

Timber Rattlesnake Conservation Strategy for Pennsylvania State Forest Lands



pennsylvania

DEPARTMENT OF CONSERVATION
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**Timber Rattlesnake Conservation Strategy for Pennsylvania State
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Introduction

The timber rattlesnake (*Crotalus horridus*), which is a resident of Pennsylvania forests, is currently a candidate species of special concern in Pennsylvania that is regulated by the [PA Fish & Boat Commission](#) (PFBC) (PA Code, Title 58, Chapter 75). Rattlesnakes are also classified as being a reptile Species of Greatest Conservation Need in the PA Wildlife Action Plan (PGC-PFBC 2015). The DCNR, Bureau of Forestry (BOF) recognizes that its forest management program and practices directly impact large parcels of land that serve as habitat for timber rattlesnakes. Because the goal of the BOF is to manage state forest lands using sound ecosystem management in order to maintain their wild character and biodiversity, state forest managers have a unique opportunity to contribute to the conservation and continued survival of this species in the Commonwealth. This document outlines past and current conservation efforts as well as the BOF's conservation strategy for the timber rattlesnake on state forest lands. Through cooperative management practices, state forests can be managed for timber, recreation, and the various other activities that occur on BOF lands while maintaining and even improving timber rattlesnake habitat.

Importance of Timber Rattlesnake Conservation

Historically, timber rattlesnakes have been feared as a dangerous venomous nuisance species and are often killed when encountered by humans. However, rattlesnakes hold historic, symbolic, medical, and ecological importance in our culture and as such are worthy of conservation efforts.

Rattlesnakes are part of our nation's history as they were used as a symbol during the Revolutionary War initiating the battle cry "Don't Tread on Me" (Figure 1). Rattlesnakes are also one of the last remaining species that give a wild, untamed character to the deep woods of Pennsylvania. Other species like gray wolves were extirpated from Penn's Woods long ago.

The venom from snakes like the timber rattlesnake is important for many medical uses. Venom is used to manufacture the anti-venom that treats snake bit victims. Through medical research new beneficial uses are being discovered. Venom is also being used to help the immune systems of patients to fight cancer, increase insulin levels, and treat heart attacks.

Timber rattlesnakes play a critical role within forested ecosystems by eating a variety of small rodents thus helping to control rodent populations. Left unchecked, small rodents can hinder forest regeneration by damaging young seedlings. Large rodent populations

also contribute to the spread of diseases like Hantavirus through their droppings, and Lyme disease by carrying ticks.

Lastly, a large portion of the North American range of the timber rattlesnake occurs in Pennsylvania making it a “Responsibility Species.” Therefore, actions taken to protect rattlesnakes in PA will benefit the species’ global population.



Figure 1 – Gadsden flag used during the Revolutionary War.

Species Summary

The timber rattlesnake is one of three venomous snakes that occur in Pennsylvania. The northern copperhead (*Agkistrodon contortrix mokasen*) and the eastern massasauga (*Sistrurus catenatus*) are the other two venomous snakes present in the Commonwealth. Rattlesnakes are either light or dark-phased depending on the color of their heads. They are long-lived reptiles that hibernate six months out of the year. Upon emergence from hibernation (typically late April-early May), timber rattlesnakes seek sunny, open south-facing rock habitat for basking. In early spring before leaf out, rattlesnakes can also use northerly-facing slopes or mountaintops (Bodar 2016). Pregnant or gravid females remain at basking sites all year until their live young called neonates are born during late August through early September. In early spring prior to traveling to their gestation sites, some gravid females may forage for food (Bodar 2016).

After shedding their skin usually in June, non-gravid females and male rattlesnakes leave basking sites to forage during the summer months in the forest. Known as ambush or “sit and wait” predators, rattlesnakes use their tongues to locate the scent trails of small rodents on a fallen log or branch. Once a scent trail is located, the snake sits with its head on the log or branch until an unsuspecting rodent walks by. The snake strikes, using its venom to immobilize the prey and then it retrieves the dead rodent.

Sexually mature rattlesnakes (5-9 years) mate during the summer months, typically in late July to early September. Female snakes store the sperm until the spring. Rattlesnakes begin returning to their overwintering or denning habitat in September and October. Snakes typically return to the same den location every year (Reinert 2010), but

some males may occasionally seek alternate dens (Bodar 2016). Dens are typically found on side slopes, often under complete forest canopy cover. They can be associated with rock talus or rock formations, but some dens are very inconspicuous with no rocks present. A water source, which provides moisture that helps to keep underground den temperatures constant year round, may be present nearby or at the den site.

Timber rattlesnakes are docile by nature. When encountered in open habitat, rattlesnakes typically give a warning buzz with their rattles and then try to retreat to safety. When rattlesnakes are foraging in the forest, they rely on their camouflage to hide from potential predators and often remain silent until danger passes them by. Bites from chance encounters do happen, but they are uncommon. Information collected by PFBC Waterways Conservation Officers who investigate venomous snake bites suggests that most people who are bitten by venomous snakes are either handling or attempting to pick up the snake.

Additional information about timber rattlesnakes natural history can be found on the [amphibian and reptile](#) pages on the PFBC website and [Rattlesnakes in Pennsylvania State Forests](#) on the DCNR, BOF website. Other suggested readings include Reinert (2010) and Hulse (2001).

Current Range and Status

The current North American and Pennsylvania range maps for the rattlesnake are shown in Figures 2 and 3. While the timber rattlesnake is declining throughout its range, Pennsylvania may harbor the largest remaining populations of this species in North America (Reinert 2005). Timber rattlesnakes are currently listed as threatened in [New York](#), [Illinois](#), [Minnesota](#), and [Wisconsin](#). It is listed as endangered in [New Jersey](#), [Ohio](#), [Indiana](#), [Vermont](#), [Massachusetts](#), and [Connecticut](#), and is thought to be extirpated from [Maine](#) and [Rhode Island](#). The timber rattlesnake is listed as a Watch List (S3) species in both [Maryland](#) and [West Virginia](#).

In Pennsylvania, the timber rattlesnake is listed as a Candidate-Rare species by the PFBC. The status is currently being assessed through the Amphibian and Reptile Technical Committee (ARTC). The ARTC, which is part of the [Pennsylvania Biological Survey \(PABS\)](#), provides expertise and recommendations to the PFBC on species classifications, statuses, and conservation. The PFBC recently proposed to de-list the timber rattlesnake. This petition was accepted by the ARTC in June of 2015. After a public comment period, it is anticipated that the timber rattlesnake will no longer be a state –listed Candidate-Rare species by mid-2016.

However, because the rattlesnake is a “responsibility species” in Pennsylvania, it will continue to be part of the [Pennsylvania Natural Diversity Inventory](#) (PNDI), environmental review process, and the [PA Conservation Explorer](#) tool. For example, if a proposed project (on public or private land) has the potential to impact critical rattlesnake habitat, a series of PFBC recommendations will be generated by the PA Conservation Explorer tool (Appendix A).

On state forest lands, projects with the potential to directly or indirectly impact rattlesnake habitat should be reviewed and assessed through the BOF Ecological Services Section. Further consultation with the PFBC will occur as needed.

