durand Eastman Park, and Irondequoit Bay Wetlands Park/Lucien Morin Park. However, two sites broadened the scope of the surveys to larger parks in Tompkins (Taughannock State Park) and Steuben Counties (Stony Brook State Park). The land-use and age of the woodland parcels vary significantly, ranging from eastern old growth beech-maple forest to second growth woodlands on former agriculture lands. All of the surveyed areas were characterized by being relatively small (ca. 2 – 90ha; though only a portion of the larger parks was surveyed) and in most cases were surrounded by a matrix of agriculture and/or suburban habitat.

When *C. dentata* individuals were identified, the GPS coordinates for each individual or group of trees was recorded (WGS 84 datum), the diameter at breast height (DBH) was measured or estimated, and the height of each stem was estimated. Additionally, the reproductive status, and chestnut blight infection status was assessed (Table 1). Voucher specimens were collected for most of the survey sites and deposited at the L.H. Bailey Hortorium Herbarium at Cornell University.

Results & Discussion

Up until ca. 100 years ago, *Castanea dentata* was one of the most dominant trees of eastern North American forests (Russell 1987). Being prized for its lumber quality and tendency to re-sprout from root collars, silviculturalists of the late 19th and early 20th centuries exerted

considerable effort to ensure sustained lumber harvests (Matoon 1909, Buttrick 1913, Smith 2000). The decimation of *C. dentata* significantly altered eastern forest ecosystems, but the post-blight ecological significance of *C. dentata* remains relatively unclear. However, significant effort toward understanding the history (Russell 1987) and genetics (Stillwell et al. 2003; Kubisiack and Roberds 2006; Shaw et al. 2003) of *C. dentata* are informing current efforts to breed blight resistant stock (Jacobs et al. 2013; Bauman 2012) and reintroduce the species to its former range (Paillet 2002).

In total, 61 individuals of *C. dentata* were identified in this study, ranging from 1-32 individuals per site (Table 1). About a third of the identified individuals (34.4%) had a single live stem with a DBH $\leq$ 5.0 cm and could not clearly be classified as root-crown re-sprouts. However, several individuals (11.5%) were characterized by large (DBH $\geq$ 10 cm) live or dead trunks surrounded at the base by re-sprouting growth. Many of these re-sprouts were appreciable in size (DBH ca. 1-3 cm). Only 8.3% of identified individuals were large (DBH $\geq$ 20cm) and apparently unaffected by blight at the time of discovery. Most (60%) of these individuals are reproductive having visible catkins at the time of discovery (Table 1), or are potentially reproductive with indications of old fruit husks on the forest floor, and should be re-evaluated in the future.

There was not a clear association of woodland type or area with *C. dentata* growth habit, or the frequency of chestnut blight. All of the surveyed woodlands in the current study tended to be dominated by American Beech (*Fagus grandifolia*), Red Maple (*Acer rubrum*), Sugar Maple (*Acer saccharum*), and White Ash (*Fraxinus americana*), but White Oak (*Quercus alba*) and Shagbark Hickory (*Carya ovata*) were also typically present, and Eastern Hemlock (*Tsuga canadensis*) was also present in the more southern sites. Paillet (1988) found that *C. dentata* was

more commonly observed near the edges of remnant forest patches, woodlots, and hedgerows than within old-growth mesic forest in Connecticut and Massachusetts. Similarly, Tindall et al. (2004) found that extant *C. dentata* in southern Ontario was associated with deciduous forests with high canopy cover, but with well-drained sandy soils. Anecdotally, this also seems to be the case in the current study, suggesting that remnant *C. dentata* in western New York persists in deciduous forests on well-drained soils. However, these surveys were not systematic, and given the patchy distribution of identified *C. dentata* it is likely that other individuals and small populations may exist throughout woodland and larger forest parcels of western New York.

While this study contributes to the identification of remnant populations in northwestern New York, additional surveys in other parts of *C. dentata*'s historical range are essential to understand the potential genetic sources of adaptation or blight resistance. Characterizing the degree of local adaptation in *C. dentata* is an important avenue to pursue to help guide future conservation efforts, yet this remains poorly understood (Steiner 2006). Despite recent molecular evidence suggesting little genetic structure across the historical range (Kubisiak and Roberds 2006; Shaw et al. 2012), local adaptation of key life history traits, such as cold hardiness, growth rate, and blight resistance, may be important for successful reintroduction of the species to certain parts of its historical range (Steiner 2006). Future efforts should investigate the current range of genetic and phenotypic variation present in remnant populations of *C. dentata* throughout the historical range by identifying these scattered persistent populations.

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Table 1. Locations and life-history status of *Castanea dentata* identified in woodlands of upstate New York. Asterisks (*) denote individuals for which voucher specimens were collected. Reproductive status; N = non-reproductive, R = reproductive. Blight status; N = no visible signs of being afflicted by blight, B = visibly afflicted by blight or a dead trunk.

