

CONSERVATION PLAN FOR THE WOOD TURTLE IN THE NORTHEASTERN UNITED STATES

Mapping Guidelines



Wood Turtle Mapping Guidelines

Northeast Wood Turtle Working Group

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Overview: Delineating populations and important habitats is an important component of large-scale conservation efforts. However, species-specific mapping guidelines can often vary considerably among state agencies as well as conservation organizations. This document is intended to (1) summarize existing Wood Turtle mapping protocols practiced throughout the Northeast and (2) propose a broadly applicable approach for mapping Wood Turtles throughout the species range.

MAPPING UNITS

For the purpose of document, individual mapped areas or “sites” correspond to the definition of **Element Occurrences** (EO) as defined by NatureServe (2016):

An Element Occurrence (EO) is an area of land and/or water in which a species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. For species Elements, the EO often corresponds with the local population, but when appropriate may be a portion of a population (e.g., long distance dispersers) or a group of nearby populations (e.g., metapopulation).

NatureServe (2016) minimum criteria for occurrences:

Evidence of historical presence, or current and likely recurring presence, at a given location. Such evidence minimally includes collection or reliable observation and documentation of one or more individuals (including eggs) in or near appropriate habitat where the species is presumed to be established and breeding.

SUMMARY OF MAPPING STRATEGIES

NatureServe Guidelines

NatureServe refers to two key concepts when mapping EOs: **barriers to movement** and **separation distances**. Barriers to movement are features on the landscape that completely (or almost completely) restrict dispersal or movement of the focal species (element), thus having a limiting effect on gene flow. Separation distances are described by NatureServe as “distances of intervening area that restrict movement” and represent habitat-specific reaches beyond which gene flow is significantly diminished. Since patterns of gene flow are unknown for most species, NatureServe recommends that separation distances be based on the best available information. Below are NatureServe’s recommended barriers to movement and habitat-specific separation distances for Wood Turtles.

Barriers to movement:

- Busy highways or roads with obstructive structures
- Impassable topography

- Urbanized areas without aquatic/wetland habitat
- Large impoundments or lakes

Separation distances:

- Continuous upland habitat: 1 km
- Along riverine corridors: 5 km
- Intermediate situations (e.g. mixed upland-riverine habitat): 3 km

Maine

All occurrences are represented by a point and assigned a 0.25-mile radius buffer.

Plans exist to shift the mapping protocol to a more detailed approach where urban areas are taken into account and delineated areas are more defined by river/stream flowlines.

New Hampshire

Wood Turtle habitat is not mapped in New Hampshire. Individual animals are represented by a point feature with an uncertainty buffer. The minimum buffer width is 25 meters, but is often expanded to 50 meters when the exact location is less certain. When location is even less certain, the observation can be represented by a linear feature like a segment of road or stream, or a polygon like a tax parcel.

NatureServe separation distances are followed, with 1 km generally separating observations into separate EOs, or 5km along riverine corridors. Separation barriers include state-numbered routes at a minimum, but aerial photographs are often examined to assess the landscape between observations to make a decision on how difficult a landscape would be for an animal to traverse.

Massachusetts (Natural Heritage Atlas)

All points within 5 km and connected by water are joined. Streams and tributaries that are closest to source points and considered optimal habitat are mapped. Mapped areas extend 2 km up and downstream of all EO source observations. Three buffer distances are applied to streams depending on the landscape context:

- 100 m: to capture all habitat types
- 300 m: to capture all non-forested appropriate habitat for Wood Turtles (i.e. wetlands, fields, nesting habitat)
- 500 m: to capture open habitats and nesting areas in rare circumstances where these habitats are absent from a 300 m buffer or are known to be readily used by Wood Turtles

Note: Buffer distances from large streams are measured from the edge, not the centerline.

For Massachusetts' largest streams, bias habitat to side streams, braided channels, and channels with low gradient (using model of optimal habitat).