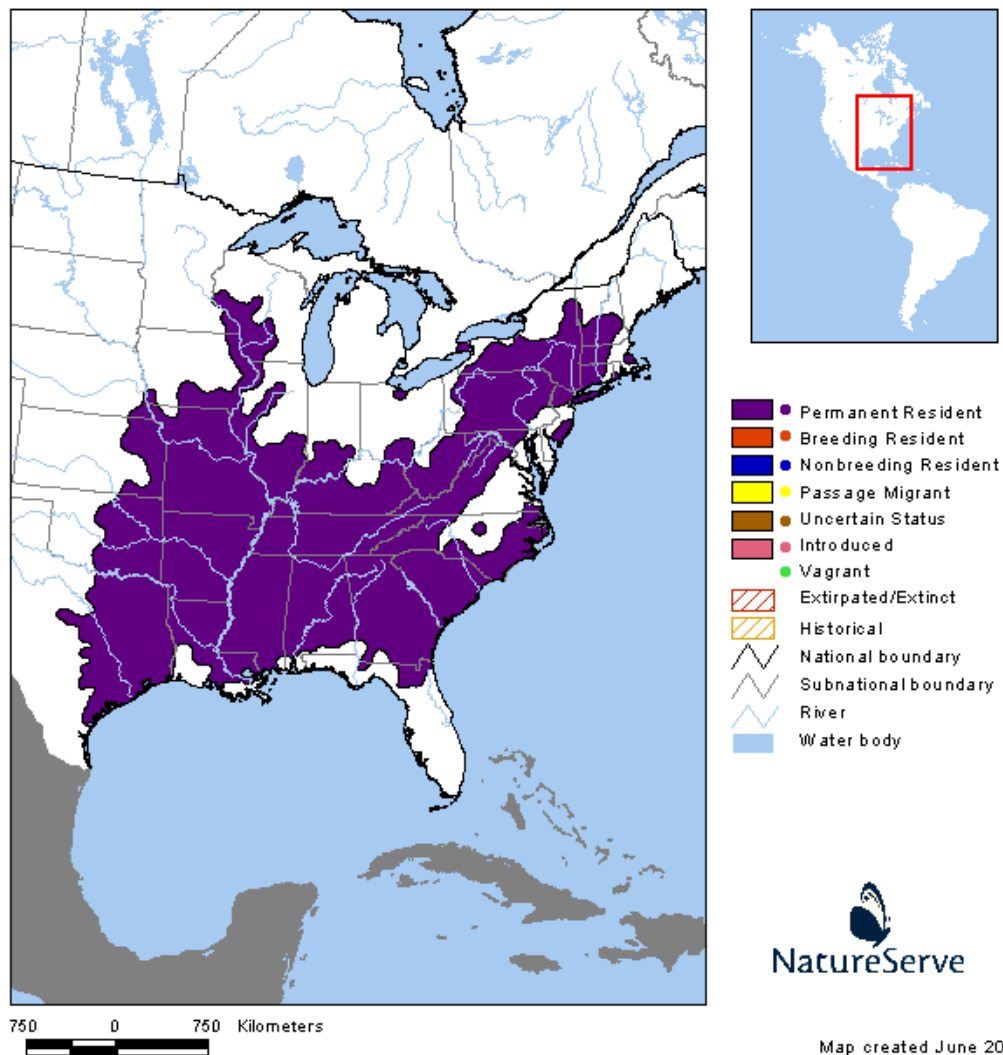


Figure 2 – North American range map of the timber rattlesnake (*Crotalus horridus*)

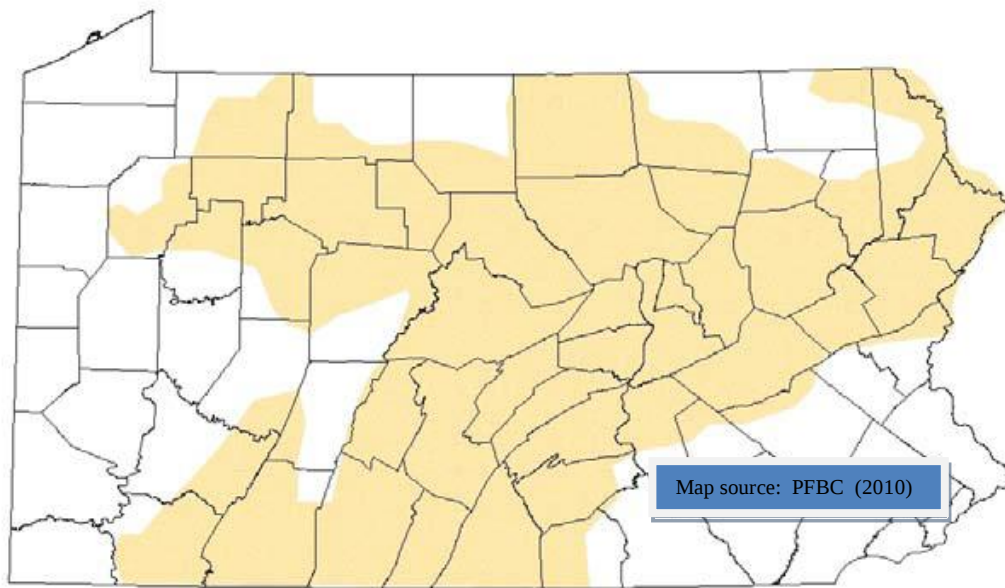


Figure 3 – Range of the timber rattlesnake (*Crotalus horridus*) in Pennsylvania

Ongoing Conservation Efforts

Pennsylvania Fish & Boat Commission Statewide Assessment

Important habitat for the timber rattlesnake includes foraging, basking, gestation, and over-wintering or hibernacula sites (Reinert 2010). As rattlesnakes forage in large forested areas, generally there is no shortage of suitable foraging habitat on most state forest lands. The protection of basking and denning habitat where there are large concentrations of rattlesnakes is more critical. To map these sites and to determine the status of PA timber rattlesnake populations, the PFBC initiated a statewide assessment in 2003. BOF staff participated in this statewide inventory and as a result, many historic basking sites were confirmed and new sites were mapped and documented on the state forest.

A second phase of the PFBC statewide assessment focused on the identification of denning sites or hibernacula. Rattlesnakes typically return to the same dens every year during their lifetime, so den protection is very important. Dens are not easily identifiable because they may be associated with rocks and rock outcrops, or there may not be any rocks present at all. The den entrance, which may be as inconspicuous as a small chipmunk hole, is usually only located by chance during early spring. Because of the difficulty in locating dens, radio tracking is often necessary to track snakes back to a den location. On state forest lands, radio tracking efforts focused on the most at risk state rattlesnake populations such as the isolated population on the South Mountain in the Michaux State Forest. Through radio-tracking, BOF staff helped the PFBC to locate 17 new den sites in the Michaux. These den locations can now be protected and included in District management plans.

Another aspect of the Statewide Assessment was the implementation of Passive Integrated Transponder (PIT) tags for research, identification, and law enforcement purposes. About the size of a grain of rice, PIT tags can easily be injected into timber rattlesnakes that are then returned to their capture sites. The tags act as a lifetime barcode for an individual animal. When a snake is captured by a researcher or a state forest ranger, it is scanned with a PIT tag reader. From the number scanned, BOF staff can contact the PFBC to obtain the information that was recorded for the individual snake such as the location of capture. The focus for PIT tag deployment was once again the South Mountain population, but PIT tags were also used in several other state forests. Because poaching has historically been an issue on the South Mountain, the state forest staff continues to deploy PIT tags in rattlesnakes in the Michaux State Forest.

One of the last and ongoing goals of the Statewide Timber Rattlesnake Assessment is to target basking sites that were identified during field surveys and are currently in need of enhancement. For example, sites that were once open and available for basking snakes, but are currently shaded by trees such as red maple and black birch. By removing a few trees or shrubs, the basking habitat will once again be used for basking by timber rattlesnakes.



Photo1 – PFBC and BOF staff inject a PIT tag into a South Mountain timber rattlesnake.

Threat Assessment

The [PFBC Timber Rattlesnake Action Plan](#) (2011) lists three main threats to PA rattlesnake populations: 1) Habitat loss and alteration, 2) Fragmentation of populations, and 3) Targeted mortality. The main causes of statewide threats are listed in Table 1. The potential threats on state forest land are described in this section.

Table 1 – Primary timber rattlesnake threats and causes outlined in the PFBC Timber Rattlesnake Species Action Plan (2011).

Habitat	Fragmentation	Targeted Mortality
Natural resource extraction and associated infrastructure development	New road construction	Wanton killing and destruction of habitat
Construction of residential and commercial developments	High vehicular traffic on previously low volume roads.	Poaching of individual snakes.
Loss of gestation sites due to forest succession	Other development	
Habitat destruction or disturbance in hibernacula areas		
Increase of human activity within habitat range		

Habitat

On state forest land, some habitat is being converted due to natural resource extraction and the associated infrastructure development. Construction activities not associated with mineral extraction does take place on state forest lands near district offices, maintenance buildings, and recreational facilities. Natural forest succession of basking/gestation sites is also a major concern in the northeast. Denning habitat may inadvertently be destroyed during timber operation, during mineral extraction activities, or other district construction projects. Some forest districts who face heavy recreational pressure or who have more natural gas extraction, experience an associated increase of human activity.

Fragmentation

New roads are constructed on state forest lands for timber sale haul roads as well as for mineral extraction. Some of these new and existing roads are experiencing higher volumes of traffic on state forest lands with heavy recreational use or minerals extraction activities. These disturbances can potentially disrupt migration and isolate rattlesnake populations. Increased direct mortality from vehicular traffic also occurs.

Targeted Mortality

Wanton killing and destruction of habitat has been documented on state forest lands and has been associated with timber sales, minerals extraction development, seismic surveys, recreational users, and camp lease owners.

Poaching or the illegal collection of timber rattlesnakes has historically been an issue throughout the state. Some state forest districts like the Michaux have experienced heavier pressure than other state forest lands. Consequently even with a PFBC timber rattlesnake collection permit, no taking of rattlesnakes is allowed on the South Mountain.

Other Factors

Mortality of timber rattlesnakes on state forest lands can be attributed to factors in addition to those listed above. Because rattlesnakes can be both predator and prey, mortality from other predators can occur. Potential natural predators include coyotes, hawks, owls, turkeys, foxes, bears, weasels, and other snakes like milk snakes or northern black racers (Reinert 2010). Accidental snake deaths can also be attributed to prescribed burning.

