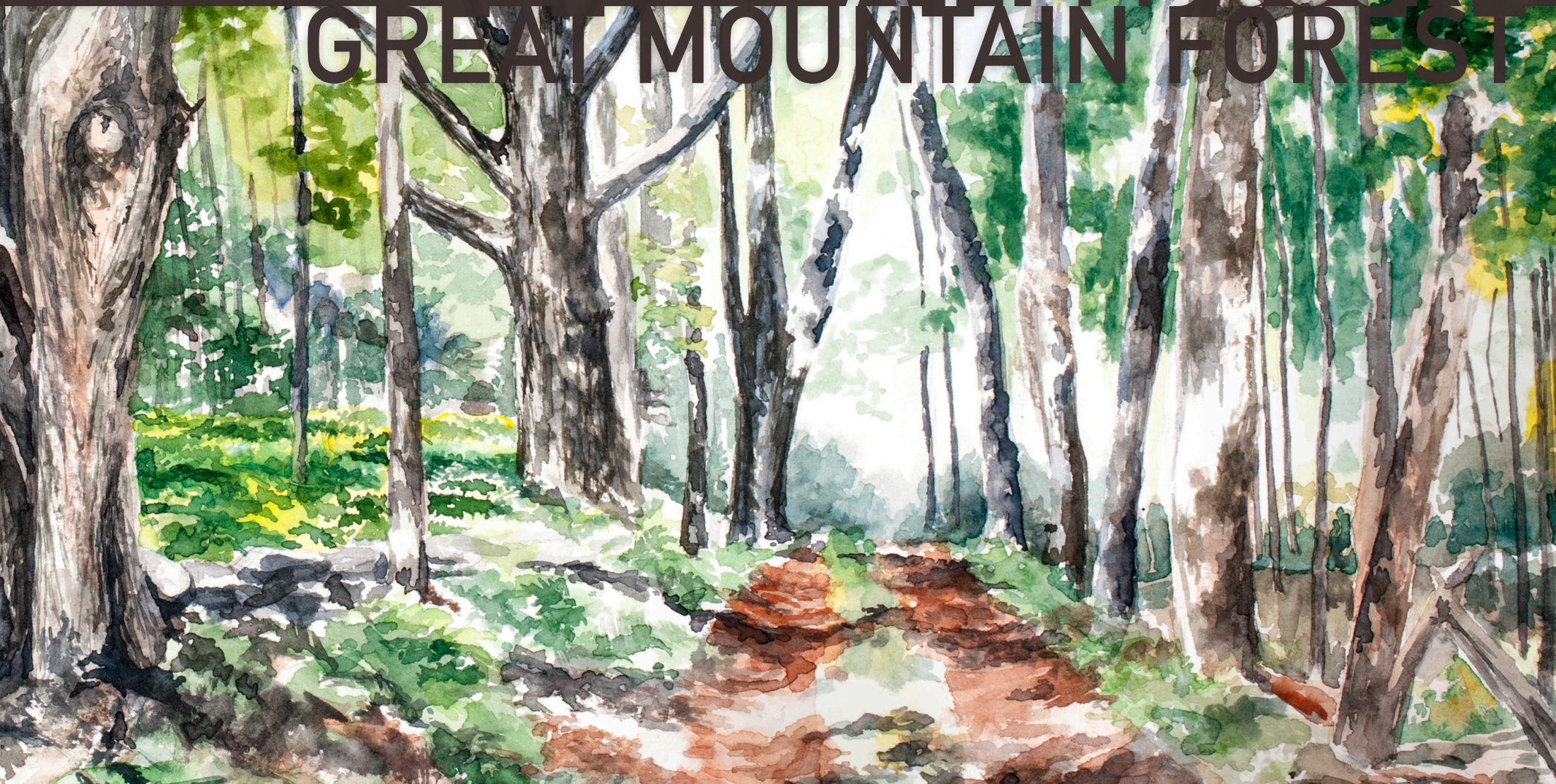
A FIELDBOOK OF THE GREAT MOUNTAIN FOREST



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SPECIES OF INTEREST

IN GREAT MOUNTAIN FOREST

Great Mountain Forest is lush with a variety of flora and fauna. What follows are brief descriptions of selected interesting and ecologically significant species, and their relevance to Great Mountain Forest. This is by no means an exhaustive list—consider it an introduction to the cast of major or otherwise notable characters who star throughout this field book. For more comprehensive inventories of GMF biota, please see Appendix II.

Eastern Hemlock (*Tsuga canadensis*)

A conifer in the pine family (*Pinaceae*) whose branches bear rows of two-ranked, flattened needles, and tiny cones. It is often a large tree, 60-70 feet tall, though it can grow much taller (up to 160 feet) given time and appropriate conditions. The canopy is often very deep, with many active branches growing beneath one another far down the trunk. The bark is brownish in scaly blocks on younger trees, and grows gray and furrowed as they mature. Extremely old (250+ years) hemlocks can be identified by the presence of crustose (crusty, hard to peel off) lichens, which accumulate on aged trees after tannin production in the bark begins to decrease. The hemlock varnish shelf (*Ganoderma tsugae*) is a conspicuous species of bracket fungi that grows almost exclusively on hemlocks, and is a common sight in Great Mountain Forest.

Eastern hemlocks grow prolifically on moist rocky ridges, at the wet bottoms of ravine slopes, and along cool forest streams. It is an extremely shade tolerant species, growing slowly in the understory beneath faster growing pines and hardwoods for many years before ascending to canopy dominance. Once there, the intense shade created by their deep evergreen crowns tends to inhibit the regeneration of other species. Hemlock forests

A tall hemlock-dominated canopy.

Hemlock varnish shelf growing on a recently fallen trunk in GMF.

Close-up of hemlock needles showing evidence of hemlock wooly adelgid infestation.

thus often have very open understories devoid of even an herbaceous layer, either growing in near monoculture stands or alongside American beech and other hardwoods.

Hemlock has limited demand as a timber product, though makes serviceable boards when grown in the right conditions. Open grown and older growth hemlocks are prone to "shake"—trees with ingrown branches that cause the trunk to shatter when felled. Eastern hemlock is the only unusable tree species in charcoal production. As a consequence, certain stands were left untouched by the industry in the Great Mountain Forest region, while others were cut down and left to rot in order to promote

the growth of more favorable species. The extremely high tannin content in the bark made hemlock trees useful for tanning hides, and there was a peak in their use for this purpose throughout the 19th century. Winer (1955) surmises that hemlocks are extremely susceptible to fire, and cannot regenerate in recently burned areas. He believes this accounts for their conspicuous absence in certain areas of the Great Mountain Forest, where runaway brush fires started from charcoal hearth sparks were a common occurrence.

