

# **MASSACHUSETTS FORESTRY CONSERVATION MANAGEMENT PRACTICES FOR EASTERN BOX TURTLES**

**Version 2007.1**



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CMPs are meant to serve as guidelines for landowners and consulting foresters to aid in development of M.G.L. Chapter 132 Forest Cutting Plans that are compliant with provisions of the Massachusetts Endangered Species Act (MESA) (M.G.L. 131A) and its implementing regulations (321 CMR 10.00). In some cases, actual practices required for compliance with MESA may differ from published CMPs. Adherence to CMPs during forestry projects shall not necessarily constitute compliance with other state laws, or with local and federal laws.

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## SUMMARY

The Eastern Box Turtle (*Terrapene carolina*) is a small terrestrial turtle recognized by its domed shell and hinged plastron. In Massachusetts, it is found primarily in hardwood/pine forests. It overwinters below ground, often with its carapace just a few inches beneath the soil surface. During its activity season from April until November, it can be found in a variety of upland habitats that include forested and open areas, meadows, scrub-shrub wetlands, and the edges of ponds and streams. Individual behavior ranges from remaining within a small home range area from year to year, to making long-distance movements of thousands of feet.

The primary concern about forestry practices within Eastern Box Turtle habitat is direct mortality of adults, due to crushing by motorized vehicles during harvesting and scarification. To minimize direct mortality, it is required that access to the harvesting site with motorized vehicles be restricted to the winter when the Eastern Box Turtle is inactive. Accordingly, seasonal restrictions will apply to the use of motorized vehicles within Eastern Box Turtle Priority Habitat. If harvesting is planned in such a way as to minimize impacts of motorized vehicles along wood and skid roads and in staging and landing areas, then access with motorized vehicles can occur during a longer time period. Minimizing impacts means restricting motorized access to 25% or less of the total site area. Habitat alterations of concern are suppression of plant growth by wood chips, disturbance of fallen trees, and loss of snags that serve as future sources of large woody debris. Therefore, wood chips must be removed from the site or left in a disturbed area such as the landing; fallen trees should not be disturbed; and some snags should be left uncut.

### The Role of Forestry in Conservation of Eastern Box Turtles

Maintaining forest land in a forested state is vital to conserving viable populations of Eastern Box Turtles. In addition, timber harvesting is often essential for private forestlands to remain economically viable, and if public and private forestlands are to supply renewable wood products to sustain local economies. However, forest managers need to recognize that harvesting can potentially result in direct mortality to individual turtles, and should look to conserve Eastern Box Turtles and other rare species proactively, in order to maintain the integrity of forest ecosystems.

## CONDENSED VERSION OF THE FORESTRY CONSERVATION MANAGEMENT PRACTICES FOR EASTERN BOX TURTLES

For the full version of the forestry conservation management practices including the management objectives and the rationale supporting them, see page 14.

**Species Identification and Biology** - The Eastern Box Turtle is a small terrestrial turtle recognized by its domed shell and hinged plastron. In Massachusetts, it is found primarily in hardwood/pine forests. It overwinters below ground, often with its carapace just a few inches beneath the soil surface, in upland forest. During its activity season, it can be found in a variety of upland habitats that include forested and open areas, meadows, wetlands, and at the edges of ponds and streams. These turtles begin to reproduce between the ages of 5 and 10 years and can live to at least 70 and probably well past 100 years.

**Forestry Practices** - Turtle conservation in general requires minimizing all sources of adult mortality. Eastern Box Turtles specifically require maintenance of forest floor conditions and fallen tree microhabitats. These management practices apply to Eastern Box Turtle Priority Habitat and were made with the assumption that forestry equipment would only enter a site once per decade.

**R** – required management practice

**G** –guideline or recommended management practice

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**R** Motorized vehicle use, consistent with the Massachusetts Forestry Best Management Practices, may only occur between December 1<sup>st</sup> and March 30<sup>th</sup> and preferably when the ground is frozen.

**OR**

Motorized vehicle use, consistent with the Massachusetts Forestry Best Management Practices, may occur between November 1<sup>st</sup> and May 1<sup>st</sup> if the harvest is planned in order to limit the impact of motorized vehicles on wood roads, skid roads, staging areas and landings to only 25% of the Eastern Box Turtle Priority Habitat in the area covered by the forest cutting plan. Woods roads and skid roads shall be marked, motorized vehicles shall be restricted to these roads, and trees must be winched to the road. Forest Cutting Plans that intend to pursue this option shall include a map of the skid and woods road layout, a description of the number and size of staging and landing areas, a list of motorized vehicles that will be used on the site, and a detailed description of the way in which only 25% of the turtle Priority Habitat will be impacted.