An emerging concern is [snake fungal disease](#) that causes skin lesions on snakes was first observed in the eastern U.S. in 2006. It has caused a higher rate of mortality in rattlesnakes, but some snakes are able to recover completely. When snakes with this ailment were tested, a fungus named *Ophidiomyces ophiodiicola* was discovered. At this time, it is not clear if the fungus is the sole cause of the infections, or where the fungus came from. Scientists do not know if the fungus was accidentally introduced or if it was always present, but recently mutated. Related species of fungi have caused similar diseases in both wild and captive snakes (NEPARC 2013). Research needs include determining the current extent of the disease, fungal characteristics, prevention strategies, and treatment options (Allender et al. 2015).



Photo 2 – A young timber rattlesnake being eaten by a black racer.

Timber Rattlesnake Conservation Objectives and Implementation Strategy

Because the Bureau of Forestry manages over two million acres of land, a large portion of the Pennsylvania population of timber rattlesnakes occurs on the state forest. However, many activities including recreation, timber management, and mineral extraction also occur on state forest lands. These multiple uses present a challenge to public land managers who must consider the needs of the public while trying to manage and conserve vulnerable species of concern. The key to the recovery and continued existence of rattlesnakes on forestry lands is to maintain and if possible increase viable, reproducing populations. Further, the BOF must strive to minimize the impact of state forest activities on timber rattlesnakes. These objectives can be achieved by the implementation of the following conservation measures:

- Identify and protect habitat through continued inventory of state forest lands, environmental review, law enforcement, and special protection area designations.
- Minimize impacts (e.g., fragmentation and maintain connectivity of habitats) from state forest operations through the implementation of Best Management Practices (BMPs).
- Maintain, restore, or create habitat on state forest lands in order to conserve and increase viable, reproducing populations of TRs on state forest lands.
- Minimize targeted mortality through education and safety measures.
- Support research projects on state forest lands that will help to advance the BOF's knowledge of how state forest activities impact timber rattlesnakes.
- Update timber rattlesnake management plan as needed through new information gained by research, monitoring, or partner agencies and non-government organizations.

These measures are designed to reflect the goals expressed by the BOF [State Forest Resource Management Plan](#), the PFBC Timber Rattlesnake Species Action Plan (2011), and current knowledge about rattlesnakes. The strategy will be updated as new information becomes available. The details of the BOF's implementation strategy are discussed in the following sections.

Habitat Protection

Inventory

Inventory of sensitive species is essential for the protection and proper management of natural resources on BOF lands. Because timber rattlesnakes are a responsibility species and species of concern, BOF personnel will strive to identify, document, and map critical habitat on existing and newly acquired state forest lands. Data collected will be entered into the PA Natural Diversity Inventory (PNDI) and the [PA Amphibian and Reptiles Survey](#) (PARS). BOF staff will continue to cooperate with ongoing field studies and

field inventory conducted by the PFBC and the [Pennsylvania Natural Heritage Program](#) to map critical rattlesnake habitats in Pennsylvania.

Environmental Review for Bureau of Forestry Projects

Even though the majority of timber sales do not require a permit, BOF staff internally review all proposed sales by conducting a PNDI review as per the [State Forest Environmental Review \(SFER\)](#) guidelines. PNDI reviews are also conducted for proposed recreational projects, prescribed burns, and DCNR construction projects (e.g., construction of a new state forest office). Proposed projects will get different responses on the PNDI receipt depending on where the project is located in relation to critical timber rattlesnake habitat. If the project occurs within supporting rattlesnake habitat (potential conflict), then a set of conservation measures will be given on the receipt. Supporting habitat buffers are drawn by biologists specifically for each timber rattlesnake record in PNDI.

If the project is within a 300 - foot radius of critical habitat (direct conflict), then further consultation will be required. Forest district staff should send direct conflict receipts to the BOF Ecological Services Section. The Ecological Services staff consults with the PFBC for potential PNDI timber rattlesnake conflicts as needed. See Figure 4 for an example map showing the habitat buffers used for environmental review purposes.

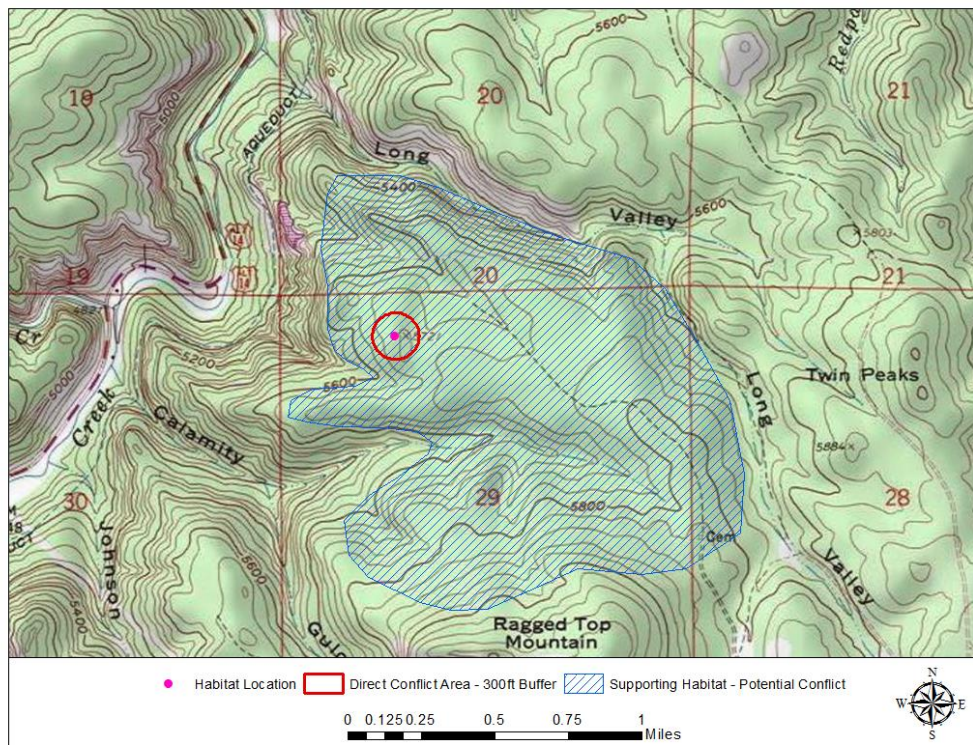


Figure 4 - Example map showing the 300-foot and supporting habitat buffers used to generate direct conflict or potential conflict responses in PNDI.

Environmental Review for Projects on State Forest Lands Initiated by Private Entities

PNDI reviews for projects, such as mineral extraction, on state forest lands that require Department of Environmental Protection (DEP) or other permits are conducted by the private company that initiated the project. The company or contractor for the company works directly with the natural resource agencies to resolve any potential conflicts with species of special concern under their purview. However, these projects are also reviewed by BOF staff. Additionally, some outside projects such as seismic surveys that do not require permits are still reviewed by the BOF.

If additional information indicates that suitable habitat for timber rattlesnakes exists within a proposed project area, then the BOF staff will consult with the PFBC. As a result, BOF or the PFBC may request a timber rattlesnake field survey even though no rattlesnake records were identified for the project area during the PNDI search. The survey would be conducted by a qualified timber rattlesnake surveyor hired by the private company. This survey may be necessary because the PNDI database contains the current known records for species of special concern in the Commonwealth. The data in PNDI is updated on a regular basis, but many portions of Pennsylvania have yet to be inventoried for timber rattlesnake and many other species of special concern.

BOF or PFBC staff may ask for special conservation measures while a private-company operates on state forest lands. For example, the presence of a qualified timber rattlesnake monitor may be required during the construction of a pipeline project.

Law Enforcement

BOF rangers can help to protect timber rattlesnake populations on forestry lands by enforcing all applicable laws and regulations pertaining to rattlesnake protection. State Forest rangers, Waterways Conservation Officers (WCOs), PFBC biologists, state forest users, and BOF district or Ecological Services staff can assist with the identification of critical habitat in each district that may be located in public high use areas. Habitat that may be vulnerable to poaching or wanton mortality can be monitored through the use of hidden trail cameras. Monitoring operations can be coordinated with PFBC WCOs and adjacent landowners such as the PA Game Commission. Lastly to aide law enforcement, PIT tags will continue be deployed in timber rattlesnakes in special protection areas such as the Michaux state forest.

Special Protection Areas

Several areas on state forest lands have been designated for special protection by law. The BOF staff and law enforcement staff will assist the PFBC by posting signs in these areas, reporting illegal activity, and enforcing the appropriate laws when necessary. Additional tracts of BOF lands may be designated as protection areas at the discretion of the district forest manager. The following areas are currently designated for special protection:

South Mountain (Michaux State Forest)

Title 58, Chapter 79 of the PA Code designated the South Mountain, which includes the Michaux State Forest, as a rattlesnake protection area. The protected area is defined as west of SR 15 and south of I-81 to the Maryland border. No timber rattlesnakes are to be collected within this defined area.

This area was selected for protection due to the isolated nature of the South Mountain (i.e., the mountain acts as an “island” that is surrounded by agriculture and development). Populations of rattlesnakes in the South Mountain are small and are effectively cut-off from other snake populations in Pennsylvania. The intense development in the South Mountain region creates a higher occurrence of snake-human interactions leading to increased snake mortality. Past collection pressures have also contributed to the decline of the timber rattlesnake in this region.