Barriers to movement:

- Large rivers: end mapped habitat where the occupied stream converges with a large river (e.g. Connecticut, Merrimack)
- Roads: for roads that bisect mapped habitat between 100 and 300 m from the focal stream, exclude the area on the far side

Exclusions:

- Commercial and residential infrastructure with densities greater than sparsely dispersed (typically \leq lots)
- Seasonal streams and streams with a continuous gradient $>2.5\%$ for more than 1.0 km
- High gradient streams near the edge of habitat (near 2 km of the EO source)
- Large bodies of water such as ponds, reservoirs, and large beaver impoundments. Note: edges and vegetated areas as well as areas that are known to be occupied by Wood Turtles should still be mapped
- Tributaries >1 km from source point or closer than 1 km to non-optimal habitat
- EO sources >500 m optimal habitat
- Sections of optimal habitat <0.5 km in length
- On a case by case basis: exclude centers of large agricultural fields >100 m wide and <500 m from streams (always include field edge [30 m] near streams; two edges if between streams)

Inclusions:

- Stream channels that are present and visible (in most recent orthoimagery) within reservoirs and beaver impoundments. Map as far as the stream is visible.
- Tributaries that are optimal habitat (according to Jones' model) \leq snapping point on the primary stream; map up tributaries 2 km from the EO sources
- All nesting, field, and early-successional habitat within 300 m of a source. Include these habitats within mapped areas when extending beyond 300 m, but less than 500 m, with the exception of large agricultural fields.
- When open field habitat is absent (within 500 m) from stream segments >2 km, include forest habitat up to 300 m on the south sloping side of the stream. Include both sides if neither are south sloping.
- Shrub swamps and stream-associated wetlands up to 300 m from focal streams

Note: Do not map if stream of origin cannot be confidently ascertained.

Connecticut

All EOs are represented by points. Buffers around points are used to represent the accuracy of the observed location data with less accurate observations given larger buffers. Observations in close proximity are assessed on a case-by-case basis to determine whether they should be considered separate EOs. NatureServe separation distances are used. Barriers to movement include roads, untraversable topography, and urbanized areas lacking appropriate habitat.

Evidence (e.g. photographs) is required to confirm new EO submissions, unless submitted by experienced individuals (e.g. wildlife biologists, experienced volunteers, and contractors). All corroborated/trusted submissions are included, regardless of distance to stream habitat. Turtles not mapped if they are thought to have been moved or were not likely to survive.

Public Natural Diversity Data Base and environmental review mapping processes also use buffers and map habitat in order to protect surrounding habitat and mask locations for species, such as the Wood Turtle, which are sensitive to collection. Public maps are updated every six months.

New Jersey

Wood Turtle observations are submitted to biologists and undergo rigorous evaluation for inclusion in mapping according to an established protocol to ensure reliability. All observations deemed valid by the biologist are entered into Biotics as Source Features, and these Source Features are then grouped into EOs using NatureServe separation distances and major roads, impassable topography, and urbanized areas as barriers to movement. No habitat specific exclusions or inclusions are made. The buffers applied in Biotics are based on minimum mapping unit standards and locational uncertainty, following NatureServe methodology. During the evaluation process by the biologist, observations are evaluated for inclusion in the Landscape Project, New Jersey's wildlife habitat mapping tool for community land-use planning and species conservation. Inclusion in Landscape Project is based on species status, record accuracy within 6-50 meters ("high accuracy" according to NatureServe), a last observation date of 1980 or later, and essential habitat type.

Endangered and Nongame Species Program (ENSP) has defined a Species Occurrence Area (SOA) for every type of occurrence (e.g. nesting area, hibernaculum), or "feature descriptor," assigned to a species. A SOA is a polygon specific to each species-feature descriptor combination that is applied to each observation location (pre source feature in NatureServe terminology) and used to value habitat in the Landscape Project. Wood Turtle SOAs are mapped as points with a 500 meter buffer, which represents the home range as reported in peer-reviewed literature and information obtained through ENSP research and expert opinion.

SOAs are then overlaid onto New Jersey Department of Environmental Protection's 2012 Land use/Land cover Update for New Jersey (LULC) to create Wood Turtle specific habitat patches. The polygons from LULC classes included as potential habitat for Wood Turtles (ex. herbaceous wetlands, deciduous brush/shrubland) are categorized as Limited Extent. Limited Extent polygons are valued upon intersection with a SOA. Once the valued habitat area is identified, any internal holes or gaps containing polygons of selected LULC classes are also valued if they are completely enclosed by, and contiguous with, the valued area. These habitat patches are also valued based on species status. Wood Turtle habitat patches are then included in the Species-Based Habitat spatial component of the Landscape Project to inform land use and conservation in the state.

Pennsylvania

Current method:

Occurrences are represented by points only.

Proposed (but unimplemented) method:

1. Select all National Wetlands Inventory (NWI) wetlands within 3900m of the occurrences that are close to waterways or wetlands, excluding isolated wetlands (farm ponds, vernal pools, etc.)
2. Merge stream segments that intersect the NWI wetlands within 3900m.
3. Exclude stream segments that do not intersect NWI wetlands (to remove high order streams that do not have open wetland habitat, thought to be of less importance to *G. insculpta*).
4. Clip this merged polygon at 3900m from occurrence(s).

