

Wildlife Value of *Castanea dentata* Past and Present, the Historical Decline of the Chestnut and its Future Use in Restoration of Natural Areas

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ABSTRACT. *Castanea dentata* was once a dominant climax hardwood in forests throughout much of the eastern United States and was a major source of food and habitat for wildlife. The passenger pigeon, black bear, white-tailed deer, squirrels and other rodents, turkey, mammalian and avian predators, several species of chestnut moths now presumed extinct, and other wildlife suffered as a result of the decline of the chestnut. Four important historical events over the past several thousand years have impacted the distribution and abundance of the chestnut and presumably the vertebrate and invertebrate species associated with it. These events include post-glacial migration from south to north, clearing of large expanses of forest for farming, logging of commercially valuable timber including chestnut, and finally the chestnut blight. During the past 300 yr, settlement by Europeans has led to the loss of food and habitat from impacts including farming, logging and the accidental introduction of the chestnut blight fungus. These events have caused enormous changes in the food habitat for wildlife, including some species dependent on large tracts of non-fragmented forest and its enormous mast crops. Many formerly abundant species of wildlife suffered great losses or even extinction as a direct result of loss of habitat and hard mast, even before chestnut blight. Today, *C. dentata* is relatively unimportant to wildlife. With recent introduction of blight resistant *C. dentata* x *C. mollissima*, restoration efforts have begun in earnest. However, wildlife may benefit most if resistance to chestnut blight is incorporated in American chestnut, or if chestnut blight is controlled via viral pathogens on stump sprouting native chestnuts.

The American chestnut, *Castanea dentata* (Marsh.) Borkh., was once a dominant tree on the slopes throughout much of the eastern United States (4, 18). Chestnut was most important in the oak-chestnut forest region (4), now generally referred to as the oak-hickory forest (2) where it has been replaced as a dominant forest canopy tree by various species of oaks and hickories. The oak-chestnut forest extended from the glaciated area of eastern New York south through parts of the Piedmont and Ridge and Valley provinces, and the northern Blue Ridge and southern Appalachian mountains. Chestnut occurred over a much larger area, including the Cumberland Mountains, Allegheny Mountains and Cumberland and

Allegheny Plateaus (4). According to one distribution map, American chestnut occurred in southern Ontario and in every state east of the Mississippi River except Wisconsin and Florida (14).

Chestnut rapidly disappeared as a dominant element of the forest after the spread of chestnut blight, caused by *Cyphonectria parasitica* (Murr.) Barr, beginning in 1904 (14) or 1906 (12) from an epicenter in New York City where the fungus was accidentally introduced. By the late 1930's most mature chestnuts were dead above the ground level except for a few small, disjunct groves (20). Since the fungal pathogen cannot survive below ground, many stump sprouts still occur throughout its normal range, but these are usually killed by the blight before maturity.

Scientific studies of forest community structure were undertaken only occasionally before the decline of the chestnut. Studies have documented its importance in forests mostly by counting dead trees or stumps.

Distribution and size of forests containing chestnut was affected by glacial conditions and more recently by human impacts. Chestnut was negatively affected by Native Americans to a small extent (12) but wholesale destruction of upland forests including those inhabited by chestnut began when European colonists cleared the land for agriculture and harvested timber for sale (7, 17). Finally, chestnut blight nearly completely eliminated chestnut as a forest canopy tree.

Only scattered references exist in the literature documenting chestnut as a wildlife food plant since it had largely disappeared before systematic scientific studies of food habits of wildlife had begun (1, 3, 14, 18, 19). Restoration efforts by local and national conservation groups have begun recently to promote the introduction of hybrids (M. Pinger, personal communication), supposedly blight-resistant chestnut cultivars for the benefit of wildlife and other conservation purposes.

The goals of this paper are: 1) to show the relative importance of chestnut as a forest tree; 2) to describe briefly the glacial and human impacts to the eastern hardwood forest, especially on chestnut and other major mast producers [hard mast includes nuts and other propagules with a hard pericarp, whereas soft mast includes fruits with a fleshy covering to the seed(s)], and how these impacts may have affected wildlife species; 3) to provide a partial catalog of American chestnut use by a few wildlife species that may have been among its most important users, provide a comparison of wildlife use of other coin-

mon hard mast producing trees, and also show that certain insects inhabiting chestnut may be rare or possibly extirpated; and, 4) to describe some restoration programs and discuss potential benefits and problems, as well and offer suggestions for restoration of natural areas, based partially on experience gained in reforestation efforts in Maryland.