BOF staff worked with the PFBC to print and post signs (Appendix B) in the Michaux State Forest at trail heads and parking areas, designating the South Mountain as a timber rattlesnake protection area. The Michaux State Forest rangers were also made aware of the regulations. The BOF will make every effort to continue to inform the public about this special protection area.

Natural Areas

DCNR has designated several tracts on State Forests as Natural Areas. These areas were set aside to provide locations for scientific observation of natural systems; to protect examples of typical and unique plant and animal communities; and to protect outstanding examples of natural interest and beauty.

Twenty - eight of the Natural Areas were set aside by the PFBC for the protection of reptiles and amphibians (Table 2). In these Natural Areas, the taking, catching, killing, and possession of individuals of any species of Pennsylvania reptiles and amphibians occurring naturally within the boundaries of the designated Natural Areas by persons other than those possessing a valid scientific collector's permit is prohibited. However, PFBC venomous snake permits *are not* recognized in these designated Natural Areas.

Table 2. List of 28 Reptile and Amphibian Natural Areas

State Forest	Natural Area
Bald Eagle	Mt. Logan
	Rosencrans Bog
	Tall Timbers
	The Hook
Buchanan	Sweet Root
Delaware	Buckhorn
	Pennel Run
Elk	Lower Jerry Run
	Wykoff Run
Forbes	Roaring Run
Gallitzin	Charles F. Lewis
Loyalsock	KettleCreek Gorge
Michaux	Carbaugh Run
Moshannon	Marion Brooks
Rothrock	Bear Meadows
	Big Flat Laurel
	Detweiler Run
	Little Juniata
Sproul	Cranberry Swamp
	East Branch Swamp
	Tamarack Swamp
Susquehannock	Forrest H. Dutlinger
Tiadaghton	Algerine Swamp
	Berk Cabin
	Miller Run
Tioga	Black Ash Swamp
	Reynolds Spring
Tuscarora	Frank E. Masland

The main points of access to the 28 Natural Areas including park areas and trail heads will be posted with signs informing the public of the reptile and amphibian protection areas. The BOF district staff will replace missing signs as needed.

Minimizing Habitat Impacts from Operations on State Forest Lands through Best Management Practices

The following BMPs should be implemented for timber sales and other projects (e.g., recreational trails, minerals extraction) on state forest lands. These BMPs will be used in known snake areas in conjunction with PNDI reviews and coordination with the BOF Ecological Services Section or the PFBC as needed.

Timber Harvest BMP Options

Reinert et al. (2011) studied the impacts of logging operations on timber rattlesnakes in the Tiadaghton State Forest. The researchers found that the logging activity and the resulting habitat changes did not alter the movements of snakes that were radio-tracked.

Most of the mortality that occurred was the result of direct snake-logger encounters and not from the logging operation itself. As a result, working with loggers to try and reduce mortality when these interactions occur during a timber sale is a priority for the BOF (see Education Section). The implementation of additional BMPS for timber sale planning and operations such as buffers or seasonal restrictions can also help to minimize the chance of unintentional mortality.

While laying out timber sale areas, BOF foresters should look for potential timber rattlesnake critical habitat (basking, gestating, and denning). Particular attention should be given to sales that include south, southeast or southwest-facing slopes. Basking/gestation habitat contains open rock talus or rock outcrops that receive six or more hours of direct sunlight a day. Potential overwintering habitat typically have exposures between 135° (SE) through 270° (W), and a slope greater than 10 degrees (PFBC). However, denning habitat is particularly difficult to identify because it may or may not be associated with concentrations of rocks. It is recommended that the forester administering the sale consult with the BOF Ecological Services Section to discuss potential options if timber rattlesnake habitat is located within a sale boundary. Critical habitat may also be identified within a sale area during the PNFI review process.

If critical timber rattlesnake habitat is identified within a sale area, then there are several management options available. Whenever possible, active (April 15th – November 1st) basking/gestation sites or other areas with large snake concentrations should be buffered. To help avoid logger-snake encounter, a minimum 50 - foot (15.2 meter) no disturbance buffer is recommended. Also, within this buffer no large rocks (> 2' diameter) may be disturbed by skidding activities, and no treetops should be left on large rock structures following the completion of a timber harvest. Another option is to place a seasonal restriction (cut timber between November 1 and April 15th) on the timber sale block that is located within the critical rattlesnake habitat. If harvesting occurs between November 1 and April 15th, no heavy equipment should be operated on top of basking/gestation or denning habitat.

In a timber sale area, consideration should also be given to habitat connectivity or the degree to which the landscape facilitates animal movement. Rattlesnakes typically travel the same routes from year to year. Males can travel up to 6.2 miles (10 kilometers) while gravid females typically use open rock habitat that is within 985 to 1300 feet (300 to 400 meters) of the den (PFBC). New disturbances such as haul roads and newly timbered areas will still be traveled by rattlesnakes. Land managers should consider how to facilitate the successful movement of rattlesnakes between areas of intact critical habitat (e.g., between denning and basking habitat). While it is not recommended that large amounts of woody debris is left on top of denning/gestation/basking sites, slash or dead and down woody material can be left through the remainder of the timber sale. The woody material will help to facilitate habitat connectivity by providing hiding places for rattlesnakes and other animal such as small rodents. Thus dead and down woody material will also create improved rattlesnake foraging habitat.

Basking/gestation sites may benefit from the removal of trees and shrubs to open up a site that is too shaded, so the removal of selected trees within the buffer may be desirable. Daylighting rocky habitat will also benefit other species of reptiles including coal skinks, five-lined skinks, and northern fence lizards. However, some vegetation must be left so that reptiles may thermoregulate in the shade during hotter conditions. The number of trees and shrubs to be removed should be decided on a case by case basis, but often the removal of a few trees is all that is needed to make a site viable once again. More care must be taken near denning sites that often exist under complete canopy closure.

During the Reinert et al. (2011) study, logging was conducted by hand-felling. Mechanized logging is becoming more prevalent in Pennsylvania. While mechanized logging provides more safety for the logger, if not done correctly it has the potential to cause more direct mortality to timber rattlesnakes from the logging activity than hand-felling. BOF foresters do not know if a timber sale put out for bid will be harvested by hand-felling or mechanized logging until the contract is awarded. For state forest districts where mechanized logging is more common, the forester administering the sale may want to add more protective BMPs (e.g., seasonal restrictions) as a stipulation in the timber sale contract if mechanized logging is to be used on the sale. The forester may also specify that a sale block that contains critical rattlesnake habitat be harvested by hand-felling only.

Road/Log Landing Restriction

Whenever possible, a minimum 100-foot (30.5 meters) protective buffer should be implemented around all known (e.g., sites mapped in PNDI) rattlesnake den, basking, and rookery areas within which no roads or log landings should be constructed. When laying out a timber sales, careful road placement is essential to minimize potential rattlesnake mortality from the increased truck traffic.

When properly located and constructed, abandoned log landings provide suitable basking habitat for rattlesnakes. However, log landings that attract and concentrate snakes may also be detrimental to snake populations by increasing the potential of human-snake interactions. To reduce this potential, log landings adjacent to roads that are open for motorized public access should be cleared of all logs and debris. Log landing located deep in sale areas (more than 0.6 mile/ 1 km) from public access roadways can be constructed to create potential basking habitat by piling waste timber and unearthed large rocks in the north side of the landing opening. This will enable the most southern exposure and will maximize the intensity and length of sunlight exposure on the rocks or a rock or log pile.

Prescribed Burning

Prescribed burning is a tool used to help regenerate desirable disturbance-dependent trees like oak. Within the Commonwealth, a number of vertebrates inhabiting oak forests may be affected by prescribed burning, both negatively and positively. The timing of BOF

prescribed burns, which are typically conducted before bud break, may have negative impacts to species like timber rattlesnakes. In the early spring, rattlesnakes are just emerging from their overwintering dens and are still congregated near the den entrance. An early spring fire has the potential to cause significant mortality to local snake populations who are hiding in the leaf litter and may not be able to retreat to safety. Beaupre and Douglas (2012) found that a healthy population of timber rattlesnakes near one den site was decimated from an early spring wild fire in an Arkansas oak forests. It took nearly twelve years for the den site to be repopulated with neonates or young dispersing from nearby unaffected sites.

However in the long-term, prescribed burning may be beneficial to rattlesnakes by improving habitat and prey abundance. In a different location in Arkansas, Beaupre and Douglas (2012) determined that habitat manipulation (burning and cutting) not only improved habitat quality for timber rattlesnakes, but it also had a positive effect on body condition and growth rates. In this study the prescribed burn was conducted during the dormant season when snakes were still hibernating.

Findings and management practices from the Ozark studies (Beaupre and Douglas 2012) may or may not be applicable to the oak and northern hardwood forests of Pennsylvania. Research specifically looking at the impacts of prescribed burns on timber rattlesnakes in Pennsylvania is currently in progress (see Research Section). The results will guide management practices and BMPs for prescribed burns conducted on state forest lands. The goal would be to minimize impacts to timber rattlesnakes and other species of special concern (e.g., bats) as much as possible, while still allowing management objectives like oak regeneration to be achieved.

