IN THE UNITED STATES

Steven Krichbaum	)	
	)	
Plaintiff	)	
	)	
	)	AFFIDAVIT OF STEVEN
v.	)	KRICHBAUM IN SUPPORT OF
	)	PLAINTIFF'S MOTION
Joby Timm	)	
Mary Yonce	)	
U.S. Forest Service	)	
	)	
Defendants	)	

In this document, Defendants refers to the USFS, Mr. Joby Timm, and Ms. Mary Yonce (in their official capacities); Plaintiff refers to Steven Krichbaum; Objection refers to Plaintiff's Objection to the North Shenandoah Mountain ("NSM") project (incorporated by reference into the FR Objection, unless reference is specifically made to the Feltz Ridge ("FR") Objection; EA refers to the NSM Environmental Assessment.

AFFIDAVIT OF STEVEN KRICHBAUM FOR THE NORTH SHENANDOAH MOUNTAIN/ FELTZ RIDGE PROJECTS

I, Steven Krichbaum, have personal knowledge of the following and could competently testify thereto if called as a witness, and do hereby declare as follows:

1. My address is 412 Carter Street, Staunton, Virginia, in Augusta County. I have lived in the vicinity of the George Washington National Forest ("GWNF") in Virginia for around 50 years.

2. I often provide information in comments to the Forest Service about the plants and animals and ecological conditions of interest and concern I observe in the George Washington National Forest, including Threatened, Endangered, or Sensitive species. I did so, for example, regarding the presence of the "declining", "imperiled", and Virginia state "Threatened" Wood Turtle or its habitat at this specific project area.

3. I participated in the formal public comment process for the North Shenandoah Mountain ["NSM"] project in Virginia and West Virginia on the North River Ranger District of the GWNF. I submitted comments in response to the initial project scoping in 2017 and to the draft Environmental Assessment ("EA") in 2019. I filed an administrative Objection for the NSM project in 2020; with the Objection I submitted a number of exhibit documents dealing with the Wood Turtle (*Glyptemys insculpta*) in digital form on a flash drive, including my Doctoral dissertation. I am now (2023) submitting an Objection to the Feltz Ridge decision.

4. In my Objections, as a requested remedy I suggested the implementation of a protected 300m buffer zone around each side of the low elevation stream reaches with Wood Turtle habitat at the NSM/FR project areas. I did so knowing that there is no law or regulation that requires the Defendants to implement the contemplated actions in the 300m WT buffer zones at these specific sites; their actions are entirely discretionary. The 300m buffer is a compromise I made in a good faith effort in hopes that the Defendants would choose to avoid the time, work, and expense of a lawsuit. In addition, the great majority of the proposed projects could proceed as per the Defendants' decision.

5. The sites for the contemplated actions are public lands; avoiding harms to the Wood Turtle at sites here at the Project area is clearly pragmatic, reasonable, and feasible. The statements in the State Wildlife action Plans are not qualified, in that the statements regarding Wood Turtles do not read that they are a "Species of Greatest Conservation Need, as long as they are within 100m of streams". In essence, the Defendants have taken the stance that Wood Turtles and their habitat outside of 100m from the streams at the NSM/FR project area are not important demographically, genetically, ecologically, or socially (with regard to humans).

6. Over the last 19 years I have spent several thousands of hours in the field searching for, observing, and studying Wood Turtles and their habitat on the George Washington National Forest. I have spent many more hundreds of hours reading published research on Wood Turtle and chelonian biology, life history, ecology, demography, and conservation. I have had many long and fruitful discussions with recognized turtle experts such as Dr. Willem Roosenberg, Dr. Peter Paul Van Dijk, the late Dr. Joseph Mitchell, Dr. Thomas Akre, and James Harding, as well as other researchers and students.

I have written and submitted dozens of letters and comment documents regarding Wood Turtles to the GWNF managers. These include comments/letters/appeals for timber sales and other site-specific actions, comments on the Forest Plan revision (such as requesting that some Wood Turtle sites be designated as Special Biological Areas - none were), reports on sites where I have found Wood Turtles, information pertaining to a Forest conservation plan for the Turtles, and letters specifying issues and concerns regarding Turtle conservation and Forest management. With these documents I also submitted dozens of reports, journal papers, and other material written by others relevant to Wood Turtle conservation, such as with a Lee RD burn project appeal in Sept. 2007, the Paddy TS in 2004, the GWNF Plan revision, and for these NSM projects.

With regard to Wood Turtles, I have been a known quantity for years. The Defendants knew of my Doctoral research on the Forest (I had gotten a permit for it from the Forest Service). And they knew that this formal study had to do specifically with the Turtle's use of forest habitat. It would have been simple matter for them to consult with me on this project. Yet they did not, nor did they use my dissertation research in the preparation of the NSM/FR Environmental Assessment ["EA"}, Biological Evaluation ["BE"], or Objection Response (no citation in the narrative or "References"). Evidence in the record does not support the NSM/FR decisions — the Defendants' decisions are not fully informed and well-considered.

7. On the Forest, I have observed approximately 275 different Wood Turtles (the great majority being adults). I searched many stream sites on the GWNF in Virginia and West Virginia that are within the Turtle's range and that appear to have suitable WT habitat (*e.g.*, low gradient streams with rocky substrates, low elevations, forested uplands). Out of around 70 sites, many of which were searched multiple times, at only 12 did I find Wood Turtles; at many locations I found only a small number of individuals. Of course, this is not to suggest that the species definitely does not occur at the other 58 sites (see list of sites at Krichbaum ESA listing comment data Table 9 submitted with NSM Objection). In the absence of systematic and comprehensive surveys, we are simply uncertain about where Wood Turtles are distributed on the GWNF.

7. I received my PhD (Ecology and Evolutionary Biology) from Ohio University, one of our nation's Tier 1 research universities. My Doctoral dissertation was entitled "Ecology and Conservation Biology of the North American Wood Turtle (*Glyptemys insculpta*) in the Central Appalachians". The focus of this research project was the Turtle's use of terrestrial habitat during the summer months, the time period of their most expansive spatial movements. The four years of field study for this work all took place on the GWNF, only around 35 miles from the NSM project area. The four summers were spent searching for and radio-tracking Wood Turtles. At the locations where Turtles were found and at random points I identified, counted, and measured structural and compositional components of the their habitat, such as types of trees and herbaceous flora, amounts of large woody debris (downed trees), and degree of canopy openness. This intensive study of habitat use and preference is of great relevance to proposals involving ground-disturbing activities that modify habitat where Wood Turtles may occur on the GWNF. The results of and factors identified by this study can be used for well-informed decisions regarding management practices, protective measures, and habitat enhancement or restoration, as well as make predictions as to the suitability of sites as potential Wood Turtle habitat.

While at Ohio University I taught conservation biology, introductory ecology, survey of the animal kingdom, and labs for introductory biology. In addition, I was a teaching assistant for herpetology, mammalogy, freshwater biology, comparative vertebrate anatomy, and field ecology.

Predation

I have found Wood Turtles on the Forest, both alive and dead, that had apparently been attacked by some unknown predator. I have also found Turtle nests that had been dug up and destroyed by some unknown predator.

The predators of concern include Raccoon (*Procyon lotor*), Gray Fox (*Urocyon cinereoargenteus*), squirrel species (*e.g., Tamiasciurus hudsonicus* and *Sciurus carolinensis*), Striped Skunk (*Mephitis mephitis*), Red Fox (*Vulpes vulpes*), Coyote (*Canis latrans*), Opossum (*Didelphis virginiana*), Mink (*Mustela vison*), River Otter (*Lutra canadensis*), Eastern Chipmunk (*Tamias striatus*), and Great Blue Heron (*Ardea herodias*) (Mitchell, J. 1994, and Ernst, C. *et al*. 1994).