Plant ID	Date	Locality Name	County	Lat. (°N)	Long. (°W)	DBH (cm)	Height (m)	Status	Reprod. Status	Blight Status	Co-occurring Species
UR1*	20Aug2008	UR Woodlands	Monroe	43.1101	77.6396	21.6	15	live single stem	R?	N	*Fagus grandifolia, Acer saccharum, Acer rubrum, Fraxinus americana, Carya ovata, Quercus alba, Prunus serotina, Populus deltoides, Juglans nigra, Liriodendron tulipifera, Sassafras albidum, Ulmus* spp.
UR2*	20Aug2008	UR Woodlands	Monroe	43.1101	77.6396	12.7	15	live single stem	N	N	
UR3*	20Aug2008	UR Woodlands	Monroe	43.1099	77.6398	26.4	20	dead trunk, re-sprouts at base	N	B	
UR4*	20Aug2008	UR Woodlands	Monroe	43.1094	77.6397	7.1	12	live single stem	N	N	
UR5*	5Sep2008	UR Woodlands	Monroe	43.1093	77.6386	19.8	20	dead trunk, re-sprouts at base	N	B	
UR6*	5Sep2008	UR Woodlands	Monroe	43.1095	77.6393	8.5	15	live single stem	N	N	
SB1*	19Oct2008	Stony Brook SP	Steuben	42.5148	77.6926	4.0	10	live single stem	N	N	*Quercus alba, Tsuga canadensis, Acer saccharum, Fraxinus americana*
SB2	19Oct2008	Stony Brook SP	Steuben	42.5148	77.6926	5.0	10	live single stem	N	N	
SB3*	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	2.0	5	dead trunk, re-sprouts at base	N	B	
SB4	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	3.0	5	live trunk, re-sprouts at base	N	B	
SB5	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	4.0	10	live single stem	N	N	
SB6	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	2.0	5	dead trunk, re-sprouts at base	N	B	
SB7	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	5.0	10	live single stem	N	N	
SB8	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	4.0	10	live single stem	N	N	
SB9	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	3.0	8	live trunk, re-sprouts at base	N	B	
SB10	19Oct2008	Stony Brook SP	Steuben	42.5147	77.6918	10.0	20	live single stem	R?	N	
T1*	27Jun2009	Taughannock SP	Tompkins	42.5381	77.6091	4.0	10	live single stem	N	N	*Quercus alba, Acer saccharum, Acer rubrum, Tsuga canadensis, Fraxinus americana*
T2	27Jun2009	Taughannock SP	Tompkins	42.5381	77.6091	4.0	10	live single stem	N	N	
T3	27Jun2009	Taughannock SP	Tompkins	42.5392	77.6058	4.0	10	live single stem	N	N	
T4	27Jun2009	Taughannock SP	Tompkins	42.5392	77.6058	20.0	15	live single stem	N	N	
T5	27Jun2009	Taughannock SP	Tompkins	42.5392	77.6058	20.0	15	live single stem	R	N	
EI1*	5Oct2009	East Irondequoit Pk.	Monroe	43.1913	77.5155	3.0	5	dead trunk, re-sprouts at base	N	B	*Quercus alba, Quercus rubra, Acer rubrum, Acer saccharum, Acer saccharinum, Carya ovata, Sassafras albidum, Liriodendron tulipifera, Fraxinus americana*
EI2	5Oct2009	East Irondequoit Pk.	Monroe	43.1918	77.5150	3.0	5	live single stem	N	N	
EI3	5Oct2009	East Irondequoit Pk.	Monroe	43.1918	77.5150	3.0	5	live single stem	N	N	
EI4	5Oct2009	East Irondequoit Pk.	Monroe	43.1918	77.5143	3.0	5	live single stem	N	N	
EI5	5Oct2009	East Irondequoit Pk.	Monroe	43.1912	77.5158	3.0	5	live single stem	N	N	
LW1	24Sep2009	Lynch Woods Pk.	Monroe	43.1004	77.6390	20.0	15	live single stem	R	N	