The BOF conducts most burns in early spring, but BMPs for summer and fall burns include buffers and seasonal restrictions. The PFBC recommends that summer burns within timber rattlesnake habitat occur between June 1 and August 15, and incorporate a minimum 30.5 foot (100 meter) buffer around known gestation sites. Avoid burning from August 15 to October 1 in order to prevent loss of neonates during birthing and dispersal to the dens.

Recreational Trail Restriction

Recreational trails will be constructed or rerouted (if feasible and as district staff and time permits) to avoid known rattlesnake den sites and gestation/basking areas. The recreational forester can distribute the “Timber rattlesnake Information for Recreational Trails” letter (Appendix C) as well as the DCNR timber rattlesnake brochure to trail clubs to emphasize the BOF’s policy.

Rock Moving

DCNR Bureau of Forestry (BOF) has developed rock-moving (e.g., for trail construction) recommendations in order to minimize impacts to timber rattlesnake habitat on state

forest lands. The PFBC considers two types of habitat used by timber rattlesnakes as extremely vital and thus refers to them as "critical habitat:" over-wintering dens and gestation or basking sites. The loss of either of these habitats will adversely impact the timber rattlesnake. **Dens** (or hibernacula) are crevices or openings that lead to underground overwintering chambers. They are often easy to overlook on the surface, appearing to be no different than any other location on a particular mountain. They can be located near rocky habitat or there may be no rocks associated with them at all. Most often they are found on a south-facing side slope and can be under heavy canopy cover. However through radio telemetry, dens have been located on the north-facing sides of mountains as well. Dens can be associated with a nearby water source such as a seep that helps to keep the underground hibernacula a constant temperature year-round and provides moisture for the snakes. Generally, there is no evidence of the underground water source observed at the surface above the den. Because dens are difficult to locate without telemetry and there is such a short window of time to locate them during site visits, it is critical to protect the potential den habitat located on slopes having an exposure ranging from southeast to west (135° to 270°). **In order to protect den sites, the movement of rock on slopes in this degree range should be minimized or avoided entirely if possible.** The BOF Ecological Services Section can provide assistance with a site visit if movement of rock in this slope range is needed.

The other type of timber rattlesnake critical habitat is the **gestation or basking site**. This is an area where gravid female rattlesnakes congregate for several months (May-October) for the sole purpose of gestating young and birthing. Gravid or pregnant females require a higher body temperature for embryonic development than non-gravid snakes, which spend most of the summer months foraging under the forest canopy. Gravid females utilize basking habitat to elevate their body temperatures. Basking sites are also used by non-gravid snakes in order to shed their skin. **Basking habitat consists of large flat rocks (usually 4' x 6' and larger) that receive a daily minimum of 5 to 7 hours of direct sunlight.** Rocks chosen as basking habitat are usually near shady areas too, so snakes have the opportunity to retreat to shade during the intense sun that occurs in the middle of the day. The rocks absorb and hold the high heat during the day and make it possible for the gravid female and basking snakes to thermoregulate during the night as well.

To minimize potential impacts to critical timber rattlesnake habitat, the following BMPs should be observed before moving rocks:

- Avoid moving rocks in the southeast to west facing exposure range (135° to 270°) to minimize the possibility of impacting dens.
- Choose rocks from north-facing slopes
- Avoid picking rocks that are 4'x6' or larger and in a sunny area.
- In open sunny areas, choose rocks that are situated at a sharp angle and not lying flat, so snakes would not be likely to choose them for basking.
- When in doubt contact the Ecological Services Section for further assistance or to schedule a field visit.

Reporting Procedures

BOF personnel will be encouraged to report any new occurrences of timber rattlesnake dens, basking, or rookery areas that are identified on state forest lands. Additionally, contract loggers and workers on state forests are asked to report snake encounters to the forest district staff. Any encounter involving more than one snake, newly identified critical habitat, or accidental or deliberate snake mortality should be reported by the district staff to the BOF Ecological Services Section. Ecological Services will document and confirm new sites, and coordinate data entry into PNDI with the PA Natural Heritage Program and the PFBC.

BMPs for Other Earth Disturbances (e.g., Construction Projects, Oil & Gas Activities)

A minimum 300 ft. (91 meters) protective buffer will be implemented around all known rattlesnake den sites, basking, and rookery areas (as defined by a qualified rattlesnake expert or PNDI review). Additional buffers or seasonal restrictions may be placed on projects with large earth disturbance areas, intensive construction activities, or larger permanent disturbances.

Erosion and Sedimentation Control

It is often necessary to use Erosion & Sedimentation (E&S) control netting for stabilization during or at the conclusion of a project. A plastic E&S control netting is commonly used, but this type of netting does not biodegrade quickly and the netting can trap and kill small mammals, reptiles, and amphibians who are unable to escape. In place of the plastic netting, an E&S control netting that uses a biodegradable natural fiber such as jute, sisal, or coir is recommended. The weave of the netting should have movable (not fixed or welded) joints between the horizontal and vertical twines. Mesh with an aperture that is either too small for wildlife to attempt to pass through, or too large to impede the passage of wildlife would reduce the threat of entrapment ([California Coastal Commission 2012](#)).

Habitat Restoration and Creation

Prioritizing Sites

Open habitat for basking is typically limited in densely forested regions. Some locations that were formally used by snakes as basking or rookery (birthing) areas have become overgrown. The BOF Ecological Services Section will work with BOF district staff, the PFBC, and state forest volunteers to identify/prioritize these critical habitats that were mapped during the Statewide Assessment and to remove trees and shrubs that are shading out a site. The sites will be evaluated to determine whether or not any habitat

enhancement is needed. Sites on state forest land will be prioritized with special protection areas (e.g., Michaux State Forest) given top priority.

Management activities could include leaving the site alone or active management such as the removal of trees that are providing too much shade at a particular basking site. Generally it may be necessary to remove only a few trees at each site. Return visits will be scheduled for each location to monitor the effectiveness of management activities. To date several habitat enhancement projects have been conducted in four forest districts including Forbes, Michaux, Moshannon, and Tuscarora state forests. Additional projects will be initiated as staffing, resources, and time permits.



Photos 3 &4 – Timber rattlesnake habitat enhancement project shown before (left) and after (right) treatment. Note that only a few small trees in the center of the picture needed to be removed in order to restore the site for basking.

Timber Sale Habitat Enhancement Opportunities

Not all timber rattlesnake critical habitat is mapped in PNDI. Foresters or BOF staff may identify new, unknown critical habitat when laying out timber sales by identifying potential basking sites (e.g., rocky outcrops at the edges of southern facing slopes). Dens can be located under tree canopy and are often found inadvertently while conducting a sale. For example during a timber sale in the Michaux state forest, a logger encountered an unknown snake den that he reported to the forester administering the sale. The sale continued and the new den was protected with a small buffer.

If a den is located, field staff should consult with the BOF Ecological Services Section before the area is cleared to avoid inadvertently clearing a timber rattlesnake den or wintering area. It is unclear whether or not canopy removal from a den would impact the micro habitat inside of the den. However, basking/gestation sites can be marked for some tree removal during logging to maximize the amount of sunlight that will penetrate the rocks.

If critical timber rattlesnake habitat is identified in or near a timber sale, the forester can work with the BOF Ecological Services Section to explore the possibility of enhancing habitat. For example, trees shading out a basking/gestation site could be removed. The

forest district staff can conduct the tree removal themselves or incorporate the habitat enhancement project into the sale contract.

Habitat Creation Opportunities

Some state forest activities create openings on State Forest lands. For example, log landings created during timber sales and opening created for well pads. These sites can be utilized to create basking and rookery habitat for timber rattlesnakes. Larger, flat rocks that were moved during construction can be placed on the north side (south-facing) of well pad sites or log landings and away from the edge of the forest to avoid too much shading. Likewise, rocks that were moved during pipeline construction can be returned when the temporary right-of-way (R-O-W) is being restored. To reduce the chance of human-snake encounters, consideration should be given regarding the proximity of the log landing, well pads, etc. to roads that are readily accessible to the public. It is recommended that whenever possible the habitat creation area be located a minimum of 0.6 miles (1 km) from public access roadways.

Any tree or shrub plantings associated with site restoration should be placed an adequate distance from the rocks so that the rocks will not be shaded when the plantings are fully grown. Please refer to the PA Fish & Boat Commission publication *Habitat Creation for Timber Rattlesnakes* (2010), [the BOF Guidelines for Vegetative Maintenance of Utility Right-of-Ways on State Forest Lands](#), and the [BOF Planting and Seeding Guidelines](#) for more details.