The hemlock wooly adelgid (*Adelges tsugae*) is an invasive insect species that is decimating hemlock species across their native range. It was introduced to eastern North America from Japan in the early 1950s, where it has slowly spread to infect hemlocks growing in 11 states. The adelgid belongs to the insect order Hemiptera, which includes the aphids, white flies, and scale insects. They reproduce asexually, laying hundreds of fuzzy eggs on the undersides of hemlock leaves—the telltale sign that a tree has become infested. The adults feed on the phloem sap of new shoots, preventing fresh growth and inviting desiccation and infestation by other pathogens. In this way, untreated trees are often killed within 5-10 years. The hemlock wooly adelgid is common in the Great Mountain Forest, though many areas are not yet affected. The harsh winters of the past several years may have helped reduce adelgid populations in the region, but the long term effects are still expected to be catastrophic. As it is the single most abundant tree species of the Great Mountain Forest, its eventual extirpation will certainly result in a dramatic restructuring of the canopy composition in the coming years.

LEFT: Chestnut stump (right) sprout on Chattleton Road.
RIGHT: Standing with a very large American chestnut, discovered within a group reserve in one of the recent harvests along the Number 4 Trail.

Eastern hemlock currently accounts for 40% of the canopy cover at the Great Mountain Forest (GMF Stewardship Plan 2010). It is most abundant in lowlands and mesic areas, especially along streams. There are several impressive old growth stands throughout the Norfolk side of the forest, some of which may be 400 years old (see Natural Communities 7: Old Growth). Research on the lifecycle and field adaptation of the hemlock woolly adelgid at GMF is currently being conducted by Dr. Carol Cheah of the Connecticut Agricultural Station.

American Chestnut (*Castanea dentada*)

Once a massive tree, frequently 100 feet tall with deep, furrowed bark. Its leaves are long, with many pronounced teeth, growing alternately in two ranks down each twig. Superficially they resemble the leaves of the American beech (*Fagus grandifolia*), with whom it is related. However, the beech leaves tend to be shorter and more egg shaped, with blunter, less pronounced teeth. Today the American chestnut is most commonly found as an understory multi-trunked shrub, often co-occurring with oaks.

The American chestnut was once the most common tree in many areas of its natural range—accounting for as much as 25% of total canopy cover in the southern Appalachian Mountains. The strong, rot resistant, yet relatively light wood was used for almost everything: construction timber, fence posts, telephone poles, caskets, crates, and all manner of furniture. The high tannin content makes the wood resistant to warping, and the bark was often used as a means of tanning hides into leather. The sweet, plentiful, protein-rich nuts, so abundant every fall, were a major food resource for Indian groups, pioneer mountain families, and animals alike.

In 1904, a pathogen known as the chestnut blight (*Cryphonectria*

parasitica), was accidentally introduced to the Bronx Botanical Garden from a shipment of Japanese chestnut trees. The airborne fungus enters existing wounds in the tree's bark and works its way through the vascular tissue, which ultimately cuts off the flow of nutrients and kills the tree. The blight quickly spread across the entire native range of the American chestnut, killing an estimated 4 billion trees within a matter of decades. State and local efforts to treat infected trees and create quarantine zones were universally unsuccessful. Salvage logging to harvest healthy trees before they succumbed to the disease was already widespread by the 1910's, and likely destroyed many individuals that may have had an innate resistance to the blight. Salvage logging of large living trees occurred in the Great Mountain Forest in 1917 and 1918, and standing dead trees (snags) were cut in 1939 and 1940 to make fenceposts (Winer 1955).

Because the blight does not destroy the root system, chestnut trees are able to re-sprout from the base. These grow as multi-trunked shrubs for 5-10 years before they become infected, senesce, and re-sprout once more. Chestnut stump sprouts are common in the Great Mountain Forest, particularly along both sides of Chattleton Rd. heading south from Yale Camp. There is a very large individual (around 15 inches in diameter) near the Number 4 Trail, in the harvest area across the road from Wapato Lookout.

The American Chestnut Foundation was established in 1983 with the goal of using selective breeding to restore the species. By hybridizing American chestnuts with Chinese chestnuts—which are resistant to the blight—and backcrossing those offspring with surviving American chestnut individuals for five generations, the resulting progeny will contain individuals that have 94% American chestnut DNA yet still possess resistance. Nuts of the first individuals of this fifth generation of backcrosses were collected in 2007, and are now being planted in experimental plots throughout their native range. One of these sites is a small plantation in the Great Mountain Forest, which was planted in 2010 (see Research Sites 3).

Mountain Laurel (*Kalmia latifolia*)

A common shrub in New England, with multiple, twisted trunks and shiny, pointed, leathery leaves. It often grows in very dense patches, shading out any undergrowth with its thick evergreen foliage. In Connecticut, mountain laurel flowers in early to mid-June, with a lavish display of white to pinkish bowl shaped flowers arranged in heavy, branching clusters.

As an evergreen plant, mountain laurel is effective at inhibiting the regeneration of plants beneath it. Like many of its fellow species in the Heath family (*Ericaceae*), mountain laurel thrives in nutrient poor environments. Logging crews, after completing a timber harvest, are often instructed to crush any nearby patches of mountain laurel with their machinery so as to give regenerating tree species a chance to sprout and grow above the shrub layer. It is often found in moister areas, even creeping into the understories of wooded swamps and the edges of bogs.

Given Great Mountain Forest's extensive history of exploitation in the 18th and 19th centuries, it is not surprising that mountain laurel grows in abundance here, often concentrated around old homesteads and charcoaling sites. Though mostly a nuisance to foresters, the species does have notable qualities. The flowering during the early summer is a beautiful sight to behold. The Cherokee prize the wood for decorative woodcarving, and historically crushed its leaves to use as a salve for wounds and skin irritations. Its best known use today is as the source of material for laurel wreaths during the Christmas season.

Mountain laurel in full flower in June.

Close-up of red spruce cones and needles.

Red spruce bark detail.