5. Buffer these selected NWI and stream lengths by 400m. A buffer of 400m was selected to encompass the majority of terrestrial movements documented by Kaufmann (1992) of 300m, plus an additional 100m to buffer to allow for mapping error and to contain some of the movements of greater than 300m documented in other studies (Behler and Castellano 2005a Quinn and Tate 1991).

For *G. insculpta* found away from aquatic habitats, assume the occurrence is at the closest distance to a wetland or waterway, but include the occurrence, ending this segment of the core habitat polygon at the closest waterways perpendicular to the main watercourse on either side of the occurrence. Inclusion of these portions aim to identify areas that are important for nesting *G. insculpta*.

Exclusions:

- Separation barriers such as busy highways or highways with obstructions (Jersey strips)
- Untraversable topography (e.g., large waterfall)
- Urbanized areas lacking aquatic or wetland habitat
- Large impoundments either upstream or downstream should be removed from the core habitat

If the location of the Source Feature (and subsequent information regarding the description of the habitat in the EOR or field notes) is not consistent with the habitat description for the species, apply a 300 m buffer to the EO source feature and use the resulting polygon both as a temporary CHP and a temporary SLP. Make a note that CPP's need further review by a zoologist, preferably the person who documented the EO or someone who has experience with the taxon.

Maryland

Streams that are occupied by populations that are considered “viable for the foreseeable future” are given EO status (E. Thompson, pers. comm.).

Virginia

Information not yet received.

RECOMMENDED MAPPING PROTOCOL FOR THE NORTHEAST

Detailed below is a fine-scale mapping protocol recommended for use by state agencies and all other entities that intent to map Wood Turtle habitat. This protocol adopts the bulk of the Massachusetts mapping protocol, with some minor addenda. These detailed guidelines take into account well established information regarding both the spatial ecology and habitat requirements of Wood Turtles and thus reflect how focal populations will likely utilize the site-specific abundance and configuration of resources.

Note: Superscript numbers indicate components outlined in the Rationale section.

Guidelines:

Starting with points representing individual corroborated occurrences, follow the procedure below.

Step 1. Assign occurrences that are on land to the closest stream or tributary (within 500 m)^a using NHD stream data (or comparable high quality data layer). Join all occurrence points within 5 km^b and connected by water. Occurrences >500m should be individually assessed. *Do not map occurrences if the stream of origin cannot be confidently ascertained.*

Step 2. Extend mapped areas 2 km up and downstream of all EO source observations^c.

Step 3. Three buffer distances are applied to streams:

- 100 m: to capture all habitat types^d
- 300 m: to capture all non-forested appropriate habitat for Wood Turtles (i.e. wetlands, fields, nesting habitat)^e
- 500 m: to capture open habitats and nesting areas in rare circumstances where these habitats are absent from a 300 m buffer or are known to be readily used by Wood Turtles (e.g., through radio-telemetry)^f

Note: Buffer distances from large streams are measured from the edge, not the centerline.

Step 4. Include the following features within mapped areas:

- Stream channels that are present and visible (in most recent orthoimagery) within reservoirs and beaver impoundments. Map as far as the stream is visible.
- Tributaries that are optimal habitat (according to Jones and Willey 2015) \leq snapping point on the primary stream; map up tributaries 2 km from the EO sources.
- All nesting, field, and early-successional habitat within 300 m of a source. Include these habitats within mapped areas when extending beyond 300 m, but less than 500 m, with the exception of large agricultural fields.
- When open field habitat is absent (within 500 m) from stream segments >2 km, include forest habitat up to 300 m on the south sloping side of the stream. Include both sides if neither are south sloping.
- Shrub swamps and stream-associated wetlands up to 300 m from focal streams

Step 5. Exclude the following features from mapped areas:

- Commercial and residential areas with densities greater than sparsely dispersed
- Seasonal streams and streams with a gradient $>2.5\%$ for more than 1.0 km^g
- High gradient streams near the edge of habitat (near 2 km of the EO source)
- Large bodies of water such as ponds, reservoirs, and large beaver impoundments.