Minimizing Targeted Mortality

State forest lands are used by a variety of people from all walks of life and include BOF staff, recreational visitors, and contractors. Some are comfortable being around wildlife like venomous snakes, while others are not. For example, the Reinert (2011) study documented the direct killing of rattlesnakes by loggers. His recommendation was that further impacts to timber rattlesnakes could be reduced if management agencies require commercial logging contractors, sub-contractors, and field employees to strictly adhere to a policy that prohibits the intentional killing of rattlesnakes encountered during logging activities.

Through training and policy implementation, the BOF believes that the direct killing of rattlesnakes on state forest lands can be reduced by working closely with all state forest users and employees. The strategies to help reduce rattlesnake mortality during the inevitable human-snake interactions on snake forest lands are described in this section.

Education

Training sessions for BOF employees will be initiated by the BOF Ecological Services Section to inform and develop expertise within the BOF on rattlesnake biology, issues, proper handling of venomous snakes, and regulations. The training will also include how

to best convey the information to loggers and others who are the most likely to encounter rattlesnakes.

The BOF Ecological Services will work with State Forest rangers regarding current rattlesnake regulations, special protection areas, and the coordination of enforcement issues. Rangers can also help to promote education about timber rattlesnakes during public encounters.

BOF staff will strive to educate state forest visitors on timber rattlesnakes through the education and outreach, public speaking, and the development of educational materials such as the BOF's [Pennsylvania Rattlesnakes in Pennsylvania State Forests" brochure](#).

In 2014, the BOF Ecological Services Section developed the first continuing education module on timber rattlesnake for the [PA Sustainable Forest Initiative \(SFI\)](#). This four-hour class is given to loggers/foresters seeking certification under the SFI program and focuses on natural history, ongoing research, BMPs, and management issues for the rattlesnake. Several of the loggers attending the class conduct timber sales on state forest land. It is anticipated that at least one timber rattlesnake class will be given annually or bi-annually as the need dictates.

The District Forester or forester administrating the timber sales can talk to loggers (and other operators on State Forest lands) in a pre-harvest or pre-construction meeting about the BOF's concern for timber rattlesnakes. At this meeting, the contractor will be given a letter (Appendix C) and the "[Pennsylvania Rattlesnakes in Pennsylvania State Forests" brochure](#)". The letter and brochure provides information on rattlesnake biology, issues, BOF policies, regulations, and how to handle encounters with rattlesnakes. A one page educational fact sheet developed by DCNR can also be distributed (Appendix D). The forester will stress that if at all possible timber rattlesnakes should not be killed during timber or construction activities. BOF or PFBC personnel can relocate the snakes if state forest workers feel that they are in danger.

Temporary Snake Relocation

If during a timber sale or other state forest projects large numbers of timber rattlesnakes are encountered by loggers or state forest workers, the District Forester or supervisory forester should be notified as soon as possible. When considering the well-being of both people and snakes, nuisance snakes do not need to be moved far. Displacing rattlesnakes long distances has been shown to drastically affect behavior and jeopardize survival (Reinert and Rupert 1999, and Sealy 1997).

Relocations of not more than 200 yards (183 meters) will keep the snake near a recognizable home range and discourage it from returning to the spot where it had a negative encounter. Each forest district will have at least one staff member designated to temporarily relocate snakes a short distance from intensive logging or construction activities. The BOF safety officer will make sure that each forest district has the correct equipment (e.g., snake tongs and snake bagger) for this task. The BOF Ecological

Services Section can also be contacted to assist with snake relocations. Ideally, this designee would return weekly to the logging or construction site until the activity is completed or rattlesnake encounter rates decline. Private sector projects initiated on state forest lands may be asked by BOF or PFBC to hire a qualified timber rattlesnake biologist for relocation purposes for the duration of their project.

Safety

The safety of state forest users is very important to the BOF. A recent death in north central Pennsylvania is a reminder that while fatalities from venomous snake-human encounters are rare, they can occur. As stated in the above sections, educational materials and outreach can provide state forest visitors with knowledge that will hopefully reduce these risks. For example, an educational wayside or display was recently added to the parking areas of a popular trailhead with a scenic vista. The wayside warns visitors that venomous snakes may be present and advises of the precautions that can be taken. Some safety suggestions in snake habitat (e.g., open, south-facing, rocky areas) include:

- When walking through unmown grass and brushy areas, wear loose-fitting pants and leather boots that at least cover the ankles. Snake gaiters that cover your legs from the ankle to just below the knee provide added protection.
- Look for snakes before you sit down or reach into, over, or under brush, logs, or rocks.
- Be aware that rattlesnakes are attracted to certain structures to hunt for rodents and to bask including rock piles, logs, firewood, and boards. They may also be found around a shed or equipment.
- Never attempt to pick up a rattlesnake, even one that appears to be dead.
- Supervise children closely and keep pets on a leash.

Research on State Forest Lands

The BOF has supported and will continue to support research to evaluate the potential impacts of forest management activities on the timber rattlesnake, and to identify critical habitat on state forest lands. To achieve success in the conservation of timber rattlesnakes, research such as the Reinert et al. (2011) study have provided valuable information that aided in the development of BMPs and the assessment of critical needs (e.g., education) on state forests. It is anticipated that the current statewide monitoring efforts of East Stroudsburg University and the ANF/Penn State prescribed burn study will also yield insights that will support the BOF's adaptive management goals and the determination of future research needs for the timber rattlesnake. Some past and ongoing research projects are detailed below.

Reinert Study

Through the environmental review process, concerns were often raised about the potential impacts of timber operations on timber rattlesnakes. To answer these concerns Dr. Howard Reinert was the lead investigator examining the response of timber rattlesnakes to commercial logging operations (Reinert et al. 2011). This study radio-tracked and observed the response of 67 rattlesnakes before, during, and after logging operations on a tract of the Tiadaghton state forest. The researchers determined that logger-related snake mortality was low (2%), but if every logger-snake encounter was included as a snake kill, the mortality rate could have reached 7%. Also, logging activity and the resulting habitat changes did not alter the behavior or movement patterns of the radio-tracked snakes. Because of the study results, Reinert recommended that further impacts to timber rattlesnakes could be reduced further if management agencies require commercial logging contractors, sub-contractors, and field employees to strictly adhere to a policy that prohibits the intentional killing of rattlesnakes encountered during logging activities.

The timber from the timber sales in Reinert's study area was removed by the hand felling of trees. Mechanized logging, which can potentially have greater environmental impacts, is becoming more prevalent on state forest lands. It would be beneficial to repeat the Reinert radio-tracking study in a sale area where mechanized logging is being utilized.

Penn State Marcellus Monitoring Study

In recent years, several new leases were issued for Marcellus shale extraction on state forest lands. Concerns have been raised by the public regarding the potential environmental impacts from Marcellus development activities. For this reason, several research projects were initiated including one assessing the potential impacts of Marcellus shale and Utica energy development on the timber rattlesnake in north central Pennsylvania. This is a Penn State (Riparia) study being conducted on state forest land with Dr. Gian Rocco and Dr. Robert Brooks as the lead investigators.

Timber rattlesnakes were chosen because they are restricted to the generally larger unbroken forest expanses within the Commonwealth, a situation that earns it the title of "indicator species" of such minimally disturbed, wilderness-type environments. Indicator species are animals or groups of animals (communities) that tend to be intolerant of environmental degradation in one or other forms. Monitoring efforts would help ascertain the response of this species to oil and gas related development

The study started in 2011 and is currently ongoing. It is important to note that in order to see any population trends or potential impacts in the timber rattlesnake population, the monitoring must be a long-term effort. To that end, Penn State will continue the study an additional two more years until 2015. During that time frame, BOF can work with Penn State researchers to incorporate the timber rattlesnake monitoring into the BOF Marcellus Monitoring Program, where BOF or contract biologists will routinely monitor the identified sites in subsequent years.

US Forest Service Northern Research Station Study

Prescribed burning is a tool used to help regenerate desirable disturbance-dependent trees like oak. BOF typically conducts prescribed burns in early spring when buds on trees are ready to open. Because timber rattlesnakes also emerge from hibernation at this time, they may be particularly vulnerable to fires as they hide in the leaf litter prior to dispersing to summer habitat. Beaupre and Douglas (2012) documented high mortality at a den site in Arkansas after an early spring wild fire.

To explore this issue, the BOF is working with the US Forest Service Northern Research Station who will study the effects of prescribed burning on the timber rattlesnake in Pennsylvania's mixed oak forest. The Forest Service is contracting the study to Penn State with Dr. Chris Howey and Dr. Tracy Langkilde as the principal investigators. As of 2014, the funding was secured and the initial planning and coordination for the study was being implemented.

Statewide Monitoring

It is likely that the timber rattlesnake will no longer be listed as a candidate-rare species in Pennsylvania by mid - 2016. Before the species becomes de-listed, the Amphibian & Reptile Technical Committee recommended that the PFBC develop a statewide monitoring plan for the species. The monitoring plan would involve long-term monitoring of rattlesnake populations in an attempt to detect any major changes or trends. In 2015 the project was awarded to East Stroudsburg University with Dr. Tom LaDuke as the lead investigator. BOF biologists and district staff will assist with selecting critical habitat to monitor on state forest lands. The initial phase of the project is slated to last for three years.