Red Spruce (*Picea rubens*)

A medium sized tree (60-70 feet) more commonly known in northern New England and Nova Scotia. Like all spruces, the growth form is straight and pyramidal, branches tapering evenly all the way up the trunk. The short needles, unlike those of the hemlock, are short and prickly, and grow all the way around the orange-reddish twigs.

Though typically a mountaintop species throughout most of its natural range, in Great Mountain Forest red spruce is found almost exclusively in forested wetlands, co-occurring with red maple and black gum in the canopy. It is distinctive here for being near the southernmost extent of its range within New England. Though never the component of a commercial harvest here at GMF, it is frequently cut farther north for boards and pulp. The quality resonance of its heartwood also makes red spruce a preferred species for the making of musical instruments, chiefly violins.

Japanese Barberry (*Berberis thunbergii*)

A small shrub (1-3 feet) with thorny, yellowish branches and small pointed leaves. In the fall it produces small, oblong, red berries that persist late into the fall as the leaves turn a distinctive bright yellow.

Japanese barberry is a common shrub planted on lawns, landscaping, and in ornamental gardens. It was originally introduced to compete with the European barberry, which it has now effectively replaced. It is found most densely in GMF in lowlands and next to running water, especially in areas of former human habitation. Thick pockets of infestation occur in the low elevation pine forest to the south of Canaan Mountain Rd, and in the wetland to the east of the "Raggy Lot" spruce plantation off of Jean's Trail. According to GMF forester Russell Russ, barberry was planted heavily in the region in the 1960s, to encourage the reintroduction of the wild turkey (though never at GMF).

As a component of their duties over the summer, GMF forestry interns are responsible for conducting surveys along all the major moving water bodies in the forest, noting the location and density of any barberry populations. Current eradication efforts are limited to the prevention of more widespread infestation in new parts of the Forest. This entails manual pulling or herbicide application—both slow, labor intensive processes. In the future, if funding becomes available, a more intensive effort to control the barberry may be undertaken.

In her program on natural dyes, GMF program director Jean

Yellowing foliage in the fall, with persistent red fruits.

Dense Japanese barberry growing into High Pocket Swamp.

Bronson successfully created a rich yellow color by boiling Japanese barberry stems and leaves, which she used to dye mordant treated wool fibers. It is a good example of using creative means to make the most of an invasive species.

Oaks (*Quercus* spp.)

The oaks comprise one of the most diverse genera of tree species in North America. They tend to be large and heavy-wooded as a group, though some, like the local bear oak (*Quercus ilicifolia*) exist as shrubs or treelets. All oaks are wind pollinated by tiny flowers that unfold in the spring along with new leaves, and mature into acorns in the fall.

Oaks in eastern North America are typically sub-divided into two groups. Species in the red oak group (*Erythrobalanus*) have leaves with bristle-tipped lobes, more pointed buds, and tend to have darker and more ridged bark. Species in the white oak group (*Lepidobalanus*) have leaves that lack bristle tipped lobes (usually rounded), smaller and more blunted buds, and tend to have lighter, more blocky and peeling bark. At GMF, four oak species occur frequently, two from each of these groups:

Red Oak Group

Northern Red Oak (*Quercus rubra*): Bark is dark with smooth ridges that form distinctive "silver rivers" in the upper portions of mature trees. Leaves are a smooth green underneath, and on average have shallower lobes and a duller complexion than those of the eastern black oak. Acorns are big with broad, shallow cups that feature tightly laced scales.

Eastern Black Oak (*Quercus velutina*): Bark is gray and blocky (unusual for the group), with less pronounced "silver rivers" above. Leaves have tufts of orange fuzz clustered around the main veins, and on average have deeper lobes and shinier complexion relative to the northern red oak. Acorns are smaller, with deeper caps that feature shaggy scales.

White Oak Group

Eastern White Oak (*Quercus alba*): Bark pale gray, peeling in strips or blocks. Leaves with many deep, rounded lobes. Acorns are narrow, with a shallower cup than the chestnut oak.

Chestnut Oak (*Quercus montana*): Bark extremely blocky with very deep furrows. Leaves lack proper lobes, and instead have rounded teeth that taper to a point at the tip. Acorns are even narrower than the eastern white oak, and have deeper cups.

Oaks are one of the most important (and diverse) tree groups in the eastern deciduous forest. The acorn mast is an important food source for wildlife, and can be eaten by humans if boiled to leach out the tannic acid. Already the dominant tree species in the region for the past 6,000 years, oaks came to occupy the niche of the ecologically similar American chestnut when the latter was wiped out by the chestnut blight over the past century.

Oaks as a group compete well on drier sites, but within the genus tend to be partitioned along a fine moisture and elevation gradient. Of the four common species at GMF, red oak occupies the most mesic sites, occasionally co-occurring with white oak in steeper, rocky woodlands. Black oak and chestnut oak are most abundant on excessively well drained sites, often growing stunted on rocky outcrop ledges and hilltops. Within sub-genera, oaks are well known for hybridization, particularly between red oak, black oak, and the less frequently occurring scarlet oak (*Quercus coccinea*). This tendency to cross-breed helps maintain genetic diversity, which is

Young black oak leaves in early spring.

White oak bark, with bear claw markings.

Multi-trunked red oak, sprouted from a long ago logging. By coring and aging one of the boles, one can estimate the date of the harvest.

advantageous in a frequently shifting environment (i.e., one repeatedly prone to the advance and retreat of massive glaciers).

Oak lumber is prized for a number of different uses, including furniture, firewood, and construction timber. White oaks in particular produce small balloons (called tyloses) in their inactive vessels to restrict water flow and prevent the spread of pathogens. This makes their wood incredibly leak proof, hence why white oak is the choice species used to make wine barrels and ship hulls. Red oak is the number one timber species harvested at GMF. It is no coincidence that the bulk of harvesting at GMF occurs along the Number Four Trail, where red and white oak grow most abundantly, or that the prescriptions themselves are specifically tailored to promote the regeneration of oak seedlings.

Eastern White Pine (*Pinus strobus*)

Tall coniferous trees with flakey bark plates and branches growing in whorls up the trunk. The only representative of the sugar pine group (subgenus *Strobus*) in the eastern United States, with needles in packets of 5 and long, slender cones.

The eastern white pine grows prolifically in a variety of habitats, most notably sandy outwash soils and rich former agriculture sites.

Emerging white oak leaves.