**R** Motorized vehicles shall not be used for soil scarification in Eastern Box Turtle Priority Habitat. Scarification with hand tools is acceptable.

**R** If only a portion of the harvesting area falls within Eastern Box Turtle Priority Habitat then the boundary of the Priority Habitat shall be clearly identified and marked prior to cutting plan approval and harvesting. NHESP will indicate the location of the boundary on a map sent with the forest cutting plan review letter to DCR.

**R** If harvesting will occur in filter strips along streams or surrounding vernal pools, the boundary of filter strips along streams and surrounding vernal pools and other water bodies shall be clearly identified by

flagging or marking prior to cutting plan approval and harvesting. The trees that will be harvested within these filter strips shall also be marked prior to cutting plan approval and harvesting.

- R** If wood is chipped, then chips shall be removed from the site or left in piles in an area disturbed by other harvest activities, preferably at the landing.
- G** Use of tracked vehicles, especially rubber-tracked vehicles, is preferable to other tire types in order to distribute equipment weight over a larger surface area and decrease soil compaction.
- G** Where feasible and in accordance with other regulations, leave two snags/acre or older/dying trees uncut in order to provide a source of large woody debris that could be used as future overwintering sites and cooler microhabitat refuges. Small patches of uncut trees around snags may avoid possible safety issues.
- G** Avoid disturbing fallen logs.
- G** Leave limbs and tops in the forest, consistent with other laws, regulations, and forestry best management practices, in order to provide cover areas with cooler microclimates.

Note: Eastern Box Turtles require well-stocked forest patches for overwintering habitat. If harvesting will be heavy over a large area, then additional requirements may apply in order to preserve enough well-stocked forest within the Eastern Box Turtle Priority Habitat.

## SPECIES BIOLOGY

### Species Identification

Eastern Box Turtle Biology Quick Reference Chart	
<b>Adult size:</b> 4.5 – 6.6 in (11 – 16.5 cm)	<b>Hatchling size:</b> $\frac{7}{8}$ – $1\frac{3}{8}$ inches (28-35 mm)
<b>Clutch size:</b> 1-10	
<b>Annual adult survival rate:</b> 95%	
<b>Time to maturity:</b> 5 – 10 years	<b>Life span:</b> at least 70 years and probably well over 100
<b>Shell shape and texture:</b> domed with a central ridge	<b>Coloration:</b> Brownish with variable yellow or orange pattern

The Eastern Box Turtle (*Terrapene carolina*) is a small turtle with a high domed shell. It has a central ridge along the upper shell (carapace) and the lower shell (plastron) is hinged. The carapace is brownish with a variable pattern of yellow or orange that can be made up of rays, spots, bars or irregular blotches. The plastron is tan to dark brown with variable coloration that has no pattern, or has dark blotches or smudges, light colored rays, or dark central areas with branches along the seams between the scutes (scales). The skin of the turtle is black to reddish-brown with yellow, red or orange spots and streaks. Hatchlings have a brownish-gray carapace with a yellow spot on each scute and a central ridge. The

plastron is yellow with a brown central blotch and the tail is long. The bottom hinge only becomes functional once the carapace length reaches 2 in (50 mm). There are a few features that can be used to distinguish males and females. The eyes of males are red, while the eyes of females are more yellowish-brown. The carapace of females tends to be more domed. The plastron of males is concave, while females have a flat or slightly convex plastron. Males have longer and thicker tails and the claws of the hind feet are long and curved, compared to those of females.



### Life Span and Time to Maturity

The approximate age of Eastern Box Turtles can be determined by counting the number of growth rings on the scutes of the plastron or carapace. These rings are laid down annually. Using this method to determine age is only reliable until the turtle has 20 growth rings. After 20 years, estimating the age becomes very speculative because of slowed growth and scute wear. It takes between 5 and 10 years for an Eastern Box Turtle to reach sexual maturity and males tend to mature sooner than females. A study in Maryland has documented