I have observed Raccoons, Striped Skunks, Opossums, Red Foxes, Coyotes, Grey and Fox Squirrels, Chipmunks, Minks, and Great Blue Herons on the GWNF, at the NSM project area or near to it. All these known Turtle depredators listed above, along with domestic Dogs (*Canis familiarus*), can be expected to occur at the NSM project area. These predators can kill adult, juvenile, and/or hatchling Wood Turtles, as well as destroy Turtle nests. Skunks and Raccoons are perhaps the biggest problem; *e.g.*, "Over the four year study period 16.8% of all [Wood] turtles were found with injuries attributed primarily to raccoons (*Procyon lotor*)" (Farrell and Graham 1991). I have observed Raccoons waiting very near female Turtles while they were nesting on the GWNF. (Also see Akre presentation of Sept. 3, 2020 on Youtube).

Increased or facilitated predation can turn areas with otherwise suitable physical conditions into "ecological traps". Such sites may look attractive to a Turtle, but they actually decrease their fitness (*i.e.*, reduce survival and reproduction) and negatively impact population viability (Exhibit 14 with my Objection).

Predation pressure having devastating impacts upon nesting success and subsequent recruitment are reported throughout the Wood Turtle's range (see, *e.g.*, James Harding pers. com. 2007, Siart 1999, Brooks *et al*. 1992, Buech *et al*. 1997b, Hunter, M. *et al*., 1999, Harding, J.H. 2002, Paradis, S. *et al*. 2004, and Bowen & Gillingham 2004).

Due to human subsidy (*e.g.*, garbage), habitat alteration (*e.g.,* increase in edges and roads), and extermination of large predators (*e.g.*, Cougar and Gray Wolf), populations of many meso-predators such as Raccoons have markedly increased in the East (Engeman, R.M. *et al*. 2005 and Mitchell & Klemens 2000). Even a small number of such creatures can have a devastating impact upon turtle populations (see Engeman, R.M. *et al*. 2003 and Engeman, R.M. *et al*. 2005).

A 2016 survey of 82 biologists with an average of 10.5 years of experience working with Wood Turtles identified the three greatest range-wide threats to Wood Turtles as habitat loss and degradation, elevated adult mortality, and poaching (pg. 173 in NE WT Conservation Plan).

At 12 different sites on the GWNF in VA and WV where I have found Wood Turtles, the sites with the lowest proportions of Turtles with major injuries were the least developed sites. The site where Turtles bore the greatest proportion of major injuries (*e.g.*, missing limbs) was the most developed/degraded. At this site, there are open and closed roads (including paved), residential development, fishing & hunting, previous recent forest cutting, invasive plant species, agriculture, and a developed recreational site in the riparian area — this is at the NSM Slate Lick "working area". It is relevant that this site is the most degraded Turtle occurrence location I know of on the Forest. I had previously notified the FS about this over ten years ago in my 2009 GWNF Wood Turtle conservation "Strategy" comments (submitted with Objection).

I have observed human-generated garbage at the Slate Lick recreational area. This serves to additionally attract Turtle predators to the site and subsidize their populations (Mitchell and Klemens 2006). And, of course, vehicle use on the open road there may result in road-kill and the visitors attracted to the site may collect and remove Wood Turtles.

The Turtle population at this site is already afflicted by multiple stressors, and now the Defendants actions (logging, burning, road building) would foreseeably make the situation even worse.

Poaching and collection

Poaching is an ongoing and persistent threat to the Wood Turtle. See section "2.c. Illegal Trade" in Objection at pp. 13-15 and see pp. 70-72 of "The Ecology and Conservation of the Wood Turtle" document in the NSM project's administrative record. And yet the Defendants have publicly broadcasted locations of the Turtles (see NSM EA) and intend to make it easier to access the sites, in addition to piling further stresses upon the populations (cumulative impacts). Poaching of Wood Turtles is already known to have occurred in Virginia and West Virginia.

Further, recreational use at Wood Turtle sites can incur non-commercial collection of Turtles that can have devastating impacts on populations (Garber and Burger 1995). Capture for pets or food directly removes individuals from populations, a depletion that has an effect on population viability not unlike that which incurs from mortality.

For the NSM Slate Lick area, the Defendants have acknowledged that unplanned trails and camping areas in the Slate Lick area are significant threats to water quality and native species. The Draft EA states that a full review of recreation was not conducted alongside the other management activities, due, in part, to the fact that "stakeholder discussions became more contentious in nature and there was an inability to reach a consensus proposal." (DEA at 58). The fact that there were divergent views amongst some stakeholders does not justify the Defendants' refusal to fully and fairly address these issues in the context of the project's potential impacts to Wood Turtles.

Moreover, the increase in human access proposed by the Defendants from increased dozer-bladed roads (permanent, temporary, skid) is not confined to the

Slate Lick working area; increased access would also occur at the FR PA.

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The Defendants "recognized" that "illegal collection, habitat loss and fragmentation, predation on nests and juveniles by predators (e.g. raccoons), and vehicular mortality" are primary factors affecting viability of the Wood Turtle viability (BE-20). But merely recognizing something is not equivalent to meaningful and adequate analysis of it, nor is it equivalent to effectively taking actions, or avoiding actions, to positively do something about it.

The Wood Turtles at my GWNF study sites tended to avoid areas of anthropogenic early successional habitat (*i.e.*, recent tracts of even-age logging) as well as roadside edge habitat. With one exception, I never found Wood Turtles inside the regenerating even-age cuts 5-35 years old with a high stem density of tree saplings. The Turtles would go right to the edge of some recent cut units, but no further. Whenever I did find them at the edge of a cut unit it was at the site of a large mature leave-tree (the trees left standing at "modified shelterwood" cuts, which are *ca*. 90% of a clearcut) around which the understory (*e.g.*, blueberry bushes (*Vaccinium* spp.)) was undisturbed. The one exception was a female turtle located *ca*. 20m into a 5-year old regenerating modified shelterwood cut who was eating blackberries (*Rubus*) growing there. See far south site at Fig. 1a in NSM Objection Exhibit 8 and the figure in the 2006 Akre & Ernst report submitted with the Objection.

Part of the reason for this may be that the closed-over canopy at such regenerating logging sites, resulting from both the high stem density sapling regeneration as well as the lack of canopy gaps, makes for constantly shaded conditions that preclude spatially efficient thermoregulatory shuttling. In addition, such sites typically manifest a scantily developed ground floor herbaceous layer (Roberts 2004) that decreases foraging opportunities and exacerbates exposure to predators. See see Fig. 5 photo at Objection Exhibit 8. The cut-over sites are soon so densely shaded that they are of little or no value as nesting, basking, or foraging sites for Turtles.

In Appendix F Section 4 of the GWNF FEIS, the Wood Turtle is not listed in the "Regenerating Forest Associates" [early successional forest] group at pg. F-58. It is listed, however, in the "Late Successional Hardwood Dominated Forest Associates" at pg. F-50. Nonetheless, tracts of late successional forest (also called "mature" or "old-age" forest) are what the Defendants intend to cut (and convert to "Regenerating Forest") at the NSM Project area (see Exhibit 7 for the names and locations of these sites).

Except for nesting females, I never observed a Wood Turtle using roadside open or edge habitat (except when crossing roads). Unlike Box Turtles, I never found them sitting out in the open in roadbeds or the road edge. The Defendants recognize that Wood Turtles are not associates of **ruderal habitats** ("previously disturbed habitats like old fields, old homesites and roadsides.") - GWNF FEIS at F-63 - Sec. 4.2.17.

In short, all these lines of evidence indicate, at least in some parts of their range such as here, it is a good idea to avoid fabricating large openings and simplifying forest structure in Wood Turtle habitat. Habitat complexity generally increases as forests age (Franklin *et al*. 2002) and, amongst other benefits, this complexity provides thermoregulatory opportunities, foraging resources, potential mating encounters, and refugia from predators (Finke and Denno 2006).