Classic stand of GMF old field white pine.

Huge trees were once abundant throughout this region, but centuries of harvesting have reduced its size and importance within forest mixtures. Indeed, the old growth white pines were once the tallest trees in the eastern deciduous forest, frequently attaining heights over 200 feet. English settlers made quick work of decimating these giants, using the timber for a variety of uses, whenever it was available. The tall straight trunks were particularly useful as ship masts—a welcome development for the English fleet, which had theretofore been reduced to splicing several smaller trunks together due to their severe timber famine. Though there are many large individuals in places like GMF today, they pale in comparison to the magnitude of their old growth ancestors.

White pine has special significance at GMF as an early invader of old pasturelands. The shade intolerant seedlings are especially adept at competing with the grasses of abandoned fields and forming dense monoculture stands. GMF is dotted with many such sites today, mostly

Needle detail. Species in the white or sugar pine group have five needles per packet, unlike those of the yellow pine group that have two or three.

Multi-trunked white pine, resulting from pine weevil damage at a young age.

LEFT: Black birch, growing atop a decaying stump.
RIGHT: Paper birch, starting to show the papery, peeling bark that distinguishes it from Gray birch, once grown to a certain age.

Yellow birch, sporting Chaga fungus.

on the Canaan side. They were among some of the earliest harvests done at GMF in the 1940s, and are still managed today in some instances (see Forest Management Sites 5: White Pine Thinning).

These densely packed old-field stands are often prone to attack by the white pine weevil (*Pissodes strobe*). This insect preferentially feeds on the dominant shoots of trees, causing them to grow multiple trunks. Aside from making trees non-merchantable as timber, the multi-trunked growth form makes the adult trees more susceptible to damage from snow loading and windthrow.

Birches (*Betula* spp.)

Fast growing trees with waxy, often papery bark. Twigs with fat buds arranged in a distinctive zig-zag pattern, aromatic when snapped. Leaves simple, often egg shaped, with many teeth. Four species occur at Great Mountain Forest, varying in abundance:

Black Birch (*Betula nigra*): Dark bark, breaking into thin plates on older trees.

Yellow Birch (*Betula allegheniensis*): Yellowish, thin papery bark that peels off in shaggy strips.

Paper Birch (*Betula papyrifa*): White, papery bark that peels off in sheets.

Gray Birch: (*Betula populifolia*): White to pale gray bark, non-peeling, usually a smaller tree than the other species, with distinctive aspen-like drooping tip leaves.

As a group, the birches are strongly associated with the northern hardwood forest, often occurring in mixtures alongside hemlock and beech. With a fast growth rate and copious wind dispersed seeds, birches are aggressive colonizers in newly opened growing spaces. They also make good toothpicks and tongue depressors because the wood is flavorless. Occasionally, well formed individuals are used to make veneer paneling.

The four birch species of GMF are mesic loving species (yellow birch slightly wetter, black birch slightly drier), and as such are spatially partitioned in the forest according to their relative tolerances to shade. Gray birch is the most shade intolerant, followed by paper birch, yellow birch, and black birch. Since so much of GMF is now later successional forest, it makes sense that the relatively shade tolerant black birch is by far the most common species. The growth shoot is very sensitive to light, and the tree will twist and grow crooked through dense hemlock stands in order to break through to the canopy.

Chaga (*Inonotus obliquus*), a canker forming fungus, occurs exclusively on species in the birch genus. Though not exceedingly common, it can often be found growing on trees at GMF. The species is used to make a medicinal tea in Eastern European folk medicine, said to be effective in reducing inflammation, inhibiting tumor growth, and even extending the human lifespan.

Maples (*Acer* spp.)

A varied genus of trees, united most visibly by their trident shaped, lobed leaves, and samara fruits ("helicopter seeds"). Three species occur commonly at the Great Mountain Forest:

Sugar Maple (*Acer saccharum*): Smooth, gray bark on saplings turns corky at the pole size, then deeply and irregularly plated and furrowed on larger trees. Leaves are 5-lobed with intermittent teeth around the edges.

Red Maple (*Acer rubrum*): Similar bark to sugar maple on young trees, but plates on older trees are shaggier and composed of papery layers. The bark develops a distinctive target-shaped canker in later years. Leaves vary dramatically by region across its wide range, but tend to be small relative to others in the Acer genus, usually with reddish leafstalk and three main, coarsely toothed lobes.

Striped or Moose Maple (*Acer pensylvanicum*): A small tree relative to the other two maple species at GMF. Bark is distinctively smooth, in green, gray, and orange stripes running horizontally up the trunk. Leaves are very large with three main lobes and many fine teeth along the margins.

These three maples vary widely from one another in regard to ecology and growth form (as opposed to the more internally homogenous oak and birch genera). The striped maple is a small understory tree that thrives in rich, cool, moist sites (seen frequently on the Sam Yankee Trail). Sugar maples can be massive trees, existing primarily on well drained mesic soils in slopes and uplands. Red maple is a study in broad ecological amplitude—it lives handily in a variety of extreme environments throughout GMF, from acidic bogs and swamps to excessively well drained rocky outcrops. All are fairly shade tolerant, particularly the sugar maple which is roughly on par with American beech and hemlock.

Of the three species, sugar maple is by far the most commonly

LEFT: Mature sugar maple, featuring irregular, plated bark.
RIGHT: Red Maple bark detail.

utilized, though red maple is sometimes used for flooring., but it is highly prized for a number of products. Among the many commercial uses for its lumber is the backing for wooden musical instruments, often favored for the "bird's eye" grain in some individuals. Though rarely co-occurring in the forest, for hundreds of years maples and red spruces have been fused together as the main body components of violins. The spruce is used as the front and sound post for its resonance qualities, while the maple forms the back and fingerboard for structural integrity.

Sugar maples are also the primary species used in the production of maple syrup. Many early New England farmers would leave a few large trees near their houses for the purpose of sap collection in the late winter. Many of these legacy trees are still around to mark former homestead sites, grown twisted and gnarly with open grown characteristics. Many sites at GMF are managed exclusively for promoting the growth of sugar maples for sap production (see Forest Management 8: Maple Sugaring Operations).

American beech inflicted with beech bark disease. The normally smooth gray bark becomes pocked with holes and fissures as the fungus spreads through the tree's vascular system.

American beech, bark and leaves.