MATERIALS AND METHODS

This paper is primarily a review of the literature on the ecological history of the chestnut and its importance to wildlife. Recommended methods for restoration will be described under the heading "Restoration of the Chestnut."

RESULTS

Relative importance of chestnut as a forest tree. The American chestnut was a component of eastern forests, to a varying degree, during the time scientists surveyed remaining tracts of forest from the early 1900's to the 1940's (4). Table 1 presents the relative importance of chestnut in various forests visited by Braun (4) and others where percentage of canopy dominant data exist. By the time of Braun's survey of woody plants in eastern forests, chestnut had been subjected to selective logging, blight and disturbance by feral animals such as hogs and other livestock

that were allowed to range freely through the forests. Logging activities, past farming, livestock, fires and other disturbances may have affected the forests that Braun surveyed to the extent that her recorded species composition probably did not accurately reflect the pre-European forest composition. However, Braun's surveys represent the most scientifically accurate account of conditions over a large area within the range of the chestnut, and she visited many extremely isolated stands that were believed to be virgin timber. Where chestnut was a component of forests, it ranged from 1.1% to 82.5% of composition in terms of total abundance (Table 1). The most frequent species occurring with chestnut included various oaks (*Quercus* spp.) and tulip poplar (*Liriodendron tulipifera* L.).

Glacial and human impacts to the eastern hardwood forest and the oak-chestnut forest. The forest that existed a few hundred years ago in eastern North America, mostly did not occur during the last Ice Age, except in the deep south, Appalachian mountains and the Ozark Plateau. Boreal floral and faunal elements mixed with southern and central elements. Glacial retreat began about 18,000 yr ago, and tree species migrated north at varying speeds and distances. American chestnut was believed to be a much slower disperser than most other trees, since its seeds were stated to be dispersed by mammals (12). Chest-

Table 1. Percent composition of *Castanea dentata* in forests where mature chestnut was present (modified from Braun 1950).

Location	Forest Type	% Composition
George Washington National Forest, Va.	White Oak, Tulip, Black Oak	1.1
George Washington National Forest, Va.	Chestnut Oak, Black Oak, Tulip	4.9
Shenandoah National Park, Va.	Sugar Maple present	9.8
Shenandoah National Park, Va.	Oak, Chestnut	34.8
Ravenel's Woods near Highlands, N.C.	Oak, Chestnut	34.2
Ravenel's Woods near Highlands, N.C.	Hemlock-mixed	11.5
Ravenel's Woods near Highlands, N.C.	Hemlock-Rhododendron	4.0
Joyce Kilmer Memorial Forest, N.C.	Chestnut	82.5
Joyce Kilmer Memorial Forest, N.C.	Chestnut and mixed mesophytic	50.5
Joyce Kilmer Memorial Forest, N.C.	Mixed mesophytic/cove hardwoods	16.9
Joyce Kilmer Memorial Forest, N.C.	Hemlock-mixed mesophytic	2.0
Grandfather Mountain, N.C.	Hemlock	4.2
Grandfather Mountain, N.C.	Chestnut	45.7
Grandfather Mountain, N.C.	Sugar Maple	6.8
Greenbrier Riv., Great Smoky Mountains	Chestnut	30.5
Alum Cave Creek, Great Smoky Mountains	Cove hardwoods	4.3
Mt. Mingus, Great Smoky Mountains	Mixed mesophytic	2.4
Western Shore district, Md.	Chestnut, middle slopes	55.8
Western Shore district, Md.	Chestnut, lower slopes	11.6
Western Shore district, Md.	Chestnut, broad ravines	47.9

nut did not reach New England until 2,000 yr ago (12). In contrast, white pine (*Pinus strobus* L.) reached Massachusetts 9,000 yr ago; American beech (*Fagus grandifolia* Ehrh.) reached upper New York state 7,000 yr ago; and, apples and elms reached the Great Lakes region 4,000 yr ago (12).