Updates to the Management Plan

The state forest timber rattlesnake management plan is not meant to be a stagnant document. It will be periodically updated based on the results of research, lessons learned from ongoing management and monitoring, and coordination with other state natural resources agencies and non-government organizations. It is anticipated that at a minimum, the plan will be updated once every five years.

Summary

The BOF strives to manage state forest lands using sound ecosystem management. The primary goal of ecosystem management is to keep the complex interdependencies of ecosystems intact and functioning well over long periods of time (DCNR 2001). The timber rattlesnake is a part of this complex ecosystem. Through the implementation of this state forest conservation strategy and through continued coordination with the PFBC

and conservation organizations and agencies, the timber rattlesnake will thrive on state forest lands for many years to come.

References

- Allender, M.C., D.B. Raudabaugh, and Andrew N. Miller. 2015. The natural history, ecology, and epidemiology of *Ophidiomyces ophiodiicola* and its potential impact on free-ranging snake populations. Fungal Ecology: <http://dx.doi.org/10.1016/j.funeco.2015.05.0003>.
- Beaupre, S. J. and L.E. Douglas. 2012. Response of timber rattlesnakes to fire: lessons from two prescribed burns. Pages 192 – 204 in Proceedings of the 4th Fire in Eastern Oak Forests Conference; May 17-19, 2011, Springfield, MO. D.C. Dey, M. C. Stambaugh, S.L. Clark, and C.J. Schweitzer (Eds). Gen Tech. Rep. NRS-P-102. U.S. Dept of Agriculture, Forest Service, Northern Research Station, Newtown Square, PA. 292 pp.
- Bodar, Stan. 2016. Personal communication. Senior herpetologist for Wildlife Specialists, Wellsboro, PA.
- California Coastal Commission. 2012. Wildlife-Friendly Plastic-Free Netting in Erosion and Sediment Control Products. Water Quality Fact Sheet. California Coastal Nonpoint Source Program.
- Hulse, A.C., C.J. McCoy, and E.J. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, Ithaca, NY.
- Northeast Partners in Amphibian and Reptile Conservation. 2013. Snake Fungal Disease: Frequently asked Questions. NEPARC Publication 2013-02.
- Pennsylvania Department of Conservation and Natural Resources. 2001. Penn's Woods: Sustaining Our Forests. Bureau of Forestry. Document # 8100-BK-DCNR1767.
- Pennsylvania Fish & Boat Commission. 2011. [Species Action Plan: Timber Rattlesnake \(*Crotalus horridus*\)](#). Natural Diversity Section.
- Pennsylvania Fish & Boat Commission. 2010. Habitat Creation for Timber Rattlesnakes Natural Diversity Section.
- Pennsylvania Game Commission-Pennsylvania Fish and Boat Commission. 2015. Pennsylvania Wildlife Action Plan (C. Haffner and D. Day, Eds.). Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission, Harrisburg, PA.
- Reinert, H.K., W.F. Munroe, C.E. Brennan, M.N. Rach, S. Pelesky, and L.M. Bushar. 2011. Response of timber rattlesnakes to commercial logging. Journal of Wildlife Management 75(1):19-29.

- Reinert, H.K. 2010. Timber Rattlesnake. Pages 50 – 53 *in* Terrestrial Vertebrates of Pennsylvania: A Complete Guide to Species of Conservation Concern. M.A. Steele, M.C. Brittingham, T.J. Maret, and J.F. Merrit, (Eds). The Johns Hopkins Press, Baltimore, MD.
- Reinert, H.K. and R.R. Rupert. 1999. Impacts of translocation on behavior and survival of timber rattlesnakes. *Journal of Herpetology* 33(1):45-61.
- Sealy, J.B. 1997. Short-distance translocations of timber rattlesnakes in a North Carolina state park: a successful conservation and management program. *Sonoran Herpetologist* 10:94–99.

Appendix A
Draft PFBC Timber Rattlesnake
Recommendations

Draft PA Fish & Boat Commission Recommendations for Timber Rattlesnakes in
Environmental Review Process

Below are the draft conservation and avoidance measures that will be recommended by the PFBC on the receipt generated by the PA Conservation Explorer tool. For A) Potential conflicts when a proposed project is within a conservation or supporting habitat buffer, and B) Direct conflicts when potential projects are located within 300-feet of critical rattlesnake habitat. See figure below.

A. Potential Conflict (Project located within the conservation or supporting habitat buffer)

Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and Pennsylvania Fish & Boat Commission (PFBC) files, the **timber rattlesnake (*Crotalus horridus*, PA candidate)** is known from the vicinity of the proposed project site. Timber rattlesnakes occur in the forested, mountainous regions of the Commonwealth. They prefer forested areas to forage for small mammals (e.g., mice and chipmunks) and southerly-facing slopes for hibernating and other thermoregulatory activities. The timber rattlesnake is threatened by habitat loss/alteration, wanton killing, and poaching. **Given the proximity of the project to known timber rattlesnake critical habitat, we request that you take the following steps in order to further conservation efforts for this species as well as protect the safety of your workers:** Projects conducted in the occupied range of the timber rattlesnake have a high risk of encountering this species during construction.

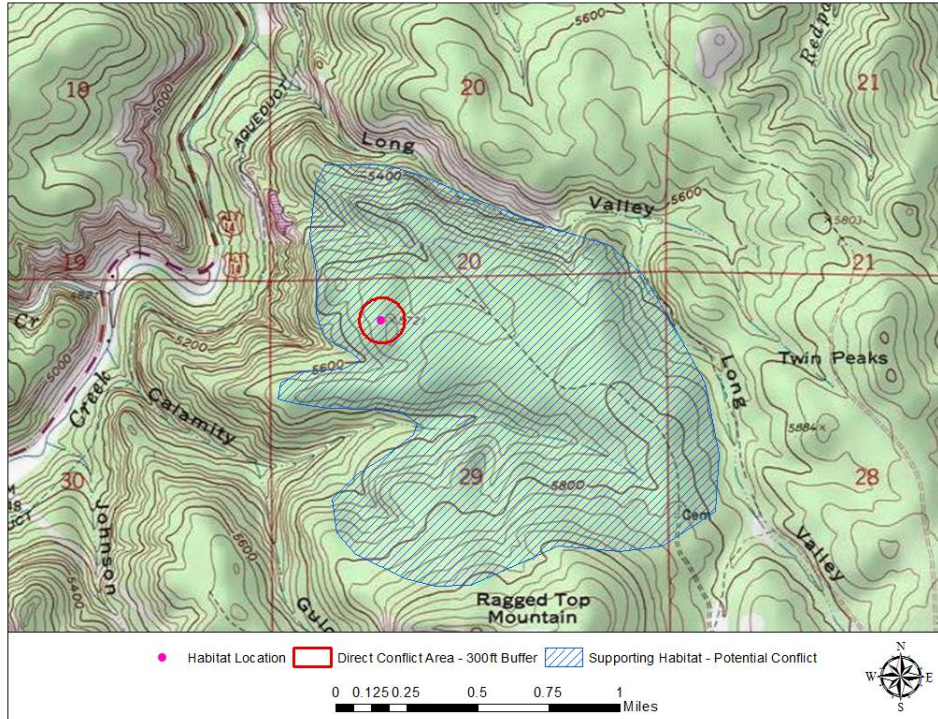
- 1) Workers responsible for implementing this project should be advised that timber rattlesnakes may be encountered and that avoidance is the best means of minimizing risks to personal safety. It is suggested that safety protocols be implemented for timber rattlesnake encounters and workers should be advised that the timber rattlesnake is a state protected species and is not to be harmed. Killing of timber rattlesnakes is prohibited by the Commission pursuant to 58 Pa. Code Section 79.6.
- 2) We recommend that a timber rattlesnake habitat assessment be conducted in the project area by a qualified timber rattlesnake surveyor in order to assist project planners in avoiding disturbance of critical habitat. A list of qualified surveyors and habitat assessment protocol can be found here.
 - [Link to Qualified Timber Rattlesnake Surveyors](#)
 - [Link to Timber Rattlesnake Habitat Protocol](#)
- 3) If potential den (over-wintering) habitat is located during the habitat assessment, we recommend that the project be modified to avoid direct impacts to this irreplaceable habitat, or a Timber Rattlesnake Presence-Absence Survey of potential den (over-wintering) habitat be conducted in the habitats that are currently slated for direct disturbance to determine the presence or absence of rattlesnake hibernacula in the project area. This information is necessary to allow us to formulate recommendations to avoid adverse impacts to this species of special concern.
 - [Link to Timber Rattlesnake Presence-Absence Survey Protocol](#)
- 4) If potential gestation habitat is located during the habitat assessment and cannot be avoided by the proposed development, we recommend that this habitat be replaced using our habitat creation guidelines.