American Beech (*Fagus grandifolia*)

Tall and with massive trunks, the American beech is atypical in the eastern deciduous forests for its completely smooth, light gray bark. In most other tree species in this area, the cracking of bark into distinctive plates, shaggy strips, or shingles is thought to help dissipate heat from sunlight more readily by exposing bark units with smaller surface areas. This need is particularly pertinent during the winter months, when there are no leaves to block the path of sunlight to the bark. Since it lacks modeled bark, American beech it is thought that it accomplishes heat dissipation by producing light colored bark, which reflects more sunlight. Another theory suggests that since beech is of tropical origin, the smooth bark may have discouraged the growth of epiphytic plants from growing up the trunk.

American beech is extremely shade tolerant, roughly on par with eastern hemlock and sugar maple. The egg shaped leaves are pointed, with an overall more rounded shape and less distinctly pronounced teeth than the related American chestnut. Hanging dead leaves are often retained on branches throughout the winter, which is another key feature for identification.

Beeches are common at GMF, growing often in rich, well drained soils. The species is a key constituent of the northern hardwood forests, co-occurring frequently with hemlocks. A prolific stump sprouter, American beeches often grow in dense clonal thickets, particularly in former harvest ve more desirable timber species like oaks a chance to regenerate is a prime concern of GMF foresters.

Coppiced shagbark hickory.

Beech bark disease is another entry in the growing list of tree afflictions. The beech scale insect Cryptococcus fagisuga was accidentally introduced to Nova Scotia in 1890, and it has subsequently spread across eastern North America. Young larvae feed on beech phloem by piercing the bark with their strong stylets. The holes they leave behind serve as a vector for two species of airborne fungi (*Neonectria faginata* and *Neonectria ditissima*) which invade the tree and kill it slowly. Though not yet spread everywhere at GMF, there are many areas where the disease is abundant, such as along the Charcoal Pit Trail on the northeastern side.

Hickories (*Carya* spp.)

Trees with hard wood, crooked twigs, and alternate, pinnately compound leaves. Two species are the most common at GMF:
Shagbark Hickory (*Carya ovata*): mature bark in strikingly shaggy strips, unmistakable for any other tree species. Leaves usually with 5 broad leaflets.
Pignut Hickory (*Carya glabra*): mature bark in tight interlacing ridges, like a less deeply furrowed ash. Leaves usually with 5-7, skinny leaflets.

The hickories at GMF are almost always relegated to dry hilltops and well drained talus slopes, often co-occurring with Pennsylvania sedge (*Carex pennsylvanica*) and hophornbeam (*Ostrya virginiana*). Though not often harvested at GMF, the extremely hard wood has extremely high thermal output as a firewood. Other historical uses include door hinges, cabinetry, hardwood flooring, and barrel hoops—pretty much anything that needs to serve as a solid fastener. The lipid-rich nut masts are a major food source for many forms of wildlife, and can be eaten by humans as well—the closely related pecan (*Carya illinoiensis*) being the most commercially popular today.

Hay-Scented Fern (*Dennstaedtia punctilobula*)

This plant is a small woodland fern, regularly growing only about 50 cm tall. The fronds have small, twice divided feathery leaflets, distinct from the many other fern species at GMF by the fact that they grow singly instead of centered in clumps. When in doubt, try crushing the leaves and

Hickory nut husks.

giving them a smell—the scent of damp hay confirms identification, as the common name would suggest.

Though native to the region, hay scented fern is extremely effective at impeding forest regeneration for long periods of time. Spreading quickly via spores and underground vegetative growth, the fronds spread rapidly in light opened areas, browsed by no herbivore, unlike the unfortunate tree seedlings of which are often fond forage. Though such a site appears verdant with its thick carpet of vegetation, it is in fact in a state of suspended forest development. GMF forester Jody Bronson refers to it as "The Great Green Lie." Places to see hay scented fern in abundance include recent harvest sites, such as the NRCS Bird Habitat Cut (Forest Management 9).

Eastern Newt (*Notophthalmus viridescens*)

The prototypical newt species of New England, with three life stages. In the aquatic larval stage individuals are long and brown, with distinctive red feathery gills. During the red eft stage (most commonly seen) the eastern newt lives on land, and has bright orange skin with up to 21 dark spots. In the final phase, adults return to the water, growing a larger tail for movement and turning an olive-green color.

The eastern newt is by far the most common amphibian at GMF and the broader eastern region. It is thought that the land stage allows for outcrossing between ponds, ensuring greater genetic diversity. Preferring moist, muddy environments as they traverse the long distances between wetlands, flushes of newts can be seen out wandering after rain events. In the wet springtime, small ruts and drainage ditches on Chattleton Road and the Number 4 Trail create small ephemeral micro-wetlands in which the young larvae of newts and other amphibian species can flourish.

Moose (*Alces alces*)

The moose is the largest herbivore in Great Mountain Forest. Massive antlers are a distinctive feature, which can spread more than 6 feet across. The broad hooves serve to distribute weight evenly on snowy or muddy ground. The dangling flap of skin on the neck is called a bell, and is

An ocean of hay-scented fern on the Sam Yankee Trail.

Eastern red newt during the red eft stage, when it lives on land.

The larval stage, with distinctive reddish gills.

of unknown utility.

Moose are more closely associated with a northerly range, and have only become common at GMF in recent years. Evidence of their habitation is common in marshy or swampy wetlands, where the tall forage means the tall creatures do not have to bend down so low to feed. Most often this evidence comes in the form of droppings or antler rubbing high on trees, as adult individuals tend to avoid humans, and can move nimbly when it is required. Occasionally, GMF staff have been able to photograph moose at long distances, or get close up shots by setting up motion sensor cameras at strategic locations in the forest.

Several studies, formal and informal had been established at GMF

Young trunk with distinctive antler markings.

A moose seen wandering in a recent GMF harvest site.

A tuft of moose hair found at GMF, likely shed as the result of fighting between two bulls.

to study how their introduction to the environment may impact the local forest ecosystem (see Forest Management 4: Wapato Lookout, and Research Sites 1: Moose Exclosure). Preliminary results show that moose do exert a strong influence on understory regeneration, which may have a bearing on forest management practices moving forward.