Human activities have caused impacts to the eastern deciduous forest since around the time of first contact by Native Americans. Fires were set by Native Americans not only to make hunting, travel and farming easier (12) but also to provide grass forage for game in previously forested areas. Large grazing herbivores such as elk (*Cervis canadensis* Erx .) and bison (*Bison bison* L.), were common to abundant in the Piedmont and mountains of Maryland and nearby states until extirpation by European settlers in the late 1700's (bison) to the mid 1800's (elk) (13). However, "perhaps the most dramatic ecological event of the past 300 yr, since the time of settlement by Europeans, has been the massive cutting of virtually the entire eastern forest" (12). The eastern deciduous forest at the time of European contact originally covered much of the United States east of the 98th meridian and of adjacent Canada in the lower Great Lakes region and upper St. Lawrence Valley, with the exception of burned openings created by Native Americans, open waterbodies, swamps and bogs, steep cliffs or river bluffs, windfalls and prairie patches and barren areas over serpentine outcrops or shale barrens and certain areas of nutrient poor sand (4).

The systematic destruction of the eastern hardwood forest by Europeans can best be understood by an examination of early settlement patterns and needs of pioneers, and later of farmers and loggers who used methods considerably more destructive than the early pioneers, and the beginning of the Industrial Revolution, especially a period that has been called "the railroad logging era."

Most of the first colonists were of Finnish origin and these colonists were met with little resistance by Native Americans, and thus were able to penetrate quickly into the interior (11). By 1740, they had colonized much of the area east of the first mountain ranges to the west, near Albany, N.Y., coastal Maine and coastal North Carolina. By 1800, their settlement included most of New York, Pennsylvania, southeastern Ohio, eastern Illinois, the northern half of Tennessee and eastern Georgia. Since the Finns cut chestnut but left the stumps, sprouting could occur. The Finns farmed and grazed livestock among the stumps and harvested more wood from the sprouts. Later farmers of Germanic origin removed the stumps to create large agricultural fields that were barren of trees (11).

Habitat fragmentation reached a peak from agricultural activities in the period from 1830 to the mid 1800's, but the pattern of destruction of the virgin forest was varied. Logging in particular progressed and intensified around the eastern United States as improved methods of transport were developed. In general, the northeastern conifers were exploited first, using water transport to float logs to the many mills that were built to meet an ever-increasing demand. Conifers were in demand from the be-

ginning of European colonization, especially for ship masts (7, 17). Later, with the advent of railroads, the lead in production moved from the northeast to other areas: Pennsylvania, 1860; Lake States, 1870; Michigan, Civil War to 1890; Wisconsin, 1890-1904; South, 1900, but beginning in the 1870's, with a peak in 1909 (9). Chestnut wood was in high demand for its lumber, for pulpwood and charcoal, fence posts, barrel staves, furniture, musical instruments, paneling and caskets. Its bark was the major tree source for tannin, and the nuts were highly valued for food (4, 18).

Coppicing (a cultural practice of cutting stumps low to the ground to encourage new sprouting) of chestnuts met with most success in the northern part of its range. However, repeated coppicing was believed to eventually kill or weaken the tree (25). Also, seed reproduction was often scant since free-ranging swine foraged extensively on the nuts, and those that did sprout were often grazed by cattle. Finally, chestnut harvesting by settlers provided a ready form of food and a cash crop (25).

Another fungal pathogen of the chestnut, *Phytophthora cinnamomi* Rands, which attacked the roots, probably was a major cause of recession from the Piedmont in the 19th century (10). By the time the chestnut blight was accidentally brought to New York City around 1904, much of the eastern deciduous forest had already been decimated. Only scattered remnants of virgin forest remained (10).

Wildlife value of chestnut. American chestnut was considered to be a very important wildlife food plant. "Fifty years ago the chestnut ranked as one of the most important wildlife plants of the eastern United States" (14), and "Bobwhite, wild turkey, squirrels, and white-tailed deer are among the many forms of wildlife that once fed upon the nuts" (18). However, little documentation of wildlife use exists for chestnut in comparison to other hard mast trees such as oaks, beech and hickory that were common during the period (1900-1950) when biologists were conducting systematic studies of wildlife food habits. Table 2 provides a comparison of food habits of 28 avian species, and Table 3 of food habits of 19 mammalian species for four major hard mast trees. The importance of the mast species in Tables 2 and 3 is indicated by asterisks, plus or minus signs, or the # sign. It should be noted that chestnut is probably under-represented and that there are probably other literature sources that would increase the list of wildlife using this tree. The following accounts briefly outline some of the rarer species that may have been negatively affected by a general decrease in habitat and mast production, as well as by over-hunting of the populations remaining after habitat destruction had increased.