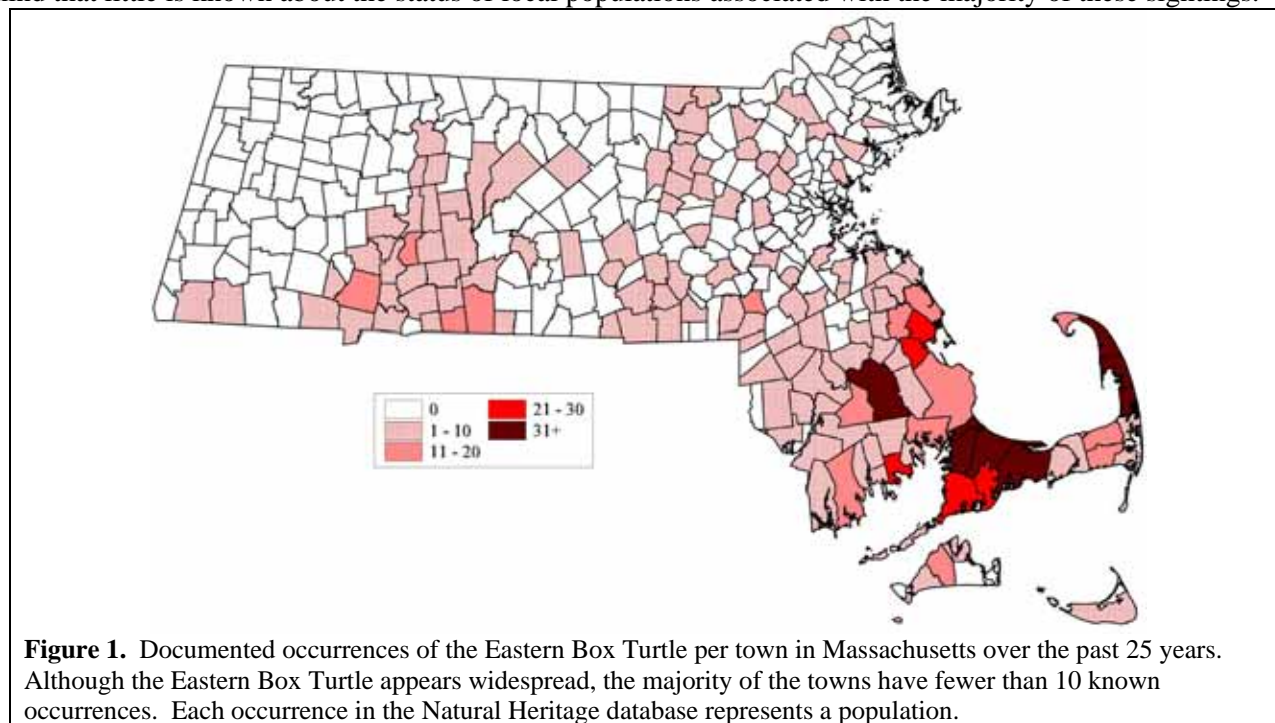
Eastern Box Turtles in the wild that are 70 years old and it is thought that they can live a century or even longer (Hall et al. 1999).

### Similar Species in Massachusetts

The only other species that might be confused with the Eastern Box Turtle at the adult stage is the Blanding's Turtle. However, Blanding's Turtles are typically associated with aquatic habitats and they do not occur in the western portion of the state. The Blanding's Turtle has a domed shell with yellow markings that may be confusing to people not familiar with the two species. The Blanding's Turtle is larger than the Eastern Box Turtle and has a distinct yellow throat and neck. The Blanding's Turtle also lacks the central ridge on the carapace that is present on the Eastern Box Turtle. This feature can also be used to differentiate hatchling Eastern Box Turtles from hatchling Spotted Turtles. The hatchlings of both species have a single yellow dot on each of the scutes of the carapace. However, the carapace of Spotted Turtle hatchlings is smooth, while that of the Eastern Box Turtles has a central ridge.

### Eastern Box Turtle Range

The northern limit of the Eastern Box Turtle's range is in Massachusetts and southern Maine. The range extends south to Georgia, west to Michigan, Illinois, Tennessee and northeast Mississippi. In Georgia, the Eastern Box Turtle is known to breed with the Three-toed Box Turtle (*T. carolina triunguis*), a closely related subspecies. The known occurrences of Eastern Box Turtles in Massachusetts are shown in Fig. 1. Although the number of sightings of Eastern Box Turtles has increased in the state since it was first listed, it should be kept in mind that little is known about the status of local populations associated with the majority of these sightings.