White-tailed Deer (*Odocoileus virginianus*)

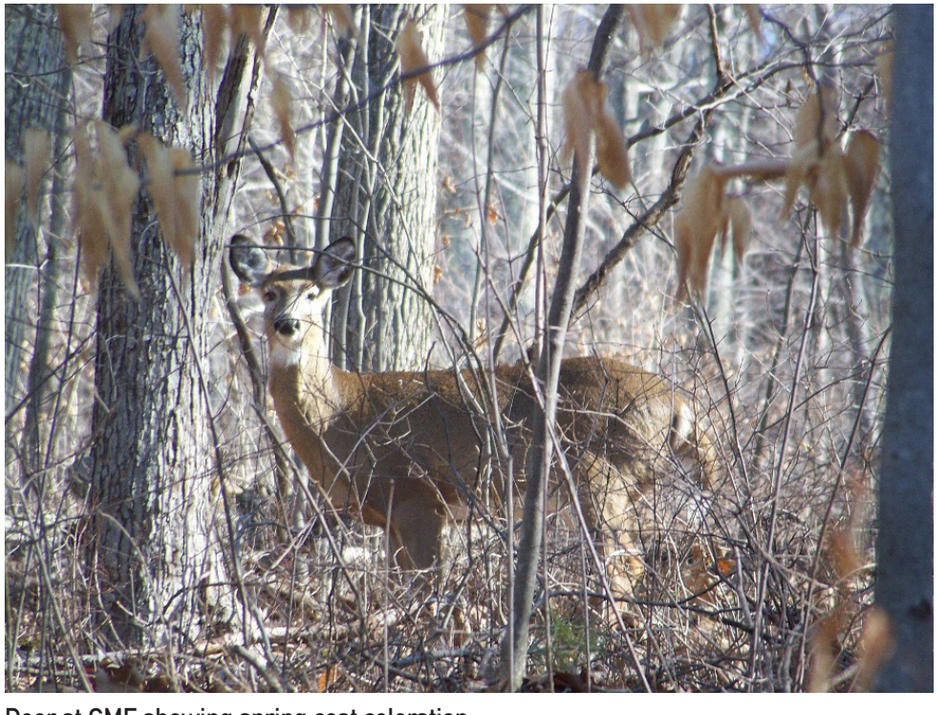
A medium sized deer species, abundant throughout the eastern two-thirds of the United States. Stocky and nimble creatures, covered in a reddish brown coat that turns grayish towards the winter time, while the tails are a distinctive bright white below. Young fawns have distinctive white spots (a la Bambi). Adults frequently weigh around 100 pounds, but can exceed 150 in certain areas.

Deer are present throughout Great Mountain Forest, with ample evidence from scat and rubbing and herbivory damage on young trees. Their proliferation across the broader landscape is likely related to the extirpation of major carnivorous predators from the region, most notably gray wolves and cougars. Damage from herbivory in particular can dramatically inhibit the ability of forests to regenerate, promoting scrubland that may be beneficial to other animal groups. A study at GMF by students from the Yale Forest School investigated the impact of deer rubbing on young trees (Lutz and Chapman 1944). More recent deer research at GMF (Tripler and Canham 1998, Tripler et al 2002, Tripler et al 2005) focuses on the impacts of deer herbivory on a variety of ecosystem drivers, including nutrient availability and forest succession.

GMF currently permits hunting on the property in the fall. The forest is delineated into hunting zones, and hunters are asked to fill out wildlife observation sheets on anything they see while stationed in a particular zone. It is a clever approach to collecting broad sets of data on the abundance and distribution of different creatures in GMF.

Black Bear (*Ursus americanus*)

The black bear is the most abundant bear species on Earth. Once completely extirpated from the New England region, black bears have made a modest recovery, living in sparsely populated forest regions like GMF. They prefer to live in dense woodlands on inaccessible features,

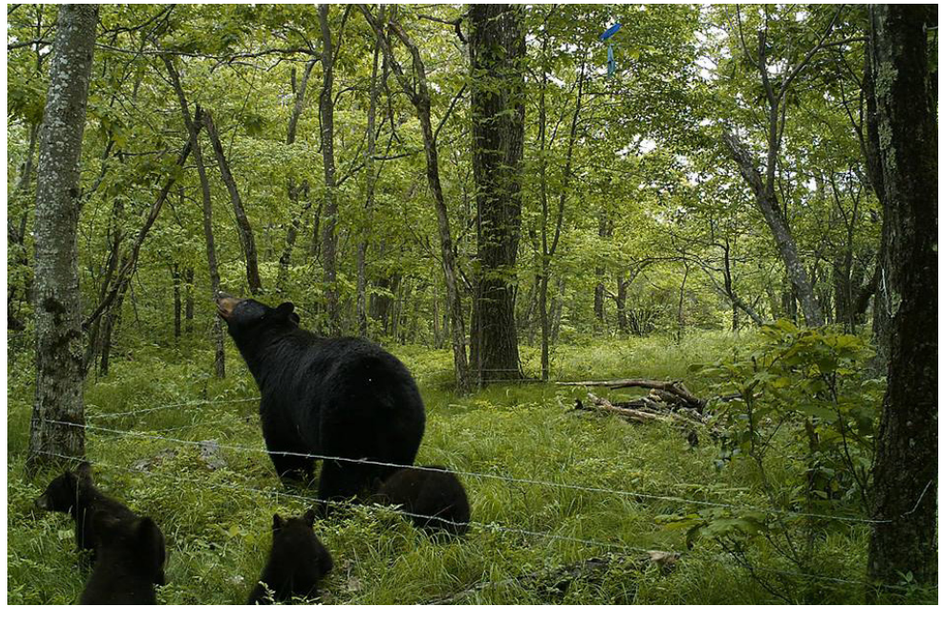


Deer at GMF showing spring coat coloration.