Passenger pigeon (*Ectopistes migratorius* L.). The passenger pigeon fed on chestnuts, acorns and beechnuts during fall and winter and on a variety of soft mast mostly during the breeding season (3). This species was thought to be the most abundant bird in what is now the United States, at the time of European discovery of the New World (19). It has been estimated that 3-5 billion birds comprised 25-40% of the total bird population in the

Table 2. Comparison of avian use of major mast-producing trees within the historical range of *Castanea dentata*.

Birds	Oaks	Beech	Chestnut	Hickory
Mallard	*E			
Pintail ¹	+Texas			
Wood Duck	***SE, *NE	*NE		**SE
Clapper Rail	+US			
Passenger Pigeon (extinct)	#	#	#	
Ruffed Grouse	***VA Alleghenies *Ohio, +NE	**Ohio, +NE		
Ring-necked Pheasant	*NE	+Ohio, +N.Y.		+NE
Heath Hen (extinct)	#			
Common Bobwhite	*NE, **SE		#	+SE
Wild Turkey	****SE, ****Pa., **Alleg. Mtn.	*SE, +Va.	#	*SE
Rusty Blackbird	+NE	+NE		
Common Crow	*E			+E
Common Flicker	*E			
Hairy Woodpecker		-Md.		
Downy Woodpecker	+E	-Md.		
Red-bellied Woodpecker	***E	+E		*E
Red-cockaded Woodpecker	+Gulf Coast			
Red-headed Woodpecker	***E			
Common Grackle	**NE	+NE		
Blue Jay	****E	*E		+NE
Carolina Chickadee		-Md.		
Tufted Titmouse	**E	**E		
White-breasted Nuthatch	***E	+E		+E
Brown Thrasher	*NE, **SE			
Eastern Meadowlark	*SE			
Rufous-sided Towhee	**NE			
European Starling	+NE			
Carolina Wren	+E			

¹A few species are included that occur within the chestnut's range but for which diet information is from a state outside of the range of chestnut.

- # = Present in diet (Bent 1932)
- = Used to an undetermined extent (Martin et al. 1951)
- + = 1/2 to 2% of diet (Martin et al. 1951)
- * = 2 to 5% of diet (Martin et al. 1951)
- ** = 5 to 10% of diet (Martin et al. 1951)
- *** = 10 to 25% of diet (Martin et al. 1951)
- **** = 25 to 50% of diet (Martin et al. 1951)

United States. One spring migratory flight witnessed by ornithologist Alexander Wilson in Kentucky in 1808 (3, 19) was one mile wide and continued to pass over him for 4 hr. Wilson estimated this flight at 2,230,272,000 birds. He calculated that this flock would eat 17,424,000 bushels of mast per day. Wilson took from the crop of a single bird "a good handful of the kernals of beechnuts intermixed with acorns and chestnuts" (4). Another flight reported by Ross King in 1866 stated that at one time in Ontario during May he observed flocks at least 300 miles long and one mile wide that continued for 14 hr. Schorger (19) estimated the number of birds in this flight to be 3,717,000,000.

The range before permanent settlement of North America was eastern North America from Canada south to the Gulf coast and west to Montana and west Texas

(21). The passenger pigeon was a colonial nester. As late as 1871, in an area of 850 square miles in Wisconsin, 136 million nested. Its nests numbered up to 100 per tree (24) and whole trees or large branches often crashed to the ground from the weight of roosting birds (1). It is possible that dead adults or squabs may have provided a food resource for the federally endangered American burying beetle (*Microphorus americanus* Oliv.) that is now restricted to Block Island, R.I. and a nearby small island where it was recently reintroduced, and eastern Oklahoma.