Note: Edges and vegetated areas as well as areas that are known to be occupied by Wood Turtles *should still be mapped*

- Tributaries >1 km from source point or closer than 1 km to non-optimal habitat
- Occurrence points >500 m from optimal habitat^a
- Sections of optimal habitat <0.5 km in length
- On a case by case basis: exclude centers of large agricultural fields >100 m wide and <500 m from streams (always include field edge [30 m] near streams; two edges if between streams)

Step 6. Exclude the following barriers to movement and consider their presence as grounds for splitting populations into separate EOs:

- Large rivers: end mapped habitat where the occupied stream converges with a large river (e.g. Connecticut, Merrimack)

- Roads: for roads that bisect mapped habitat 100 and 300 m from the focal stream, exclude the area on the far side

Additional Considerations

The above protocol provides a thorough methodology for mapping populations across a broad range based on occurrence points alone. However, the incorporation of site- and population-specific information can greatly enhance the utility and conservation value of maps. The recommendations outlined below have the potential to enable more effective management and monitoring of priority sites as well as aid the environmental review process.

Ephemeral or vulnerable habitats.— Early-successional habitats and nesting areas play a critical role for Wood Turtles and can be scarce at certain locations. Succession can render early-successional cover obsolete and nesting areas can quickly erode or become inundated with invasive plants. Even sites with an abundance of these features are vulnerable to rapid change and degradation. Without effective long-term monitoring, high quality Wood Turtle habitats can decline precipitously in areas that are not adequately maintained by natural disturbance processes. Institutions and agencies should consider delineating all nesting habitats and important patches of early-successional habitat present within areas mapped using the protocol above. This will reduce the reliance on memory-based decisions and allow for valuable visual assessments of the spatial distribution and relative abundance of resources over time.

Population-specific information.— Radio-telemetry and ground surveys can reveal important (and sometimes unanticipated) high-activity zones and high-use nesting areas. Focusing attention on these areas will optimize the efficiency and effectiveness of management. Therefore, institutions should consider mapping these areas separately.

Rationale

^a*Exclusion of observations greater than 500 m.*— Turtles are often displaced by flood events. Turtles found >500 m from streams in unsuitable habitat may be displaced individuals returning to their original stream section.

^b*Joining points within 5 km.*— Jones and Sievert (2007) found that the average stream length of five Massachusetts populations was 3.9 km. The maximum stream length use observed during a multi-year study of several populations was 9.3 km (Jones 2009).

^c*2 km upstream/downstream.*— The 95th percentile of stream home range lengths for males was 1.4 km, while the maximum was 6.2 km (Jones 2009). Parren (unpublished data cited in Fowle, 2001) observed a single turtle maximum in stream length of 1.7 km in VT. Stream home range areas are known to shift 2 km upstream or downstream between seasons for individual turtles (Jones pers. comm.).

^d*100 m buffer for all habitat types.*— The 50th percentile river-to-forest distance Wood Turtles traveled over a five year time period was 115 m (Jones and Sievert unpublished data, 2008). Median distances traveled from the stream by Wood Turtles at 3 macrosites in Massachusetts ranged from 34.6–73.1 m and the maximum was 103.2–129.8 m (Jones 2009).

^e*300 m buffer for non-forested habitat.*— In Massachusetts the median distance traveled from rivers by females was 132 m and the maximum distance was 307 m (Jones 2009). Kaufmann (1992) and Arvisais (2002) indicate that all radio-tracked turtles were within 300 m of streams. The average of maximum distances moved from streams in agricultural areas in MA was 113 m and the average across all sites was 190 m (Jones pers. comm.). TRC and Hyla (2003) report that adult Wood Turtles (n=31) travel up to approximately 205 m in a straight line distance from their over wintering streams at the 90th % in Methuen. In NH, Tuttle and Carroll (2003) report that 95% of adult locations (n= 489 from 10 radio

tagged turtles) were within 175 m of stream, with the maximum distance for males at 198 m and females at 231 m.

^f*500 m buffer when open/nesting habitats are absent nearby.*— The median distance moved by individual Wood Turtles in ME during a 2 year radio-telemetry study was 3.6 km (Compton 1999). Kaufmann (1995) reported that longest axis of 10 male and female home ranges (95% area polygons) ranging from 389–537 m in PA. A female Wood Turtle was observed to travel up to 945 m straight-line distance from their home stream in MA; males have been observed making overland movements greater than 16 km (Jones and Sievert 2007). Further, Kaufmann (1992) reported adults traveling up to 600 m in a straight line distance away from their home streams. Typically, females tend to spend more time in terrestrial habitats and are additionally found further from their overwintering streams compared to males.

^g*Stream gradient.*— Wood Turtles have been documented to be strongly associated with low-gradient streams. The median stream gradient used by 120 radio-tracked Wood Turtles in MA was 0.36%, and 95% of all home ranges were associated with streams less than 1.1%. Wood Turtles are associated with steeper sections of smaller streams (<2%) and very flat (0–0.5%) braided section of large rivers.