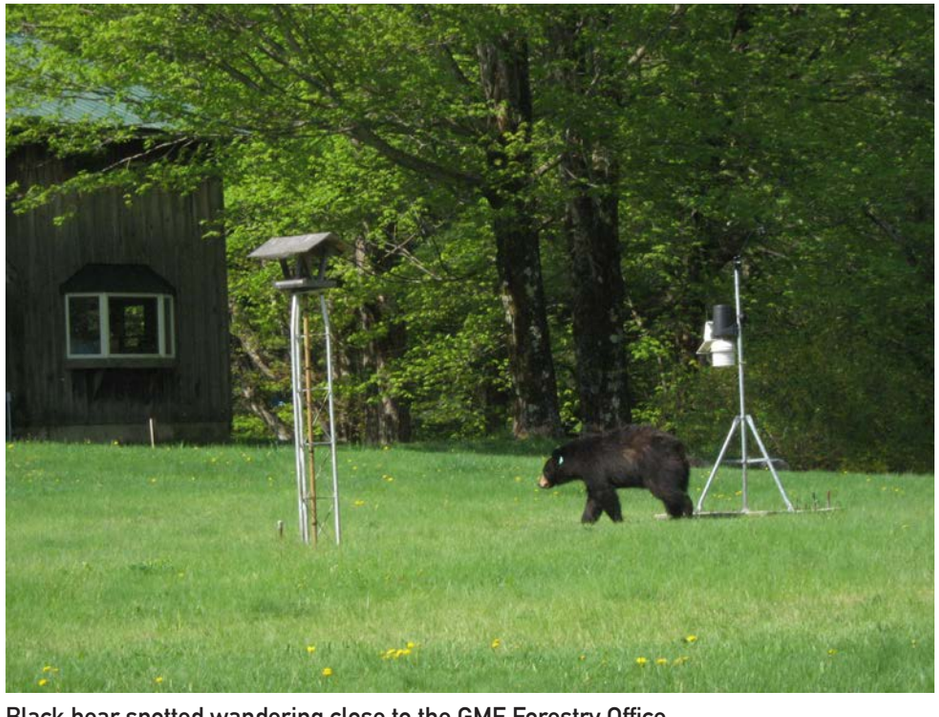
White oak showing evidence of bear claw marks.

which GMF has in abundance. Such sites also tend to contain greater abundances for masting tree species such as oaks and hickories and hardy low bush blueberries, which constitute a major portion of their diet. In our wanderings at GMF, we frequently saw evidence of bear habitation near the crest of high elevation balds, such as Collier's Cliff south of the Yale Camp (see Natural Communities 4: Balds and Rocky Outcrops).

Great Mountain Forest was part of a statewide PhD research study led by Michael Evans of the University of Connecticut, whose goal is to track and map the distribution of black bears across the state. Hair corrals are strategically set up throughout the forest to (harmlessly) catch tufts of fur from bear passerby. By analyzing the DNA in these hairs, the researchers can track the movement patterns of the bears from other hair corrals they have set up throughout Connecticut.



A mama black bear and her cubs, exploring one of the GMF hair corrals. This photo was captured via motion sensor camera, strategically set up to view the plot.



Black bear spotted wandering close to the GMF Forestry Office.

American Beaver (*Castor canadensis*)

Beavers are the ancient water-dwelling ecosystem shapers of GMF. Though North American beavers are of modest size today, fossils of their giant beaver progenitors (*Castoroides ohioensis*) frequently measure in at 1.9 meters in length, and up to 2.2 meters in height. Beavers were the most aggressively sought after species in the early fur trade. Increased pressures from overhunting, coupled with their naturally low reproductive rates, led to their elimination from southern New England by 1660, and near extirpation from the continent.

Today, beavers are rebounding throughout the region, once again shaping entire ecosystems with their dam-building affinities. To learn about the importance of these unique natural communities at GMF, please see Natural Communities 11: Beaver Ponds.

An eagerly gnawing beaver, standing in the shallows of Wapato Pond.

GMF turkeys, now abundant and strutting their stuff. This photo was captured via motion sensor camera, placed along the trail.

Wild Turkey (*Meleagris gallopavo*)

Like many of the preceding creatures, turkeys were once functionally exterminated from the New England landscape. Unlike them, however, the wild turkey has been the subject of many reintroduction attempts by humans, usually with poor results. The released individuals tended to be farm-raised turkeys, who did not fare well on their own. One of the first successful efforts in Connecticut to naturalize game turkeys was actually conducted at GMF in 1975. The large, contiguous, sparsely populated forest was just what the turkeys needed to flourish.

A research report was later conducted at GMF by the state Department of Environmental Protection to determine how turkey populations were faring throughout Litchfield County, Connecticut (Hussein 1979). They employed mark and recapture techniques with radio transmitters to track flock movements, and conducted a census by soliciting sighting reports from various other state agencies and the general public. After 5 years of study, the researchers concluded that populations, though still small, were at last steadily increasing in the region. Today, of course, turkeys are a common sight when driving though Connecticut, often roaming in flocks through woodland meadows.