The pigeon's extinction was due to the wholesale destruction of its forested habitat, including chestnut and other mast-producing forests, and later market hunting. New railroads allowed exploitation of passenger pigeons and other wildlife since the game could be rapidly trans-

Table 3. Comparison of mammalian use of major mast-producing trees within the historical range of *Castanea dentata*.

Mammals	Oaks	Beech	Chestnut	Hickory
Black Bear	****Va., ****W.Va., ****Pa.	****Pa.		+Va., +W.Va.
Gray Fox	+S	+E		+Va.
Red Fox	+NE	+E		
Muskrat	+NE			
Opposum	+E			
Eastern Cottontail Rabbit	*Mich.		-Conn.	+Conn.
New England Cottontail Rabbit	*NE		-Conn.	+Conn.
Raccoon	***SE, ****NE	+NE		+E
Flying Squirrel	**NE	***NE		
Fox Squirrel	+++E	***Ohio, *NE		**NE, ***Ohio ***Mich.
Western Fox Squirrel ¹	****Mich.	**Mich.	-Mo.	
Gray Squirrel	****E	**E		***E
Red Squirrel	**E	**E	*NE	***E
Eastern Chipmunk	**NE	**NE	*NE	**NE
Meadow Mouse	+E			
White-footed Mouse	**E	+E		+E, +NE
Allegheny Wood Rat	-NE		-E	
White-tailed Deer ¹	***N.C. Mtn. *N.Y., *Pa., *N.C. Coast +Northern Mtn/Desert	+N.Y.	#	+Texas

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- **** = 25 to 50% of diet (Martin et al. 1951)

ported to major urban areas before spoilage occurred. With the decline and extinction of the passenger pigeon, native avian predators such as the Cooper's hawk (*Accipiter cooperi* Bona.) and peregrine falcon (*Falco peregrinus* Tuns.) lost an important prey item (13).

Other vertebrate wildlife. White-tailed deer (*Odocoileus virginianus* Bodd.) (18), wild turkey (*Meleagris gallopavo* L.) (3) and the Allegheny woodrat (*Neotoma floridana* Baird.) (22) were known users of mast including chestnut and suffered a near extirpation in many areas as a result of over-hunting (turkey and deer) or habitat loss (all three). The black bear (*Ursus americanus* Pall.) was a major consumer of mast (14), probably including chestnut, and also was extirpated from a large portion of its range by around the late 1800's. The heath hen (*Tympanuchus cupido* L.) fed on acorns and perhaps other mast (21), and became extinct in 1932. It once had a range along the eastern seaboard from Massachusetts south to Virginia, but was limited after 1835 to Martha's Vineyard, Massachusetts, due to overhunting and habitat loss. It was "to some extent a forest bird when eastern forests were intact but mostly on brushy scrub oak plains of eastern seaboard" (21). Other wildlife such as squirrels probably declined greatly as a result of habitat destruction and loss

of hard mast during fall and winter, and avian and mammalian predators also decreased as a result of decline of prey populations.

Chestnut moths. Several species of moths are known to have fed on *C. dentata* or other members of the *Castanea* genus (Table 4). Many of these are believed to be extirpated or greatly reduced (15, 16) but some of these have recently been rediscovered after an absence of 60 or more yr (23). In particular, Wagner has recently collected *Synanthedon castaneae* Buten. and *Coleophora leucochrysell* L. in Connecticut (D. Wagner, personal communication). He believes other *Castanea* obligate feeders will be rediscovered. In addition to chestnut moths, many other species of insects are attracted to the bark, wood, nuts and flowers of chestnut (pers. obs.). Two weevils are considered pests of the nuts, *Curculio auringer* Casey and *C. preboscidus* Fab. (5). One investigator collected 3,600 larvae from a bushel of chestnuts (6).

Restoration of the chestnut. Blight resistant hybrid chestnuts from American chestnut and Chinese chestnut have been developed recently that produce nuts and foliage that are very similar to the American chestnut. *Castanea dentata* x *C. mollissima* hybrids developed by R. Dunstan have larger nuts than the American chestnut,

which average 35-70 nuts per kg, as compared to the 15-20 nuts per kg produced by the Chinese chestnut (24). Hybrids being distributed by the American Wild Turkey Society (AWTS) (1) average about 60 nuts per kg. AWTS distributed about 25,000 whips (single-stemmed, small woody plant stock) of the 'Sweetheart' variety in 1991 and 30,000 whips in 1992 to 27 states in the eastern United States (1). AWTS expects to distribute 60,000-70,000 trees in 1993. Mature trees are predicted to produce 180 kg of nuts each year.