### Eastern Box Turtle Movements and Home Range

Eastern Box Turtles display a range of behaviors with regard to their movement patterns. Some individuals will stay within a small area from year to year (Table 1), while others exhibit long distance movements within a single season (Table 2). A radio-telemetry study in Weymouth, Massachusetts, documented a turtle that moved a straight-line distance of over 6000 feet over the course of its activity period



(Tetra Tech NUS, Inc., 2005). Even over the course of a week, Eastern Box Turtles can move hundreds of feet. A radio telemetry study in Osterville, Massachusetts, found that the maximum distance traveled in a week was 1900 feet (Horsley and Witten, Inc., 2001).

Unlike Wood Turtle movements that occur within a riverine corridor or Spotted Turtle movements that originate from wetlands and vernal pools, Eastern Box Turtle movements do not occur within an identifiable area with regards to any specific habitat feature. This makes it difficult to predict their location on the landscape.

State	Average (Acres)			Maximum (Acres)			#	#	Source
	Males	Females	Adults	Males	Females	Adults	Turtles	Seasons	
Maryland	3	3	-	-	-	-	103	4	Stickel, 1989
Virginia	-	-	3	-	-	6	6	-	Bayless, 1984 as cited by Dodd, 2001
Massachusetts	12	6	-	19	12	-	7	2	VHB/Vanasse Hangen Brustlin, 2000
Massachusetts	-	-	10	-	-	24	6	1	Horsely and Witten, Inc., 2001
New York	-	-	10	-	-	24	23	-	Madden, 1975, as cited in Dodd, 2001
Massachusetts	-	-	20	-	-	84	10	-	Larese-Casanova et al., 2001
Massachusetts	22	41	-	75	156	-	22	5	Tetra Tech NUS, Inc., 2005

**Table 1.** Summary of Eastern Box Turtle home range sizes.

State	Home Range Length (feet)		Distance from Hibernacula (feet)		#	#	Source
	Avg	Max	Avg	Max	Turtles	Seasons	
Maryland	318	571	-	-	11	-	Hallgren-Scaffidi, 1986, as cited by Dodd, 2001
Maryland	411	-	-	-	103	4	Stickel, 1989
Pennsylvania	548	-	-	-	10	3	Strang, 1983
Indiana	569	1401	-	-	109	5	Williams and Parker, 1987
Tennessee	623	869	-	-	4	-	Davis, 1981, as cited by Dodd, 2001
Virginia	699	1197	-	-	6	-	Bayless, 1984, as cited by Dodd, 2001
Massachusetts	1059	1450	1435	3073	7	2	VHB/Vanasse Hangen Brustlin, 2000
Massachusetts	-	-	-	6232	22	5	Tetra Tech NUS, Inc., 2005

**Table 2.** Summary of Eastern Box Turtle home range lengths. Home range lengths represent the farthest distance between two capture points or the maximum dimensions of a home range area calculated using the minimum convex polygon method.

## Life History of the Eastern Box Turtle

Life History Quick Reference Chart		
WHAT	WHERE	WHEN
Overwintering	Terrestrial habitat: forested upland habitat buried in soil under leaf litter, in stump holes, mammal burrows, pits and depressions	Late fall to spring: November to early April
Terrestrial habitat use	Terrestrial habitat: hardwood/pine forests, fields, meadows, scrub-shrub wetlands	Year round
Courtship and mating	Terrestrial habitat: upland forest	April to October
Nesting and hatchling emergence	Terrestrial habitat: open areas with well-drained soils, open uplands, gravel pits, powerlines, fields	Nesting – June Hatchling emergence – late August to October or the following spring
Foraging	Terrestrial and aquatic habitat: forests, fields and meadows, edges of ponds, streams, shrub wetlands	April to November

### Overwintering

Eastern Box Turtles may cease their activity as early as the 2<sup>nd</sup> or 3<sup>rd</sup> week in November but they have been known to be active until the third week of December in Barnstable County, Massachusetts (Ciaranca, 2005, pers. comm.). Eastern Box Turtles do not retreat to wetlands or rivers for overwintering, as do the Wood Turtle or Spotted Turtle. They remain in terrestrial habitat and bury down into the soil beneath leaf litter. They also use stump holes, pits, depressions and mammal burrows for overwintering. Most turtles overwinter with their carapaces just a few inches below the soil surface. Eastern Box Turtles are known to



**Figure 2.** Eastern Box Turtle emerging from overwintering site.

return to the same overwintering site on an annual basis. The turtles become active again in early April.