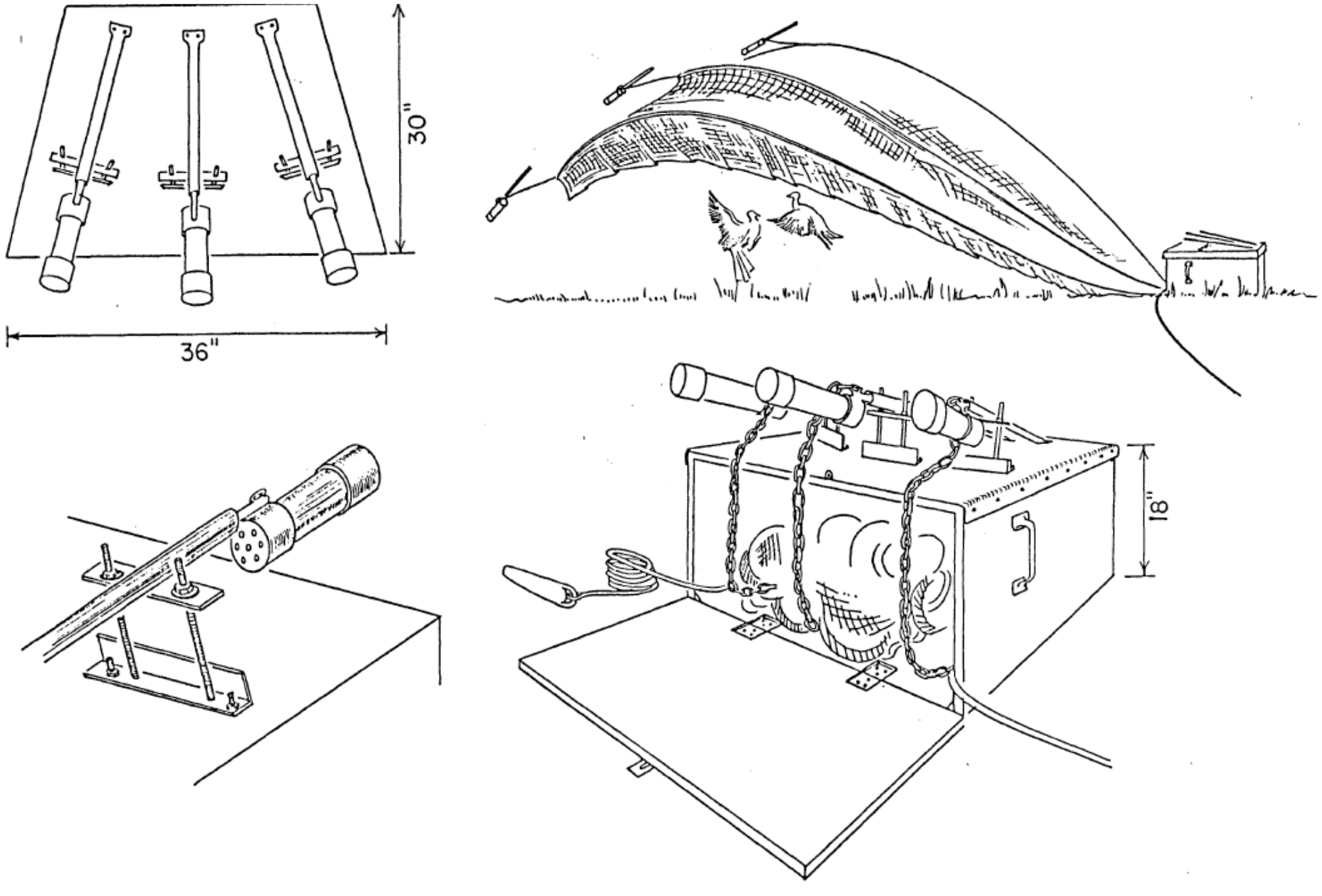


Figure from the turkey reestablishment study, conducted at GMF (Hussein 1979). Above is a schematic detailing the mechanics of the study's box rocket net apparatus, used to capture turkeys for banding and future study. Despite the impressive design, only a few dozen turkeys were caught in this way throughout the five year study. As noted in the published paper: "Poor results were mainly due to poor net construction, which allowed turkeys to escape from the net, in the first year. Malfunction of the propellant, caused by moisture condensation or extremes of temperature, also reduced success."

Resources

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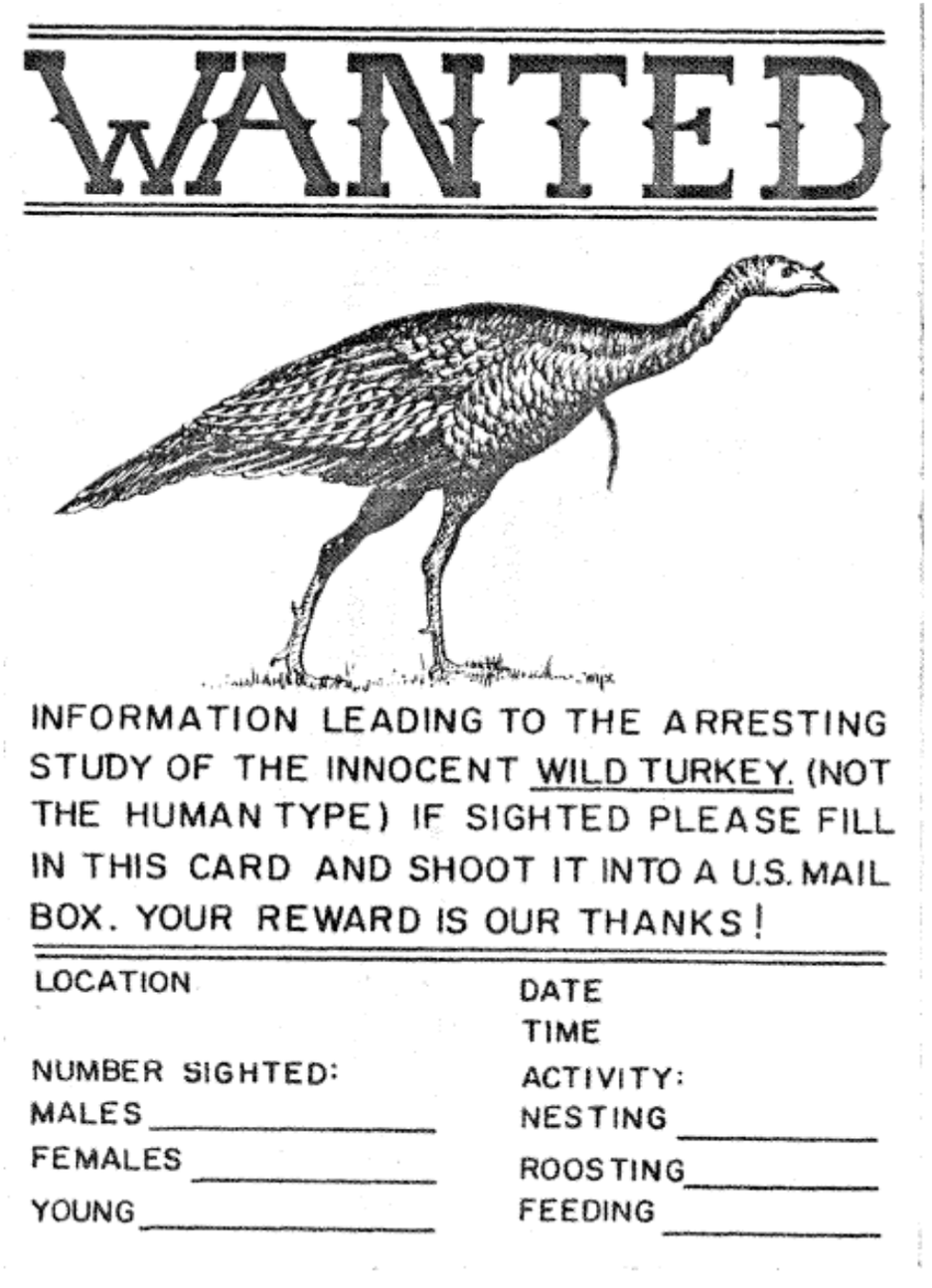

Figure from the turkey reestablishment study, conducted at GMF (Hussein 1979). Picture of the postcard that was mailed to residents in the region of study with the aim of conducting a census of wild turkey populations.