The even-age cutting implemented/ proposed/allowed at Wood Turtle sites on a place such as the NSM/FR area (*e.g*., modified shelterwood or coppice with reserves) is like that proposed elsewhere to fabricate high stem-density thickets for the benefit of species such as Ruffed Grouse (*Bonasa umbellus*). Such cutting sites may function as "openings" for birds or even Deer. But for a creature that basically lives its life four inches off the ground such as does the Turtle, these areas do not function as openings in any real sense of the word.

Canopy gaps - natural processes/disturbance

My studies clearly showed Wood Turtles to prefer slightly more open canopy conditions (due to broken overhead crown branches or small natural gaps such as from tree downfall) than were available at random: preferring a mean canopy openness of *ca*. 19.8%. Mean canopy openness as measured with a spherical densiometer at 197 paired random points at the VA study site was *ca*. 13.1% (se = 0.40), for 123 random points at the WV study site it was 16.7% (se= 0.97). Whereas for Turtle locations it was a little higher, 19.6% (se = 0.97) for 123 WV turtle points and 20.1% (se = 0.96) for 197 VA turtle points (Exhibit 6).

Mean amount of ground area beneath canopy gaps $\geq 9m^2$ estimated in the $400m^2$ plots at 197 adult Turtle points at the VA study site was $41.4m^2$ (se = 4.41), for 123 adult Turtle points at the WV study site it was $33.1m^2$ (se = 4.11) (Exhibit 6). In other words, Wood Turtles associate with small natural canopy gaps. These broken canopies or canopy gaps are in otherwise intact forest. This information was submitted to the Defendants at Objection pg. 30.

Wood Turtles are said to be "Open Woodland Associates" at 4.2.15.h. at FEIS App. F-58 - "These species are associated with mature stands of trees with open (26-60% open) canopies and well developed grassy or shrubby understories."

The Defendants do not substantiate the Turtles' alleged preference for such 26-60% openness with citations to studies on or around the GWNF. Due to differences in conditions such as floristics and climate, Wood Turtles in the Northern parts of their range (*e.g*., Michigan, Maine, or Quebec) may use or prefer different forest conditions than at other locations such as here.

In addition, there is nothing more closed-canopy than the interior of regenerating even-age logging sites. And they stay this way for decades. This corresponds to the stem

exclusion and understory reinitiation stages of stand development (Oliver and Larson 1996).

By providing both shaded and exposed microhabitats that allow for a range of humidity and temperature conditions, broken canopies and small gaps facilitate efficient osmo- and thermo-regulatory shuttling for a small animal such as the Wood Turtle. In addition, by providing a greater range of forest floor light levels and temperature regimes at small scale, gaps can allow for more floristic richness and/or abundance, *i.e*., increased foraging opportunities for Turtles.

According to activity budget theory regarding allocations of time and energy (Dunham *et al*. 1989), perhaps the most efficient use of time and space by an animal would involve a form of multi-tasking (Fortin *et al*. 2004); meaning that while one was engaged in thermoregulation, one would also be engaged with foraging, avoiding predation, and/or the seeking of mates or other reproductive activities.

Small canopy gaps in mature forests, and the litter, woody debris, and herbaceous vegetation found therein, may afford Wood Turtles just such an opportunity to implement synchronous thermal, foraging, and predator avoidance strategies at a single site. The possible advantages of such multitasking sites are the reduction in exposure to predation when forced to move about, reduction in search time for seeking out sunny spots, shady shelter, or foraging patches, and reduction in the energy expenditures consequent of locomotion to such locations. (Objection pp. 30-31)

Mature forests are of the age that a mosaic of habitats is gaining expression due to the operant natural disturbance regime (Franklin *et al*. 2002). And still more such niche complexity (including canopy openings and loadings of large woody debris (LWD)) can be expected to develop as mature forests grow older (Dahir and Lorimer 1996). I have consistently found the Turtles to associate with large woody debris and smaller coarse woody debris in both their terrestrial and aquatic habitat (NSM Obj. Exhibit 6).

Broad-scale habitat alterations, such as intensive logging of areas 10ha in size or road building, could fabricate conditions that Wood Turtles might avoid from a thermoregulatory perspective. Conversely, small canopy gaps, the result of the natural disturbance regime in NE forests (Runkle 1985 & 1990 & 1991b, Rentch 2006, Glasgow and Matlack 2007), create diverse conditions at a fine spatial scale that allow for shuttling and thermoregulatory ease as well as multi-tasking. Mature and old-age forests with such naturally provided fine-scale structural complexity and heterogeneity, and concomitant thermal diversity, should be encouraged in Wood Turtle habitat. (Objection at pg. 27-32)

Wood Turtles are said to be "Riparian Area Associates" (4.2.16. at FEIS F-60) - "There are also a number of the species in this group that benefit from open canopies. These include wetland plants and many of the birds. Flood events, canopy gaps, edaphic conditions and beaver activity are expected to meet most of the needs of these species." In other words, natural processes and conditions suffice.

It must be remembered, however, that Wood Turtles are NOT confined to riparian areas.

It is clear that Wood Turtles use a diversity of habitat conditions, not a narrowly proscribed set, such as amount of canopy openness. What is "optimal" is in some ways difficult to precisely define. By having a 300m conservation zone around streams with diverse natural processes operant, however, a broad range of habitat structural and compositional conditions will be provided, *viz*., a diverse range of tree densities and sizes, cover of herbaceous understory, and absence/presence of subcanopy or mid-story trees — within-patch variation. In this way, with this Turtle-scale heterogeneous landscape, as opposed to narrowly circumscribed and homogenous outcomes (*e.g.*, similar large-scale even-age management impressed upon numerous stream habitats), we are less likely to compromise their fitness. This project is an example of how narrow and inflexible management prescriptions designed for one purpose, *i.e*., restoration of Shenandoah Mountain, can lead to habitat homogenization/degradation that compromises the outcome for other conservation objectives, *i.e*, Wood Turtle viability.

Claim 2
Population Viability:

Population persistence involves a balance between exogenous/extrinsic ecological factors (habitat quality/quantity that influence carrying capacity – "K") and endogenous/ intrinsic evolutionary & demographic factors (vital rates that contribute to population growth rate "r" or λ) (Kinniston & Hairston 2007). The self-sustainability of populations in the long-term is a function of population size (Willi & Hoffmann 2009, Reed & McCoy 2014).

Habitat quality is a consequence of abiotic and biotic structural, compositional, and functional attributes of patches. Within any patch, organisms experience their surroundings as gradients of differential quality in relation to ecological and life-history characteristics (McGarigal & Cushman 2005). Poor habitat quality may involve: predation (decreased survival, nest failure), decreased reproduction, and/or decreased nutrition or increased energy expenditure. Reduced food availability was the most commonly identified proximate cause of population declines/extinction due to climate change (Cahill *et al*. 2013).

If Wood Turtle adults, juveniles, and/or hatchlings are at sites, then we must assume the potential for some to be killed during logging, burning, and/ or road building operations – the question is: How many? And how did the Defendants determine that this mortality or serious injury is not significant to distribution, abundance, and viability? From a population biology perspective, Wood Turtles are at razor's edge, perhaps the most sensitive chelonian species in the entire United States with regard to the impact of the loss of adults or juveniles upon population viability (see Reed and Gibbons (2003) paper submitted with Objection).

The Defendants do not have important basic information on **existing conditions** or projected results regarding Wood Turtles at the NSM/FR project areas; see, e.g., NO estimates listed at pp. 8 & 10 of NSM Objection. Yet they have decided to implement project actions that may kill still more Turtles or degrade still more Turtle habitat, adding additional stresses to populations. A critical question to ask is: How much cumulative mortality and stress can a population absorb and still be healthy and viable for the long term?

Though the Defendants do not have fundamental information on the Turtle's populations and distribution at the Project area, somehow they *do* know that their decisions are having "no significant impact".

As stated in my Objection: "**the impacts are at best significantly controversial and uncertain:** The Defendants do not not clearly address and explain how the direct, indirect, and/or cumulative losses potentially accruing from the above listed concerns and sources of take/ harm do not reach the bar of significance – instead we have conclusory assertions."