In order to survive winter conditions, Eastern Box Turtles have developed a tolerance for freezing similar to that of Gray Treefrogs and Wood Frogs. Eastern Box Turtles are the largest known vertebrate to have this adaptation (Dodd, 2001). Glucose is produced in the liver acts as a type of antifreeze to lower the freezing point of the body fluids. The vital organs are the last to freeze and Eastern Box Turtles can tolerate ice formation within their body cavity. Other turtles also have cold weather adaptations. Painted Turtles hatchlings use super cooling to survive below freezing temperatures. However, a Painted Turtle will die if any ice formation occurs within the body cavity.

## Terrestrial Habitat Use

Eastern Box Turtles are primarily terrestrial. In Massachusetts, Eastern Box Turtles are found primarily in hardwood/pine forests. Although they are terrestrial, wet areas such as the edges of ponds, streams and wetlands are important to them for hydration and foraging. They are typically active during the day. In the mornings and during cool weather, they will bask to increase their body temperature. At nights and in hot/dry, conditions they can be found in “forms”. These are depressions in the soil, leaf litter, under brush or other vegetation that take the shape of the turtle’s shell. The density of local populations is variable but this species can be locally abundant with locally high densities (Table 3).

State	Density (turtles/acre)	Source
Massachusetts	0.17	Tetra Tech NUS, Inc., 2005
Maryland	1.5	Swarth, 2005
Indiana	6.7 - 14	Williams and Parker, 1987
Maryland	24.5 - 30.6	Stickel, 1950, as cited in Dodd, 2001
Tennessee	46.4 - 56	Dolbeer, 1969, as cited in Dodd, 2001

**Table 3.** Density of Eastern Box Turtles in terrestrial habitat.

## Reproduction – Courtship, mating, nesting and hatchling emergence

Courtship and mating can occur anytime during the turtles’ activity season. Females leave forested areas and move into open fields and uplands in order to nest. Nesting sometimes occurs in open areas that can be quite small such as along dirt roads. Most nesting occurs in June but it can carry on into early July. Nesting activity is often associated with rainfall. Females will test the substrate with their hind feet prior to digging a cavity. Females lay 1 – 10 eggs; average clutch size is usually 4 or 5 eggs. The eggs are then covered and the site is concealed with small pebbles or nearby plant debris.

Eastern Box Turtles have temperature-dependent sex determination. Instead of the sex being determined by sex chromosomes, it is determined by the temperature at which the eggs are incubated. Eggs incubated at cool temperatures tend to produce males while those at warmer temperatures produce females. Hatchlings emerge 2 ½ to 4 months after the eggs have been laid, in late August to October. Hatchlings are also known to overwinter in the nest and emerge the following spring.

## Foraging

Eastern Box Turtles have an omnivorous diet, consisting of both plant and animal matter. These turtles will eat a smorgasbord of food both on land and in the water. The animals they eat include invertebrates, vertebrates and carrion. The invertebrates they are known to eat include snails, crayfish, slugs, caterpillars, beetles, centipedes, earthworms, spiders, isopods (pill bugs), millipedes, centipedes, wood roaches,

grasshoppers, crickets, flies, ants, termites, cicadas, moths, insect grubs and maggots. Their vertebrate diet includes fish, frogs, toads, salamanders, lizards, small snakes, birds and other turtle eggs. They are also known to prey on the carrion of ducks, green herons, amphibians, mice, shrews, and cottontail rabbits.

Eastern Box Turtles will eat various parts of plants including the flowers, leaves, fruit, stems, roots and seeds. They are seed dispersers for many wild plants. The fruits they eat include blackberries, elderberries, mulberries, wild grapes, plums, strawberries, tomatoes, mayapples and ground cherry. They also eat mosses, grasses and mushrooms.