Table 4. A partial list of lepidoptera associated with *Castanea*.

<i>Castanea</i> spp. (Chestnut)	
Gracillariidae	
	<i>Cameraria castaneaeella</i> (Cham.)
	<i>Marmara fulgidella</i> (Clem.)
	<i>Neurobathra strigifinitella</i> (Clem.)
	<i>Phyllonorycter kearfottella</i> (Braun)
<i>Castanea dentata</i> (Marsh.) Borkh. (American chestnut)	
Gracillariidae	
	<i>Cameraria</i> spp.
	<i>Cameraria castaneaeella</i> (Cham.)
	<i>Phyllonorycter kearfottella</i> (Braun)
	<i>Phyllonorycter restrictella</i> (Braun)
Nepticulidae	
	<i>Ectodoemia castaneae</i> (Busck)
	<i>Ectodoemia phleophaga</i> (Busck)
	<i>Stigmella castaneaeefoliella</i> (Schrank)
Sesiidae	
	<i>Synanthedon castaneae</i> (Huebner)
Tischeriidae	
	<i>Tischeria perplexa</i> (Zeller)
Coleophoridae	
	<i>Coleophora leucochrysell</i> (Huebner)
Argyresthiidae	
	<i>Argyresthia castaneella</i> (Huebner)
Yponomeutidae	
	<i>Swammerdamia castaneae</i> (Huebner)
Tortricidae	
	<i>Pseudexentera faracana</i> (Heinrich)

The Maryland-National Capital Park and Planning Commission has been involved since 1989 in habitat restoration in parks in Montgomery County, Maryland. We use native trees and shrubs, mostly of local genetic stock, and have planted over 50 ha of forest and restored several hundred additional acres through the use of natural regeneration. When planting, we normally prefer to use 15-20 species of trees and shrubs with a random spacing of ten feet, thus totalling 180 trees per ha. The success rate varies with type of stock and origin of stock. A success rate (defined as survival after 2 yr) of about 90% has been

achieved with container grown stock, 50-80% survival with whips, and approximately 75% with balled and burlapped stock. High rates of success have also occurred using direct seeding of locally collected seeds. Higher rates of success have occurred on floodplain soils than in upland soils, where dehydration, exotic invasion and competition, and generally poorer soils prevail in relation to more saturated and richer floodplain soils.

In the spring of 1992, the Department of Parks planted about 1000 whips supplied by the AWTS, and as of mid-July 1992, survival was approximately 80%. These chestnut whips were interspersed with about 15 other species of container grown and balled and burlapped stock in several upland and well-drained floodplain sites for the purpose of habitat restoration and providing wildlife food and cover.

DISCUSSION

Castanea dentata was an important canopy tree according to studies made in several southern states (4, 25), but unfortunately similar studies do not appear to exist for undisturbed forests in the northern part of its range. From less scientific references it is apparent that chestnut was a canopy dominant within the oak-chestnut forest (4) and was important in other forest associations (12, 17).

Human disturbance, especially from European agriculture and logging, had a devastating and prolonged impact on the eastern deciduous forest and chestnut. Agricultural and logging practices caused erosion of topsoil and loss of nutrients, as they continue to do today when these cultural practices are implemented improperly. The eastern deciduous forest was essentially depleted in many states (7, 17) by the mid-1800's. Some regrowth of certain stump-sprouting trees such as chestnut occurred but these were logged repeatedly (25). By the late 1800's, formerly abundant wildlife game species were extinct or near extinction, due to loss of habitat (food and cover) and overhunting (8, 13). The great die-off of remaining chestnuts as a result of introduction of the blight beginning and ending in the early 1900's happened after the massacre of game by market hunters and others. Certainly the loss of chestnut may have slowed the repopulation of wildlife such as white-tailed deer, black bear, wild turkey and avian and mammalian predators due to destruction of habitat. Today, some of these species, such as black bear, wild turkey, goshawk (*Accipiter gentilis* L.), Cooper's hawk (*A. cooperi*), cougar (*Felis concolor* Kerr), bobcat (*Lynx rufus* Schr.) and others are still in the process of contraction from or expansion into their former range.