For instance, the Defendants fail to sufficiently address impacts of reduced Turtle carrying capacity or harm to population viability due to direct or indirect decimation of critical food resources. To what extent will the contemplated actions (*e.g.*, logging/cutting/ burning/herbicides) cause reductions in abundance of critical food resources? Replacing mature forests with early successional regeneration at cutting sites could result in decreased carrying capacity, increased dispersal, increases in Turtle mortality, or reductions in reproduction or recruitment. These issues (see, *e.g.*, Objection at pp. 28-29) have not been realistically and sufficiently addressed in the NSM/FR Projects analyses and disclosure. Of particular concern are impacts to the flora that are associated with Wood Turtles that are discussed in Plaintiff's NSM Objection Exhibit 5. This lack of "scientific integrity" produces "significant uncertainty" and "unknown risks", as well as the potential for significant impacts.

Lack of Surveys

An additional problem and concern is that the Defendants only intend to implement their Design Elements (*i.e.*, mitigation measures) at sites known to be occupied by Wood Turtles (see Objection Response). However, they have not performed/obtained sufficient surveys to detect presence at 14 of the stream sites proposed for intensive ground disturbance that can result in direct and indirect mortality and harm to Turtles that may be present. This is also an issue of significant "uncertainty".

The response of the Defendants to my FOIA request and the information provided in the EA and DN make clear that comprehensive surveys throughout the NSM/FR Project areas have not been accomplished for Wood Turtles. Only a handful of the stream sites proposed for ground disturbance were surveyed (in some way at some time). The agency does not know if fourteen (14) stream sites proposed for various management "treatments"

are actually occupied by Wood Turtles. The habitat at these 14 sites appears to be suitable for Wood Turtles; this assessment is based upon my personal observations of the Project area, my observations of Wood Turtles in the wild in VA and WV, information in the EA regarding forest types at the sites, and my intensive Doctoral research of Turtle habitat use on the Forest.

With regard to surveys and management, see the statement in "Wood Turtle Surveys - West Virginia April 16, 2019" FOIA document 2.17 in the Administrative Record: "[WV] State herpetologist, Kevin Oxenrider, noted that any of the perennial tributaries to the South Fork of the South Branch Potomac River are within the species range, have suitable habitat for wood turtles (Jones and Willey 2018), and should be managed as if they are present."

I too recommended to the Defendants that the suitable sites at the streams in both VA and WV should be managed as if they are occupied by Turtles, but the Defendants refused to do so (see NSM Objection Response).

This refusal is repeated here for the FR project (see DDN). The FS repeatedly refers to design elements (mitigation) as only applying to streams " known to be occupied by wood turtles". But this is flagrantly insufficient as it is not apparent that comprehensive surveys for the Turtles at all the streams have been accomplished. <u>It is clear that they may occur at Old Road Hollow and Straight Hollow in addition to "known occupied" places</u>.

Mitigation - Scouts

Turtles are difficult to find. The vague use of "scouts" is an ineffective way to mitigate harms. Wood Turtles are difficult to find, therefore, the chances of detection and consequent mitigatory effectiveness are low. And what is the knowledge base of these "scouts" and what is their competency? On this the Defendants are silent. Nor is it clear precisely where, when, and how the "scouting" would take place.

And how can it be certain that the project's "Design Element" actions are actually carried out? How do we know Wood Turtles would not be intentionally removed from sites or intentionally killed there?

The Defendants do not substantiate that the use of "scouts" is an effective mitigation methodology for this species here; they cite to no research that this methodology is successful at avoiding significant impacts to populations. Wood Turtles are generally cryptic and can be very difficult to locate on land (*i.e.*, have a low detectability). They can be in and under all kinds of ground cover. They are not large and they are not sedentary. They cannot, however, run away or fly away from harm. They can be easily overlooked and at the mercy of motor vehicles and falling trees. To say nothing about their vulnerability to the flames from intentional fires — the Defendants are silent about the impacts to Wood Turtles from **burning and herbiciding** in their Objection Response.

An additional problem and concern is that the Defendants only intend to implement their Design Elements (*i.e.*, mitigation measures) at sites known to be occupied by Wood Turtles (see NSM Objection Response and FR DDN). However, they have not performed/obtained sufficient surveys to detect presence at 14 of the stream sites proposed for intensive ground disturbance that can result in direct and indirect mortality and harm to Turtles that may be present.

Habitat Use, 300m, Core Habitat

Although often found near the main streams, in my study of Wood Turtles on the GWNF both sexes were regularly observed at dry drainages, slopes, and ridges far from water (*e.g.*, >500-700m away). Similarly, movement patterns at all three of Akre and Ernst's (2006; submitted with Objection) study areas in Virginia nearby the NSM project area were found to be similar to and consistent with my and other studies (*e.g.*, Compton 1999, Arvisais *et al*. 2002 Kaufmann 1992, Arvisais *et al*. 2002 & 2004, Flanagan *et al*. 2013, Parren 2013).

In VA, the distance from the main stream containing 95% of female terrestrial location points was 375m and 256m for males, while in WV the distance was 406m for females and 243m for males (Exhibits 1 & 6 with Objection). Clearly, the Turtles regularly use forested habitat beyond 300m from the streams — further indication that the 300m buffer is a compromise I made in a good faith effort.

In VA, ninety-five percent of all (M & F combined) Turtle location points were within a 295m buffer zone around the main stream. This zone extending out 295 meters from both sides of the stream included 560ha of National Forest. In WV, ninety-five percent of all Turtle location points were within a 290m buffer zone around the main stream. This too is congruent with the work of Akre and Ernst (2006) on the GWNF: at their forested study site in VA, 95% of Turtle locations were within 300m of the perennial stream there.

My limited sample of individuals clearly showed that Juvenile Wood Turtles also disperse outside of "riparian areas"

This terrestrial zone extending out 300m from the perennial streams can be considered the "**core habitat**" for Wood Turtles (*sensu* Semlitsch and Jensen 2001, Semlitsch and Bodie 2003, Congdon *et al*. 2011). Core habitat is the area wherein the animals spend most of their time and make their living; *i.e.*, it supplies food, cover from predators, sites for thermo- and osmo-regulation, and mating opportunities. This terrestrial zone core habitat is where conservation efforts for this species can be focused. It may be only part of some individual's overall home range (the area encompassing the totality of its movements), but it is a significant part.

The 300m metric is also consistent with numerous other Wood Turtle studies in various locations in the species' range (Compton 1999, Kaufmann 1992, Arvisais *et al*. 2002, Jones 2009; see Plaintiff's Dissertation in submitted exhibits with NSM Objection) In

Maine, 95% of Turtle activity areas were within 304m of rivers and streams (Compton *et al*. 2002). Radio-tracking studies clearly show that they may normally range up to 200-600 meters (660-2000 feet) from the water (Kaufmann 1992, Arvisais *et al*. 2002, Compton *et al*. 2002, Akre and Ernst 2006, Remsberg *et al*. 2006). In a Massachusetts study, 470 meters represented the 95th percentile median distance from water, with maximum distances being 634-932 meters (Jones 2009). In Ontario, Canada, a 500m zone on both sides of waterways is used to define "regulated habitat" in order to minimize harm to the species (Thompson 2018).

The normal extent of their terrestrial use of habitat varies amongst individuals, populations, and site conditions (Saumure 2004). Furthermore, the spatial extent of Turtle habitat use differs in landscapes with different types of land cover/use. For Akre and Ernst's (2006) study in Virginia, at the more altered and agricultural sites the Turtles did not disperse as much terrestrially (200-250m). The NSM Shoemaker River/Slate Lick "working area" Turtles of Sweetan exhibit this pattern (cited in BE); that site has agricultural, residential, and recreational development in and around it. Turtles of the same species shift their habitat use in response to differing anthropogenic disturbance at different sites (Roe *et al*. 2018).