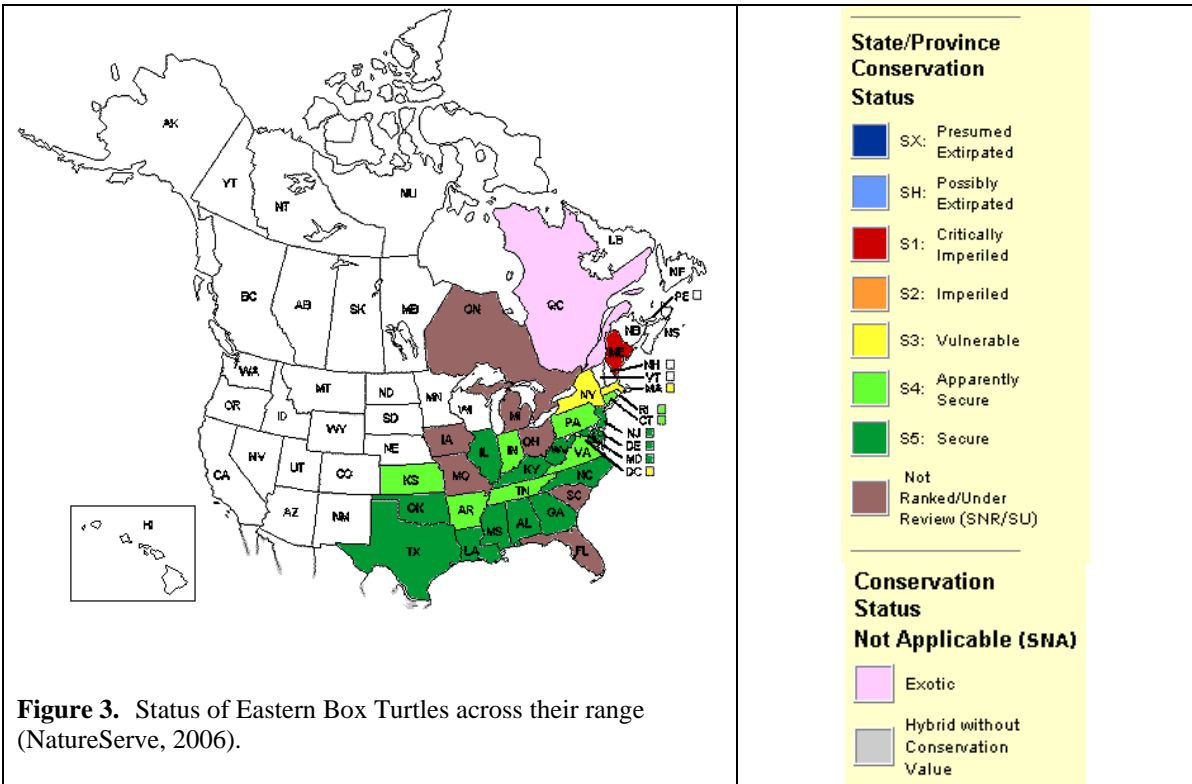
### Predators

Eastern Box Turtle nests are preyed on by skunks, foxes, raccoons, crows and snakes. Juveniles are prey for crows, vultures, barn owls and snakes. Adults can have limb mutilations caused by predator attacks, probably raccoons, skunks, coyotes, dogs or foxes cause these injuries.

## EASTERN BOX TURTLE CONSERVATION CONCERNS

### Status Across Range

Eastern Box Turtle populations are categorized by NatureServe as secure and apparently secure through much of their range. However, Maine populations, which are the most northerly, are state-listed as Endangered. This turtle is a Species of Special Concern in New York, Ohio and Massachusetts. It was originally added to the Massachusetts rare species list because of a lack of documented occurrences. Although the number of records in the state has increased since it was initially listed, it continues to remain a species of concern in Massachusetts for the reasons outlined below.



## **Turtle Population Biology**

Turtle fossils date back over 200 million years to the Late Triassic period. Over time, turtles have evolved a reproductive strategy that makes them vulnerable to human disturbances. Hatchling survival from nests and juvenile survival is very low while the time to sexual maturity is long. These characteristics are compensated by adults being long-lived and reproducing multiple times. Increases in population size tend to take a long time and the potential time to recover from a population decline is also long.

The classic story of the tortoise and the hare is a useful comparison to think of when considering the reproductive strategies of turtles as compared to many mammal species. In the same way that the movement of the individual animals differs, so does the amount of time needed to reach sexual maturity. Hares can start reproducing within a year of being born, while many turtle species take a decade to become a reproductive adult. Therefore, the potential to increase the size of a mammal population such as the hare occurs over a much shorter time frame than for turtles. Similarly, recovery from a population decline can occur much faster for a mammal than for a turtle.

The chances for a long life are much better for the turtle than for the hare. The slow and steady adult turtle lives a much longer life. A long life together with multiple years of reproduction compensates for low rates of hatchling and juvenile survival in turtles. However, this reproductive strategy that has evolved in turtles makes them exceptionally vulnerable to any disturbances that increase the rate of adult mortality. The survival of adult turtles on an annual basis is typically greater than 95%. Long-term studies of turtle populations as well as models of population dynamics indicate that increased mortality rates of adults that are as low as 2-3% annually may be enough to lead to the ultimate loss of a local population.