With the widespread and increasing loss of other mast producing trees, especially oaks, from the spread of the gypsy moth (*Lymantria dispar* L.), it is possible to predict decline of wildlife reliant on mast. Mast is especially important during cold or prolonged winters when little other nutritious food is available. Control of exotic organisms such as chestnut blight and gypsy moth that kill mast trees is especially crucial today.

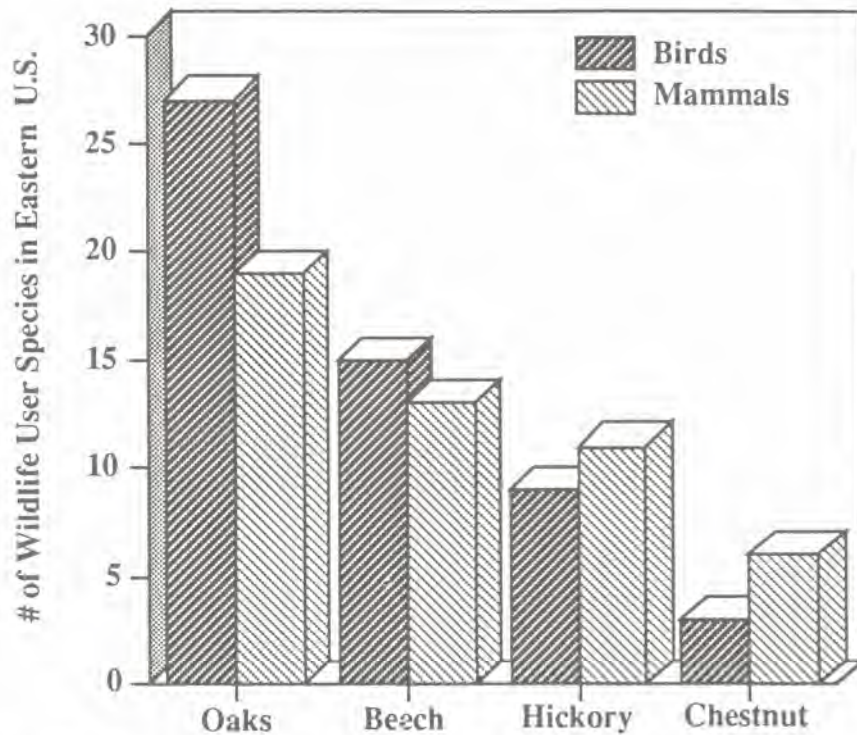


Figure 1. Comparison of value of four hard mast types to birds and mammals in the eastern United States.

Castanea dentata is under-represented in the literature as an important wildlife food in comparison to other major mast trees (Tables 2, 3, Figure 1). However, this may be an artifact of a lack of sampling and observation during the period when chestnut was more plentiful.

We plan to monitor the success of restoration plantings and begin to gather information on wildlife use of fruits and nuts, especially of the chestnut. Chestnut varieties with small nut size, approximating that of the native American chestnut, should be planted in the former range of *C. dentata*. Smaller nuts will allow a wider variety of wildlife to utilize this potential food resource. We encourage others to observe wildlife use of chestnuts and report findings. This is especially important in regard to the widely held but unsupported view that chestnut mast was very important to a large variety of wildlife. Another experiment will involve planting hybrid chestnuts into natural forests, including those where gypsy moth has caused nearly complete mortality of canopy trees, especially white oak (*Quercus alba* L.) and chestnut oak (*Q. prinus* L.). The response of the forest community to resurrected canopy dominant chestnuts will be interesting to observe in the long-term.

Finally, it is difficult to imagine that planting hybrid chestnuts will restore the chestnut to its former dominance. At best, a few thousand acres will be successfully planted and maintained in the next few decades. Perhaps blue jays and other agents of dispersal will help spread the nuts and these will sprout and survive. Continuing re-

search on viral pathogens of the blight fungus in North America offers a much more reasonable chance for large-scale restoration of the native chestnut. If successful, viral pathogens may allow stump sprouting chestnuts to survive to maturity. Wildlife dispersal agents would help to spread the species and all wildlife would benefit in many ways from the American chestnut.

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