One of the reasons expansive (relative to narrow stream buffers typically applied on the GWNF) protected zones are needed for the Turtles is not only to address the direct protection of their "core habitat", but also to mitigate, diminish, or prevent "**edge effects**" that may also reduce habitat quality/quantity. Timber cuts, roads, development, and other conversion of habitat result in the fabrication of ecological edges with a multitude of deleterious impacts. Edge width or depth/distance of edge influence (DEI) is the result of the penetration distance of various environmental variables and gradients, *e.g*., soil temperature, air temperature, litter moisture, photosynthetic active radiation effect on vegetation patterns, alien plant species invasion, and ingress by herbivores or predators (Zheng and Chen 2000). For conservation to prove to be effective, it is critical that deleterious edge effects, which translate to a form of habitat loss, receive much more explicit consideration (Harris *et al*. 1996, Zheng and Chen 2000, Fletcher 2005, Harper *et al*. 2005).

Wood Turtles have somewhat small home ranges (well recognized in the literature). The Turtles I studied/tracked had summer activity areas (their time of greatest terrestrial activity) that averaged *ca*. 2.25 hectares ± 0.38 (MCPs) — when corrected for sample size (number of observation points) bias the area was *ca*. 4.95ha ± 0.71 (see Table 1.1 in Exhibit 1 with Objection). Wood Turtles are not territorial, so multiple individuals can have overlapping home ranges or activity areas, *i.e*., they share on-the-ground habitat space.

Individual cutting units can be (and typically are, in my experience in the GWNF and other eastern USA forests) far larger than the typical activity area or home range of a Wood Turtle. Therefore, single cutting unit of 10ha/25 acres could destroy or significantly degrade the area used by multiple Wood Turtles. From the cutting proposed at the NSM,

long-term harmful impacts are probable, with limited very short-term beneficial impacts (*e.g.*, perhaps a few years of increased blackberries).

Numerous studies have revealed that over extended time periods adult Wood Turtles are strongly philopatric, *i.e.*, exhibiting a high degree of site fidelity, with an individual often occupying somewhat the same home range over multiple years (Quinn and Tate 1991, Kaufmann 1995, Ernst 2001a, Arvisais *et al*. 2002 & 2004, Tuttle and Carroll 2003, Akre and Ernst 2006, Jones 2009, Parren 2013, T. Akre unpub. data, my study).

Turtles at both my VA and WV sites presented a strong degree of philopatry, with individuals being found in multiple years at the same general locations. For example, in thirty+ field searches in the period 2006-2014 at the WV site fifty-nine adults were captured 125 times, with thirty-two being recaptured at least once; of the sixty-six total recaptures, all were adults. Of the 59 adults, 54.2% were female and 45.8% male. Nineteen of the thirty-two Turtles recaptured were female (59.4%) and 13 were male (40.6%). Three males were observed six different years and one male was observed five years. One female turtle was found in in five different years, with four others being found in three years or more (Krichbaum Exhibit 2 with NSM Objection). Some of the Turtles at the VA study site have been found there for three decades (Personal observation; Akre unpub. data).

Even when 300m no-disturbance buffer zones on both sides of perennial streams known or reasonably expected to be occupied by Wood Turtles are implemented, offsite effects from anthropogenic disturbance to forests remain of concern. Even stream communities at sites with stringently protected 300m riparian buffers can still be significantly degraded by disturbances elsewhere in the catchment (Wahl *et al*. 2013).

The cumulative effects of timber harvest on sedimentation rates last for many years, even after cutting has ceased in an area (Frissell 1997), and erosion from roads used for logging often contributes more sediment than the land logged for timber (Box and Mossa 1999). Increased sedimention, turbidity, and/or nutrient loads from erosion are known to reduce dissolved oxygen levels (Henley *et al*. 2000). Oxygen levels may be a critical variable for Wood Turtle survival during winter dormancy (Graham and Forsberg 1991, Ultsch 2006, Greaves and Litzgus 2007 & 2008).

The Virginia Water Quality Standards prohibit conditions that are "inimical or harmful to human, animal, plant, or aquatic life" and conditions in streams attributable to discharges include "turbidity" and other characteristics.

Because the condition of the matrix within which occupied patches exist may influence turtle abundance and population viability, effective restoration and protection must ultimately perhaps encompass even larger spatial scales (beyond the 300m zones) (Hansen and Rotella 2002, Ficetola *et al*. 2004, Roe and Georges 2007, Quesnelle *et al*. 2013).

Forest types

I have personally observed Wood Turtles in all the forest types such as are found in

the NSM/FR Project areas' Wood Turtle core habitat zones (see EA App. 5 and Exhibit 7), except for the Pitch Pine-Oak. I have certainly found Pitch Pine at WT location sites, but I do not know if it was a dominant taxon in the entire stand. So, the sites listed in Exhibit 7 where the Defendants propose to implement cutting and/or burning have suitable habitat for Wood Turtles from the standpoint of forest types. My personal observations on visits to these areas also corroborates this**.** These suitable sites at the streams in both VA and WV should be managed as if they are occupied by Turtles (as the WV biologist stated to the Defendants).

Overall, stands of at least ten forest types were used by Wood Turtles at my GWNF study sites (see Exhibit 5 – Table 5.4). Most of these are the same as are found at this NSM project area. Almost 92% of VA Wood Turtle terrestrial location points were in stands of just three forest types: White Oak – Northern Red Oak – Hickory (FT 53), Cove Hardwoods – White Pine (FT 41), and White Oak (FT 54). While in WV, over 96% of Wood Turtle terrestrial location points were also in stands of just three forest types, but different ones: White Oak – Northern Red Oak – Hickory (FT 53), Upland Hardwoods – White Pine (FT 42), and Virginia Pine (FT 33).

Importantly, even stands that may not be of a type as preferred as others can have many inclusions of smaller tracts of preferred forest (Exhibits 5 & 6 with Objection). It also must be kept in mind that just because a delineated Forest "stand" has high amounts of a certain taxon, such as Chestnut or Scarlet Oaks, does not mean that Wood Turtles cannot or do not use it. Such sites can have habitat attributes that the Turtles prefer, such as LWD, abundant mushrooms, particular forbs, or understory cover.

One aspect of the NSM/FR projects is to convert, through cutting and burning, some of these suitable forest types to Short-leaf Pine. Not only would the resultant compositional and structural change be of questionable use to Wood Turtles, the conversion would also entail repeatedly burning the sites later, actions that may incur additional Turtle mortality and/or habitat degradation.

Plant Indicator Species - mostly upland taxa

Wood Turtles regularly use habitats far outside of protected/designated riparian or wetland areas. Though the Wood Turtle is often characterized as or implied to be a riparian species or denizen of wet areas (see, *e.g.*, USDA FS EA), they clearly use dry uplands a great deal. Over thirty herbaceous and woody taxa were indicators for Wood Turtles at the $400m^2$ and/or $1m^2$ scales at my VA and WV study sites (Tables 5.13-5.20 in Exhibit 5 submitted with NSM Objection); all these taxa can be expected to occur in the NSM project area; it is within their known distributions and contains suitable habitat. The great majority of the indictors for Turtles were upland or facultative upland taxa, not wetland species (Tables 5.13, 5.17, 5.19).

In addition, Turtle $400m^2$ and $1m^2$ plots also had greater herbaceous richness than did random plots in both states (Exhibit Figs. 6.4, 5.14, 5.15); which pattern was also the case at another study's WV Wood Turtle river site (McCoard *et al*. 2016b). Another salient result involved herbaceous cover: in both VA and WV, $1m^2$ plots positioned at Turtle points

had significantly more herbaceous cover (combining both forbs and grass) than did plots at random points (Exhibit Fig. 5.20). The lack of difference in amounts of herbaceous cover between $1m^2$ plots at the center of $400m^2$ plots and the four $1m^2$ plots placed at the perimeter of the $400m^2$ plots suggests that the Turtles are selecting for higher levels of herbaceous cover at the meso-scale as well as the micro.