## **Activities that Impact Eastern Box Turtle Populations**

Habitat destruction, degradation or alteration, and fragmentation all threaten Eastern Box Turtle populations. Turtles are also particularly vulnerable to any activity that consistently reduces adult survivorship on a yearly basis. For example, populations in which females cross roads in order to access nesting habitat are at a higher risk of extirpation because of road kills. The specific activities outlined below are concerns for many turtle species as well as the Eastern Box Turtles specifically.

### **Commercial and casual collection**

Collection for the domestic and international pet trade, as well as for home pets, has contributed to the decline and extirpation of Eastern Box Turtle populations. Between the late 1980's and early 1990's over 100,000 wild Box Turtles from the U. S. were exported to Europe, Japan and Hong Kong (Thorbjarnarson et al., 2000). In recognition that without closely controlled trade, the Eastern Box Turtle could become extinct, it was listed in Appendix II of the Convention on the International Trade of Endangered Species of Wild Flora and Fauna (CITES) in 1994. Although international trade has stopped, domestic and black market collection within the U. S. still continues to the detriment of wild turtle populations.

### **Roadkill**

Mortality of turtles because of road kill is a concern for all North American turtle species. Of particular consequence is that many of the individuals moving across roads and being killed are female turtles looking for nesting habitat. Highways with high traffic volumes become impenetrable barriers that isolate turtle populations and prevent dispersing individuals from maintaining genetic diversity across populations. Even smaller roads with moderate traffic volumes can cause enough mortality to cause a population to decline.

A modeling study that investigated the effects of road density and traffic volumes on turtles found that for land turtles such as the Eastern Box Turtle, roads could contribute enough to annual adult mortality that positive population growth would not be maintained. Mortality rates greater than 5% were determined to cause

decline in the size of local turtle populations based on previous long-term studies of various turtle species (Gibbs & Shriver, 2002).

In Massachusetts, increased mortality rates because of road kill are certainly a concern and have been documented. Nine percent of the records in the Massachusetts Eastern Box Turtle database are based on observations of dead turtles killed on roads.

## **Predation**

In recent decades, raccoon and skunk populations have benefited from the availability of additional food sources such as garbage, bird seed and food for pets, provided by humans in commercial and residential areas. These mammals are efficient turtle nest predators. For turtle populations that border on areas developed for residential use, besides the direct loss of habitat, the increase in nest predators such as raccoons and skunks can be very detrimental to the hatching success of nests and greatly reduces the number of young turtles that are born and survive. Nest predation can destroy the majority of a turtle population's reproductive output on a yearly basis.

## **Mortality and injuries from heavy equipment**

Eastern Box Turtle populations are often found in areas with agricultural activities. Eastern Box Turtles are known to use agricultural fields and utility rights-of-ways for nesting and foraging. Mortality and injuries can result from Eastern Box Turtles being run over by agricultural and other heavy equipment.

## **Forestry**

Maintaining forested habitat is essential for the conservation of Eastern Box Turtles. The impacts of timber harvesting are recognized as having significantly fewer lasting effects as compared to other permanent changes in land use, such as residential and commercial development. However, certain precautions should be taken during timber harvesting in order to maintain the long-term viability of Eastern Box Turtle populations within forested areas.

The primary concern about forestry practices within Eastern Box Turtle habitat is direct mortality of adults due to crushing by motorized vehicles during harvesting and scarification. This could occur at any time during the Eastern Box Turtle activity season since they are primarily terrestrial and it could even occur during the winter since the turtles overwinter in upland forests, usually within a few inches of the soil surface. Habitat alterations that are of concern include suppression of plant growth from wood chips since these turtles forage on the forest floor. Disturbance of fallen trees and removal of snags that serve as future sources of large woody debris are also concerns, because these turtles will overwinter beneath fallen trees, often in the pit created by the root mound. Also, fallen trees are used for cover during the active season.

## FORESTRY CONSERVATION MANAGEMENT PRACTICES FOR EASTERN BOX TURTLES

The following management practices apply to Eastern Box Turtle Priority Habitat. Reducing the frequency that motorized vehicles enter Eastern Box Turtle habitat would be beneficial in minimizing direct mortality of adults. For long-term management, heavier cuts spaced at longer intervals are favored over lighter cuts at more frequent intervals, as long as sufficient well-stocked forest habitat remains. These recommendations were made with the assumption that forestry equipment would only enter a site once per decade. If the time lag between motorized vehicles entering the site is shorter than 10 years, then access to the site should occur only between December 1<sup>st</sup> and March 30<sup>th</sup> and preferably when the ground is frozen. Total impact with motorized vehicles should not exceed 25% of the area.