- [Link to PFBC Gestation Habitat Creation Guidelines](#)

- 5) Tree clearing and timbering within potential timber rattlesnake critical habitats (135°-275° aspect, >10% slope) should be conducted from October 16 to April 14 in order to avoid encounters with timber rattlesnakes.
- 6) For the safety of workers and snakes, the Commission recommends that a PFBC permitted timber rattlesnake biologist who has the proper skills to handle this venomous species be on-site prior to and during construction, between April 15 and October 15, to inspect and clear the area (including staging areas and access roads) of timber rattlesnakes and to capture and remove any rattlesnakes that may interfere with work activities.
- 7) If concerns arise during construction over high numbers of snake encounters or habitat alteration, please contact the PFBC at 814-359-5237 for consultation with our biologists.

B. Direct Conflict (Project located within 300 feet of critical habitat)

Your project appears to overlap with known critical overwintering habitat for the **timber rattlesnake (*Crotalus horridus*, PA candidate)**. These critical habitats are ancestral dens that are used communally by the snakes. Due to the susceptibility of this species to targeted collection, this location cannot be revealed to you in the PNDI tool. Please contact the PFBC for more information and to discuss potential ways to avoid impacting this critical habitat and protecting project workers. Killing of timber rattlesnakes is prohibited by the Commission pursuant to 58 Pa. Code Section 79.6



Example map showing the 300-foot and supporting habitat buffers used to generate direct conflict or potential conflict responses in PNDI.

Appendix B
Signs Posted at Special
Protection Areas



STATE FOREST NATURAL AREA

REPTILE AND AMPHIBIAN PROTECTION AREA

DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

BUREAU OF FORESTRY
BOF-I-22 9/05

TIMBER RATTLESNAKES

-PROTECTED IN SOUTH MOUNTAIN-

Due to the documented continued decline of the timber rattlesnake population in the South Mountain area, it is unlawful for a person to hunt, take, catch, or kill timber rattlesnakes west of Route 15 and south of Interstate 81 to the Maryland line where there is no open season (PFBC Code: Chapter 79.3 (h)).



APPENDIX C
Sample Letters for Activities on State
Forest Lands

DCNR, Bureau of Forestry
Timber Rattlesnake Information for Timber Sales

It has been determined that the sale area of this project lies within critical habitat for the timber rattlesnake (*Crotalus horridus*). Although timber rattlesnake populations are apparently secure in Pennsylvania, many states that surround us have listed rattlesnakes as either threatened or endangered. A large portion of the North American range of the timber rattlesnake occurs in Pennsylvania making it a “Responsibility Species.” Therefore, actions taken to protect rattlesnakes in PA will benefit the species’ global population. As stewards of natural resources, the protection of rattlesnakes is a critical part of the BOF’s mission.

Due to site conversion of much of its historical range, State Forest Lands are more important than ever for the long term survivability of this species. In cooperation with the PFBC, the BOF would like to inform state forest land users about the rattlesnake and their protection efforts, and facilitate more effective cooperation in enforcement of laws protecting rattlesnakes.

Enclosed in the contract packet is an informative brochure about this species “Rattlesnakes in PA State Forests”. It is believed that rattlesnakes are a direct measure of the health of an ecosystem, and that their presence reflects a generally healthy condition of the environment. Through research recently conducted on State Forest Lands, logging activities pose no great threat to the rattlesnake. It was found, that the greatest danger to the species is direct human contact and illegal killing. We are asking for cooperation in protecting this valuable species, and to refrain from illegally killing timber rattlesnakes.

To better understand the species and its population, the BOF and the PFBC are continuously updating records of timber rattlesnake populations. If a rattlesnake is encountered, please inform the administering forester of the sightings. This will aid in better informed management decisions to help protect the viability of snake populations.

Rattlesnakes are generally docile and non-aggressive. However, if working in an area where rattlesnakes are active and workers feel unsafe, please contact the District Forester or the administering forester. Bureau of Forestry personnel will coordinate the removal of the snake(s) from the sale area. If there is an unusually high activity of rattlesnakes in the sale area, BOF and the PFBC will investigate the need for suspending the logging activity for a period of time until rattlesnakes are no longer active in that area or are in hibernation. This time would be added to the end of the contract as a free extension.

Thank you for following these guidelines to help the Bureau of Forestry and PA Fish and Boat Commission in preserving the diversity of species on State Forest Lands. ***Please share this information with anyone who will be working on your timber sale.*** If you have any questions or would like more information on the timber rattlesnake, please contact the Bureau of Forestry’s Ecological Services Section in Harrisburg at 717-787-3444.

DCNR-Bureau of Forestry
Timber Rattlesnake Information for Recreation Trails

It has been determined that this proposed recreational project lies within critical habitat for the timber rattlesnake (*Crotalus horridus*). Although timber rattlesnake populations are apparently secure in Pennsylvania, many states that surround us have listed rattlesnakes as either threatened or endangered. A large portion of the North American range of the timber rattlesnake occurs in Pennsylvania making it a “Responsibility Species.” Therefore, actions taken to protect rattlesnakes in PA will benefit the species’ global population. As stewards of natural resources, the protection of rattlesnakes is a critical part of the BOF’s mission.

Due to site conversion of much of its historical range, State Forest Lands are more important than ever for the long term survivability of this species. In cooperation with the PFBC, the BOF would like to inform state forest land users about the rattlesnake and their protection efforts, and facilitate more effective cooperation in enforcement of laws protecting rattlesnakes.

Enclosed in the contract packet is an informative brochure about this species “Rattlesnakes in PA State Forests”. It is believed that rattlesnakes are a direct measure of the health of an ecosystem, and that their presence reflects a generally healthy condition of the environment. The greatest danger to the species is direct human contact and illegal killing. We are asking for cooperation in protecting this valuable species and to refrain from illegally killing timber rattlesnakes.

To better understand the species and its population, the BOF and the PFBC are continuously updating records of timber rattlesnake populations. If a rattlesnake is encountered, please inform the local forest district office of the sighting. This will aid in better informed management decisions to help protect the viability of snake populations.

While the potential exists to encounter a timber rattlesnake on many of the miles of trails, such encounters are infrequent due to this species’ generally solitary habits, cryptic coloration, and secretive behavior. The probability for encounter increases when trails intersect or come in close proximity to critical habitat such as basking or over-wintering sites (dens).

Trails will be constructed or rerouted to avoid known rattlesnake den sites and gestation/basking areas. BOF and PFBC staff will work closely with trail groups to identify measures to protect the snakes. Ongoing field studies of timber rattlesnake spatial ecology and habitat use within our forests will help guide decisions on measures needed to protect both visitors and snakes. Rerouting sections of trails may be one alternative. Consideration will be given to closing certain trails for a short time in the spring and fall when the snakes move from their dens out to forage. Biologists will make the determination as to which sections of trails may need this short-term closure and the BOF staff will provide information in a variety of venues to notify users of any closures.

Thank you for following these guidelines to help the BOF and PFBC in preserving the diversity of species on state forest lands. ***Please share this information with others in your club, family, and friends.*** If you have any questions or would like more information on the timber rattlesnake, please contact the Bureau’s Ecological Services Section at 717-787-3444.

DCNR, Bureau of Forestry
Timber Rattlesnake Information for Contractors Working on State Forest Lands

It has been determined that your proposed project lies within critical habitat for the timber rattlesnake (*Crotalus horridus*). Although timber rattlesnake populations are apparently secure in Pennsylvania, many states that surround us have listed rattlesnakes as either threatened or endangered. A large portion of the North American range of the timber rattlesnake occurs in Pennsylvania making it a “Responsibility Species.” Therefore, actions taken to protect rattlesnakes in PA will benefit the species’ global population. As stewards of natural resources, the protection of rattlesnakes is a critical part of the BOF’s mission.

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To better understand the species and its population, the BOF and the PFBC are continuously updating records of timber rattlesnake populations. If a rattlesnake is encountered, please inform the district forester of the sightings. This will aid in better informed management decisions to help protect the viability of snake populations.

Rattlesnakes are generally docile and non-aggressive. However, if working in an area where rattlesnakes are active and workers feel unsafe, please contact the timber rattlesnake monitor working for your company on this project. The monitor will coordinate the removal of the snake(s) from the project area.

Thank you for following these guidelines to help the Bureau of Forestry and PA Fish and Boat Commission in preserving the diversity of species on State Forest Lands. ***Please also share this information with any field staff or sub-contractors who may be working on any aspect (e.g., pad sites as well as pipelines) of this project.*** If you have any questions or would like more information on the timber rattlesnake, please contact the Bureau of Forestry’s Ecological Services Section in Harrisburg at 717-787-3444.

Appendix D

One-Page Educational Flier

WANTED!

For excellent small rodent control



Timber Rattlesnakes

Snakes contribute to a healthy functioning forest. Rattlesnakes are protected under Pennsylvania Fish & Boat Commission regulations.

Do not touch or harass snakes.

Timber rattlesnakes are docile by nature, but view them from a distance of at least 3 feet. Be cautious around logs and rocky outcrops where snakes hunt and bask.