As with the herbs, most of the woody seedling taxa found in Turtle plots were facultative upland or upland taxa; only three of the seedling indicator taxa were classified as wetland species (Table 5.19 in Exhibit 5). This is further evidence that Wood Turtles regularly use habitats far outside of riparian or wet areas.

A major concern is that the plants they associate with may be harmed or diminished by logging or burning. - see Exhibit 5. The same concern goes for the invertebrates they feed upon being harmed or diminished, from things such as loss of leaf litter and cover (ground vegetation) or coarse woody debris. I brought this up, but the Defendants did not respond. There are complexities involving impacts from the proposed actions that have been ignored. Degradation of Wood Turtle foraging opportunities is not compliant with the agency's stated goals for the GWNF. See the Goals and Conservation Measures in the GWNF FEIS Appendix G at pg. 45-47: **Goal 1** Watersheds are managed to maintain or enhance the terrestrial summer foraging habitat of wood turtles. Compliance with this Goal and Conservation Measure for the GWNF is not apparent here.

Body condition can influence survival and reproductive output of turtles and other reptiles (Litzgus et al. 2008, Jacobsen and Kushlan 1989) and is related to environmental conditions. Change in vegetation/availability can influence weight gain that then can affect reproductive output and hence viability (Jenkins 2008). Thus, alteration or diminishment of forage quantity or quality can affect demography and population viability — for instance, somatic growth rate and body size affect reproductive success in turtles (Congdon and van Loben Sels, 1991; Brooks et al., 1992; Kaufmann 1992; Rowe, 1997). Such alteration also may diminish the greater energy reserves needed to survive overwintering (Brooks et al., 1992; Ashton and Feldman, 2003; Litzgus et al., 2004; Greaves and Litzgus, 2009).

Both natural and anthropogenic disturbances that alter vegetative conditions can influence **thermal conditions** on the ground (see Exhibit 3 submitted with NSM Objection and the citations therein, *e.g.*, Saunders *et al*. 1998), though generally natural disturbances may have less of an impact than anthropogenic ones (Lewis 1998, Saunders *et al*. 1998). Typically, thinning or removal of the forest canopy results in reduced relative humidity and moisture at the ground surface and increased mean temperature, temperature fluctuations, and solar radiation (Collins *et al*. 1985). A road, roadside, or newly logged site may not provide buffering plant cover conditions.

For example, in oak-hickory forests in southern Indiana Currylow and colleagues (2012) found ground temperatures in exposed recently logged sites to be significantly warmer (as much as 13°C) than forested control sites. They concluded that the summer temperature extremes in the logged sites (0.15 - 4.4ha in size) reduced their suitability for *T. carolina* and other herpetofauna. Similarly, the highest proportions of temperatures

above the Turtle's critical thermal maximum (CT_{max}) in my study were at array sites of anthropogenic disturbance, a roadside and a fabricated opening, while the only VA site that recorded no temperatures ≥ CT_{max} was in a thickly regenerated 30-years-old clearcut (Exhibit 3).

From a thermal perspective, it appears best is to let the natural disturbance regime operate in the Turtle's core habitat here. In this way the Defendants can "maintain or enhance" the natural canopy gaps and broken canopy that are sufficient for thermoregulation. Wood Turtles take advantage of the countless very small sun flecks and splotches on the forest floor for basking, shuttling between shade and sun. They did not spend a lot of time in direct sun at my research sites, perhaps since their preferred body temperature is relatively low. Only 10.1% of 337 terrestrial locations of adult Wood Turtles encountered during the four-year study were in the direct sun. The mean diurnal shell temperature of female Wood Turtles was 1.5°C higher than that of males, with a mean of 22.8°C ± 0.06 vs. 21.3°C ± 0.03, though there was no significant difference between the sexes (see Exhibit 3 submitted with my Objection). They are small and not herd animals, so simply do not need large logging cuts in order to thermoregulate. Furthermore, such cuts quickly become thickly overgrown with saplings and do not then offer a lot of fine-scale heterogeneity.

In the cut-over sites, the high stem density sapling regeneration as well as the lack of canopy gaps make for constantly shaded conditions that preclude spatially efficient thermoregulatory shuttling. In addition, these sites generally manifest a scantily developed ground floor herbaceous layer (Roberts 2004) that decreases foraging opportunities and exacerbates exposure to predators. At my study site, the GWNF roadsides presented the opposite problem, with consistently high temperatures outside of the "preferred body temperature range". Except for nesting females, I never observed a Wood Turtle using roadside open or edge habitat. In short, all these lines of evidence indicate that from a thermal perspective, at least in some parts of their range such as here at their southern range limit, it is a good idea to avoid fabricating large openings and simplifying forest structure in Wood Turtle habitat.

Furthermore, due to differences in life history characteristics, habitat preferences of animals at the periphery of their geographic ranges may differ from those at the core (Kapfer *et al*. 2008). In short, all these lines of evidence indicate that from a thermal perspective, at least in this part of their range, it is a good idea to avoid fabricating large openings in Wood Turtle habitat. These can significantly alter the thermal connectivity of a landscape (Saunders *et al*. 1998).

Extrapolation beyond the region and scale where models were developed is generally to be avoided (Bollman *et al*. 2005, Hirzel and Le May 2008); there is little theoretical support for believing preferences estimated in one region will be good predictors of preference in different regions (Beyer *et al*. 2010). Over-reliance on the range-wide EWT document can be problematic.

Claim 4 Mitigation/Design Elements

Wood Turtles are cryptic and can be very difficult to locate. They can be in and under all kinds of ground cover. Due to their size, shape, and color they can be easily overlooked and thus at the mercy of motor vehicles and falling trees, to say nothing of the flames from intentional fires. I have searched for days at sites where I know they live and not found a one. For this NSM/FR project, the potential clearly exists for crushing them with skidders, tractors, dozers, trucks, and trees. As well as killing them or severely harming them with the flames from prescribed burning. Being so cryptic and often hidden, even if somebody wanted to, it would be extremely difficult, next to impossible, to get them out of harm's way. The Defendants' mitigation/DEs are foreseeably ineffective and will do little if anything to stop the potential harm.

The use of the 100m buffer zone dimension in the project's "Design Elements" is apparently based (at least partially) on recommendations in a "Guide to Habitat Management for Wood Turtles" (GHM). This document, however, contains generic guidelines for the entire species-wide distribution of the WT. It covers a very large area in somewhat general terms. As such, these guidelines should be considered as a minimal fallback/default position in the absence of more localized information and considerations. No reputable or competent scientist would posit this document as the be-all and end-all that overrides site-specific evidence, information, issues, and consideration.

In other words, its recommendations are not chiseled in granite as cosmic verities. The GHM was laudably put together to help further Wood Turtle conservation. However, further site-specific analysis and consideration is required to determine the effects of a particular project on local Turtle populations. In some situations, its recommendations may exceed that which would otherwise be implemented. In other cases, it may be practical and reasonable to exceed its general recommendations – this is one of those situations.

The preparers of the GHM were responding to a variety of different land ownerships, land uses, possible types of management actions, political entities, land types, ecological conditions, Wood Turtle population statuses, profit motives, practical considerations, and legal landscapes. As such a document, it is a good general default position. However, there is a danger when local planning or prescriptions are unjustifiably extrapolated from scientific study elsewhere, leading to wasted resources or unanticipated outcomes. In the instant case, we are dealing with biogeographically significant Wood Turtle populations on public lands that are known to regularly use upland forests and are in "critical" and "greatest conservation need", where, as a practical matter, a 300m buffer zone is reasonable, scientifically supported, and can be relatively easily implemented and administered. [It is relevant that the GHM document also refers to 1000 ft. with regard to Wood Turtle protection/management]

I note that when it comes to mowing, the 1000 ft. (300m) metric is used for raising the mowing deck (FEIS App. G Goal CM 4.02); of course, Turtles could still be run over and killed or maimed.