LW2	24Sep2009	Lynch Woods Pk.	Monroe	43.1004	77.6388	12.0	10	live single stem	N	N	*Fagus grandifolia, Acer saccharum, Acer rubrum, Fraxinus americana, Carya ovata, Quercus alba, Prunus serotina, Populus deltoides, Juglans nigra, Liriodendron tulipifera, Sassafras albidum, Ulmus* spp.
DE1*	5Jun2011	Durand Eastman Pk.	Monroe	43.2282	77.5638	5.0	10	live single stem	N	N	*Fagus grandifolia, Acer saccharum, Acer rubrum, Tsuga canadensis*
IW1	30Jun2011	Irondequoit Wetlands	Monroe	43.1666	77.5313	8.4	12	live single stem, sapling 1m S	N	N	*Quercus alba, Quercus rubra, Acer rubrum, Acer saccharum, Acer saccharinum, Carya ovata, Sassafras albidum, Liriodendron tulipifera, Fraxinus americana, Populus deltoides, Ulmus* spp
IW2	30Jun2011	Irondequoit Wetlands	Monroe	43.1666	77.5313	7.4	10	live single stem	N	N	
IW3	30Jun2011	Irondequoit Wetlands	Monroe	43.1666	77.5313	5.3	8	live single stem	N	N	
IW4	30Jun2011	Irondequoit Wetlands	Monroe	43.1668	77.5313	5.8	8	live single stem	N	N	
IW5	30Jun2011	Irondequoit Wetlands	Monroe	43.1668	77.5313	3.6	2.5	live single stem	N	N	
IW6	30Jun2011	Irondequoit Wetlands	Monroe	43.1668	77.5313	8.9	13	live single stem, re-sprouts at base	N	N	
IW7	30Jun2011	Irondequoit Wetlands	Monroe	43.1668	77.5313	3.1	3	live single stem	N	N	
IW8	30Jun2011	Irondequoit Wetlands	Monroe	43.1669	77.5313	6.1	12	live single stem, re-sprouts ~5m N, 1m S (3.8 cm DBH)	N	N	
IW9	30Jun2011	Irondequoit Wetlands	Monroe	43.1666	77.5314	6.9	8	live single stem	N	N	
IW10*	30Jun2011	Irondequoit Wetlands	Monroe	43.1664	77.5321	2.5	1.5	dead trunk, re-sprouts at base	N	B	
IW11	30Jun2011	Irondequoit Wetlands	Monroe	43.1656	77.5301	5.3	3	live single stem	N	N	
IW12	30Jun2011	Irondequoit Wetlands	Monroe	43.1650	77.5289	5.3	0.5	2 dead trunks, re-sprouts at base	N	B	
IW13	30Jun2011	Irondequoit Wetlands	Monroe	43.1649	77.5288	5.3	7	2 trunks, re-sprouts 3m W & 2m S	N	N	
IW14	30Jun2011	Irondequoit Wetlands	Monroe	43.1649	77.5288	2.0	3	live single stem	N	N	
IW15	30Jun2011	Irondequoit Wetlands	Monroe	43.1650	77.5287	5.6	3	live single stem, re-sprout 1m N	N	N	
IW16	30Jun2011	Irondequoit Wetlands	Monroe	43.1649	77.5286	21.1	20	live single stem	R?	N	
IW17	30Jun2011	Irondequoit Wetlands	Monroe	43.1648	77.5284	1.3	2	live single stem	N	N	
IW18	30Jun2011	Irondequoit Wetlands	Monroe	43.1648	77.5284	2.3	2	live single stem	N	N	
IW19	30Jun2011	Irondequoit Wetlands	Monroe	43.1648	77.5284	6.9	4	live single stem	N	N	
IW20	30Jun2011	Irondequoit Wetlands	Monroe	43.1648	77.5284	6.4	7	live single stem	N	N	
IW21	30Jun2011	Irondequoit Wetlands	Monroe	43.1649	77.5284	6.1	7	live single stem	N	N	

IW22	30Jun2011	Irondequoit Wetlands	Monroe	43.1648	77.5283	11.2	15	live single stem, re-sprout 1m E	N	N	
IW23	30Jun2011	Irondequoit Wetlands	Monroe	43.1647	77.5283	10.9	15	live single stem	N	N	
IW24	30Jun2011	Irondequoit Wetlands	Monroe	43.1647	77.5283	6.4	8	live single stem	N	N	
IW25	30Jun2011	Irondequoit Wetlands	Monroe	43.1647	77.5282	9.1	10	live single stem	N	N	
IW26	30Jun2011	Irondequoit Wetlands	Monroe	43.1647	77.5283	4.3	5	dead trunk, re-sprouts at base	N	B	
IW27	30Jun2011	Irondequoit Wetlands	Monroe	43.1646	77.5281	10.9	12	2 trunks	N	N	
IW28	30Jun2011	Irondequoit Wetlands	Monroe	43.1647	77.5281	4.1	7	live single stem	N	N	
IW29	30Jun2011	Irondequoit Wetlands	Monroe	43.1647	77.5280	3.6	2	dead trunk, re-sprouts 5m E, 20 m E	N	B	
IW30	30Jun2011	Irondequoit Wetlands	Monroe	43.1649	77.5279	15.2	25	live single stem	N	N	
IW31	30Jun2011	Irondequoit Wetlands	Monroe	43.1650	77.5279	18.8	30	dead trunk, re-sprouts 2m N, 3m E, 1 m N	N	B	
IW32	30Jun2011	Irondequoit Wetlands	Monroe	43.1655	77.5279	3.6	3	dead trunk, re-sprouts 5m W, 10 m W, 2 m N	N	B	