**R** – required management practice      **G** – guideline or recommended management practice

### Preventing Turtle Mortality

#### Conservation management objective

Avoid direct mortality of Eastern Box Turtles from any timber harvest activity involving motorized vehicles.

#### Rationale

Individual survival of long-lived adults is important since they need to reproduce many times before they replace themselves in the population. Potential mortality of adults can be avoided by using motorized vehicles during the turtles' inactivity period in the winter, when the turtles are underground, or by minimizing the area affected by motorized vehicles.

#### General management recommendations

Adjust the timing of motorized vehicle use for timber harvest activities so that the Eastern Box Turtle is less likely to be directly harmed.

#### Specific management practices

**R** Motorized vehicle use, consistent with the Massachusetts Forestry Best Management Practices, may occur only between December 1<sup>st</sup> and March 30<sup>th</sup> and preferably when the ground is frozen.

**OR**

Motorized vehicle use, consistent with the Massachusetts Forestry Best Management Practices, may occur between November 1<sup>st</sup> and May 1<sup>st</sup> if the harvest is planned in order to limit the impact of motorized vehicles on wood roads, skid roads, staging areas and landings to only 25% of the Eastern Box Turtle Priority Habitat in the area covered by the forest cutting plan. Woods roads and skid roads shall be marked, motorized vehicles shall be restricted to these roads, and trees must be winched to the road. Forest Cutting Plans that intend to pursue this option shall include a map of the skid and woods road layout, a description of the number and size of staging and landing areas, a list of motorized vehicles that will be used on the site, and a detailed description of the way in which only 25% of the turtle Priority Habitat will be impacted.

- R** Motorized vehicles shall not be used for soil scarification in Eastern Box Turtle Priority Habitat. Scarification with hand tools is acceptable.
- R** If only a portion of the harvesting area falls within Eastern Box Turtle Priority Habitat then the boundary of the Priority Habitat shall be clearly identified by flagging or marking prior to cutting plan approval and harvesting. NHESP will indicate the location of the boundary on a map sent with the forest cutting plan review letter to DCR.
- R** If harvesting will occur in filter strips along streams or surrounding vernal pools, the boundary of filter strips along streams and surrounding vernal pools and other water bodies shall be clearly identified by flagging or marking prior to cutting plan approval and harvesting. The trees that will be harvested within these filter strips shall also be marked prior to cutting plan approval and harvesting.
- G** Use of tracked vehicles, especially rubber-tracked vehicles, is preferable to other tire types in order to distribute equipment weight over a larger surface area and decrease soil compaction.

## **Maintenance of Microhabitats**

### Conservation management objectives

Retain microhabitat refuges that are cool and moist on the forest floor by avoiding disturbing fallen logs and leaving snags, as sources of large woody debris. Maintain forest floor conditions.

### Rationale

Overwintering sites may be limited for Eastern Box Turtles. By not disturbing fallen logs and by leaving snags in the forest, overwintering sites and microhabitat refuges will be maintained and created. In order to maintain an optimal body temperature, Eastern Box Turtles need access to habitats that range in temperatures so that they can thermoregulate properly. Ensuring the availability of microhabitats that are cooler is particularly important in heavier cuts, when areas of the forest floor will be exposed to sunlight and increased ground temperatures.

### General management recommendations

Avoid disturbing fallen logs and leave snags as potential sources of future overwintering sites. Leave limbs and tops in the forest. Avoid creating wood chip piles that suppress herbaceous plant and mushroom growth.

### Specific management practices

- R** If wood is chipped, then chips shall be removed from the site or left in piles in an area disturbed by other harvest activities, preferably at the landing.
- G** Where feasible and in accordance with other regulations, leave two snags/acre or older/dying trees uncut in order to provide a source of large woody debris that could be used as future overwintering sites and cooler microhabitat refuges. Small patches of uncut trees around snags may avoid possible safety issues.
- G** Avoid disturbing fallen logs.



**G** Leave limbs and tops in the forest, consistent with other laws, regulations, and forestry best management practices, in order to provide cover areas with cooler microclimates.

Note: Eastern Box Turtles require well-stocked forest patches for overwintering habitat. If harvesting will be heavy over a large area, then additional requirements may apply in order to preserve enough well-stocked forest within the Eastern Box Turtle Priority Habitat.

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## FIGURE AND DATA CREDITS

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