For the NSM project, the Defendants have proposed **no seasonal road closures** in order to protect Wood Turtles. At another GWNF area seasonal road closures are implemented to protect Wood Turtles during May-October, their nesting, foraging, and hatching times of greatest movements (see NSM EA). This is important. Adults, juveniles, and hatchlings are more likely to be killed then. Road kill is one of the biggest dangers (ECWT pp. 65-66 and Krichbaum pers. obs., see Fig. 4 photo at Exhibit 8). I have seen Wood Turtles killed on roads in the GWNF, including at this project's Slate Lick working area. The Forest Service knows of this danger and has implemented road closures elsewhere. Cumulative impacts accrue from this neglect here.

ATVs

On the GWNF, I have seen ATVs being illegally ridden in a Wood Turtle stream, in forested terrestrial sites inhabited by Wood Turtles, and in other wetlands.

Through its roadbuilding and other dozer lines this project will foreseeably greatly facilitate illegal ATV use and concomitant poaching and road kill. I have personally witnessed this illegal activity on the GWNF, and I have personally called the FS Law Enforcement Officers before. I have also observed aftermath of such activity. For example, evidence of such illegal use/trespass is obvious at Turner Run (NSM Slate Lick working area).

The discussion on impacts to Wood Turtles totally leaves out that there is a serious problem with unauthorized ATV or Off Road Vehicle (ORV) use in the GWNF, not just the Slate Lick or NSM area, and Forest Service law enforcement is pretty helpless to do anything about it (so few officers covering such a large territory). This project authorizes repeated logging, burning, and pesticide applications to thousands of acres. It improves and builds roads, and bulldozes road-like paths through large blocks of forest for firebreaks or skidding logs. It is not plausible to think the ORVers are not going to use them - If you build it they will come.

The Forest Service has made specious claims that gating/blocking techniques and law enforcement can control illegal ATV use (see, *e.g.*, GWNF 2005 AHTS EA-64). This assertion is refuted time-and-time again by observations on-the-ground in the GWNF. I have witnessed innumerable evidence of trespass on blocked and gated roads on the GWNF, such as at Paddy Run, Sours Run, and Maple Flats special biological area. I have seen obvious illegal off-road ATV routes well into the interior of both Crawford Mountain roadless area and Dameron Mountain on the GWNF, as well as at Potts Pond SBA. It is not reasonable to act as if the NSM/FR area is somehow immune to this activity.

Biocides

Some pesticides and herbicides are known to have harmful impacts upon various biota, including amphibians and reptiles. I am concerned about the direct, indirect, and cumulative harms to populations of and communities with endangered and threatened species, as well as harmful impacts to the overall ecosystems and ecological processes that sustain these species. In addition, there is much that we do not know about direct, indirect, and cumulative impacts of biocides. Endangered, threatened, rare, and sensitive

species should be able to live out their lives and maintain the viability of their populations without these dangerous and avoidable significant impacts. The requisite full, intensive, and competent surveys, inventories, data gathering, and analyses to consider and ascertain impacts of biocides upon Wood Turtles have not been performed for the NSM/FR projects.

Distribution on the Forest

Empirical evidence indicates that the Turtles only occupy a minuscule portion of the George Washington National Forest — avoiding the problematic impacts to them would be easy to implement. Nonetheless, the Defendants apparently want to force Wood Turtles to conform to intensive ground disturbing actions instead of conforming their actions to a species sensitive to disturbance that is in critical need of conservation.

Out of the thousands of stream reaches on the GWNF, there are only a relative handful of locations where a Wood Turtle population is known to definitely occur. And these extant populations can be widely scattered. It may be difficult for populations and individuals to interact, thereby raising further problems regarding viability. Turtles have limited dispersal abilities, so recruitment into a local population from a distant population is difficult. And intervening habitat between populations may be unsuitable, and even be a source of direct mortality (*e.g.*, vehicular traffic on roadways - see Fig. 4 photo at Exhibit 8). The Turtle is considered "imperiled" in West Virginia. According to a "viability outcome" in West Virginia's Monongahela National Forest FEIS (2006) the Turtle has "low abundance and is distributed as isolated occurrences. While some occurrences may be self-sustaining, metapopulation interactions are not possible for most occurrences." My experience indicates this same situation may apply to the Turtles on the George Washington National Forest.

Human Interactions and Uncertainty

Far from being maintained or enhanced here, the Turtles' terrestrial summer foraging habitat may be significantly degraded or destroyed by the Defendants' regime of cutting, burning, herbiciding, and dozering — through alteration of foraging resources, modifying microclimates, and facilitating predation (see above paragraphs, *in re, e.g.*, food resources, predators, microclimates - thermoregulation)

It is abundantly clear that human interactions here are NOT being "managed to minimize impacts to wood turtles" by the Defendants, as clearly directed in the Forest's LRMP and its supporting FEIS. There is nothing in the Forest Plan about any 100m buffer zone for Turtles. This is a *post hoc* rationalization in an attempt to deceive those uninformed about Wood Turtle ecology and conservation biology, be it the public or this Court, that the Defendants are indeed "minimiz[ing] impacts to wood turtles".

For example, **road kill** is one of their biggest direct dangers (ECWT pp. 65-66). I have seen Wood Turtles killed on roads in the GWNF, including, for instance, at the NSM project's Slate Lick working area. But the Defendants have proposed no seasonal road closures here in order to protect Wood Turtles. Unfortunately, this is not the only

"motorized vehicle use" that is not being "managed to minimize impacts to wood turtles" here — dozers, skidders, and logging trucks are also to be inflicted upon them, ATV use will be facilitated, and the road and developed recreation site at Slate Lick are not being "managed to minimize impacts to wood turtles".

I am also gravely concerned about the significant uncertainty as to the ecological results of the proposed burning, thinning, and logging. For instance, at various sites the proposed heavy thinning and other logging could easily result in dense shrub layers that hinder herbaceous growth or overstory tree seedling regeneration (see Barton and Keeton 2018). It is not at all clear that this would improve habitat for Wood Turtles or for other flora and fauna species/populations that they live with and subsist upon. The Turtles are not known to browse on shrubbery. Yet this is glossed over in the EA as if there is certainty as to the on-the-ground results of said management activities; *e.g.*, assuming that burning automatically results in enhanced herbaceous growth.

Opening up the canopy to the extent proposed (see EA chap. 2) may or may not result in greater "understory vegetation diversity" — depending on current species composition, seed dispersal, pollinators, browsers, aspect, slope inclination, edaphic conditions (*e.g.*, nutrient availability, soil acidity, moisture), presence of invasive species, future climate and disturbance regimes, and more influential factors.

All forest understories are not the same; there is a difference between "grassy, shrubby, and herbaceous understories". But the Defendants lump them together when discussing the conditions on the Forest and the purported results of proposed actions. Some species may benefit much more from one type of understory than the others. Wood Turtles, due to their foraging preferences, would benefit far more from herbaceous plants than shrubby ones. But the increased canopy openness could easily not accomplish this. The Defendants' own photograph on pg. 10 of the 2017 NSM proposal document (labeled Fig. 4) is a perfect example of resultant non-grassy/herbaceous ground floor conditions from a so-called "open canopy condition".

In the EA/BE the Defendants did not admit the lack of comprehensive data. When I brought up these deficiencies, they were not addressed in their Objection Response. They were alerted to the problems in general, and sometimes very specific, terms. They were "on notice of and had the opportunity to consider and decide, the same claims now raised in federal court." *Great Old Broads,* 709 F.3d at 846-847(citing to 5 U.S.C. § 704).

The Defendants failed to explicitly disclose in the NSM EA/BE/Objection Response or FR DDN that the streams that have not been surveyed and/or do not have occurrence records are indeed suitable habitat for Wood Turtles.

Because the NSM project EA provided only conclusory statements regarding its Wood Turtle FONSI analysis, and the BE was not then even available, Plaintiff lacked the information necessary to bring more specific claims during the notice and comment period. Given the lack of transparency surrounding the assertions provided in the EA, Defendants cannot now claim that Plaintiff failed to raise his concerns with sufficient

clarity to allow the Forest Service to address those concerns during the administrative process.

Wood Turtle Population Viability

During the administrative objection period, I explicitly noted that the Project EA did not clearly state how the 'no significant impact' conclusions with regard to the Wood Turtle were obtained. There is not sufficient information disclosed to validate the FONSI. The status and health of the Turtle populations or subpopulations is not clear. What is clear is that implementation of the Defendants' decision poses an existential threat to the Wood Turtles of the NSM/FR project area (at the sites tabulated in Exhibit 7). The critical question to ask is: How much cumulative mortality can a population absorb and still be healthy, well distributed, and viable for the long term? The Defendants disclose no such detailed demographic or impact analyses and rationale for the Project area.

What is the current status of Wood Turtle populations on the Forest and at this Project area? What were the impacts of previous actions upon these populations? There is nothing in the EA/BE or in the agency's response to my Objection or to my FOIA request on this significant issue/concern of population numbers and trends. Then how were conclusions reached as to the FONSI? In conservation biology terms, cumulative impacts could drive populations into an "extinction vortex".

My demographic study/analysis was performed on a GWNF population of Wood Turtles at a WV site near to NSM that has no open roads and without recent logging, road building or other human disturbance. That population was borderline stable (Exhibit 2 with Objection). With all the disturbance and impacts resulting from the NSM/FR projects' implementation, it is not difficult to see that significant impacts to the populations here may occur.

Field studies and statistical analyses clearly show that even modest rates of take (intentional or incidental) of adult turtles can lead to strong declines in populations. As the analyses of Drs. Reed and Gibbons (2003) show [submitted with NSM Objection], **of all North American turtle species, Wood Turtle populations specifically are among the most sensitive to the loss of individuals of either adults or juveniles**. The implications of this relevant factor to population persistence are striking: It means that the loss of a very small number of Turtles above natural attrition can be devastating. The Defendants' contemplated logging/burning/ dozering actions can clearly result in just such "additive mortality" to the Turtle populations at the NSM/FR project area. The Turtles may not reproduce enough or survive long enough to make up for the losses from collection, predation, habitat degradation, and being killed on roads or by logging operations.

The Wood Turtle, as do most turtle species, possesses life history traits that make populations especially vulnerable and sensitive to increased human-caused loss and mortality: slow growth, late maturity, high natural mortality of eggs and hatchlings (such

as from predators), high survival of adults, long lives, and low reproductive potential (Gibbs and Amato 2000, Heppell *et al*. 2000). After reaching maturity, turtles must then survive and reproduce for decades more just to replace themselves (the "feasible demography" of Seigel 2005; Congdon *et al*. 1993 & 1994). There is no apparent "density dependent" response operant (Congdon *et al*. 1993); *i.e*., at low population levels there is no compensatory increase in birth rate or hatchling survival. In fact, just the opposite can reasonably be expected to occur, *i.e*., decreases in birth rates), due to such factors as difficulty in finding mates (Belzer and Seibert 2009); in other words an "Allee effect" producing further reductions in population size.

Ecological trap

The fabrication of very small sandy/soily nesting sites relatively closeby occupied streams may facilitate population recruitment and help prevent mortality to females by obviating long distance travel to find suitable nesting sites (see Kiviat, E. 2000). However, this action has the potential to make matters even worse by fabricating an "ecological trap", the use of which elevates risk to population persistence (Kristan, W.B. 2003). The concern is that fabricated nesting site(s), particularly those in close proximity to watercourses and anthropogenic edges, may actually have negative effects upon the Turtle population there. This is due to high predation pressure, congregation of female Wood Turtles at nest sites, and clumping of nests (Walde *et al*. 2007). It is not a given that the Defendants' actions will result in increased Turtle reproduction at the NSM/FR area.

Prescribed fires

Prescribed fires are often implemented through ignitions around the perimeter of the burn area. And on top of these multiple perimeter ignitions, the interiors of burn sites are also ignited. See, *e.g*., USFS 2007 Lee RD burn project DM-10: "Boundaries of the area may be ignited with drip-torches followed by strips through the interior to complete burning out the area." The NSM project as proposed includes burning riparian areas (down to the streamsides) and other upland forest at sites with suitable habitat that may harbor Turtles and at least one site known to be inhabited by a population of Wood Turtles. Small and/or slow moving animals have negligible chances to escape when thus surrounded, and even large and/or swift movers can become confused and trapped by a wall of flames that is seemingly in every direction.

Surrounding an area with fire and also burning it from within have a great chance of killing wildlife of public interest, such as Wood Turtles. The ethical underpinnings for knowingly (even if incidentally) incinerating sentient beings for any reason are certainly questionable. But it is particularly heinous when the incineration could be avoided or it is unnecessary or that it's done simply to perhaps achieve some uncertain floristic composition/structure that somebody somehow deems desirable.

The Defendants intend to use streams as fire breaks and burn riparian areas - thereby potentially burning Turtles if they try to escape to streams. I have found Wood Turtles and Box Turtles on the GWNF with shell injuries/deformations that looked as if the scutes and underlying bone were melted. One partially melted Box Turtle had missing front feet. For Wood Turtles this could be a severe disability for females trying to get to air when mounted by aggressive males under water.

Wood Turtles are NOT in the "Fire Dependent and Fire Enhanced Associates" species group (see GWNF FEIS Sec. 4.2.7 at pp. 47-48). "These species are generally associated with open woodland conditions that require frequent fires. These species range from those generally dependent upon fire (weighted very high) to those that are not dependent upon fire, but whose habitat is enhanced through frequent fires."

There was no consultation with me — this is not a "non substantive" issue.
If there was "consultation" with others as to impacts to habitat and population viability there is no documentation of it in the AR. I even specifically suggested that the Defendants "ask them [the state herpetologists] if providing a 300m buffer is good for Wood Turtles". I got the impression my NSM Objection had not been read — there was no give and take at the 'resolution' call, nothing about specific sites and actions there such as "timber stand improvement". And there was no mention of burning *in re* impacts to Wood Turtles in the Defendants' Objection Response.

9. In summation, based on my experience, observations, research, and training I believe that implementing the proposed North Shenandoah Mountain logging and burning project has the potential to significantly harm the Wood Turtle on the George Washington National Forest, such as by: altering the composition, structure and functioning of site conditions (*e.g.*, opening the canopy and making them drier and hotter), removing or diminishing valuable habitat such as forage plants, leaf litter and downed woody debris (important for cover from predators and for Wood Turtle prey), removing mature forest conditions and thereby decreasing populations of food species such as invertebrates and herbs and mushrooms, forest perforation/fragmentation that increase deleterious edge effects (*e.g.*, attracting predators such as Raccoons and facilitating increased grazing/browsing by Deer), increasing the potential for predation by making the Turtles more exposed due to loss of cover or from forcing them to move and thereby increasing their exposure to predators, and facilitating further human disturbance/collection/mortality (such as from roads and illegal motorized access on "control lines"). This is on top of the clear potential for direct mortality from flames , vehicles, and/or falling trees. The operations will contribute to species decline, as well as loss of my recreational and spiritual opportunities and quality. The Defendants' running around citizen input and participation and sweeping concerns and issues under the rug, resulting in their failure to protect the landscapes and critical ecological values on the GWNF, constitute a flagrant abuse of the 'Public Trust.'

10. The Wood Turtle populations known to be dependent on the Project area are significant. As populations of this species are oftentimes small in number and very localized, site-specific management actions that directly result in mortality, or that alter habitat causing stress or indirect mortality or impeding interactions of reproductive individuals, can significantly impact the viability of the Turtles on this site and this Forest. There are only a small limited number of locations where they have been found on the Forest. Searches of many streams and forested areas have yielded no Turtles; and at many locations where I have found them multiple searches yielded only a few individuals. The great majority of areas within the Turtle's range simply are not suitable or high quality habitat due to human population and development pressures.

Pursuant to 28 U.S.C. §1746, I declare under penalty of perjury that the foregoing is true and correct. This 27th day of June, 2023

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STEVEN KRICHBAUM, PhD