Steven Krichbaum, PhD
[redacted]

USDA Forest Service
George Washington National Forest
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subject: North Shenandoah Mountain Restoration and Management Project

Pursuant to 36 C.F.R. § 218, this letter and attachments are a formal objection to the North Shenandoah Mountain Restoration and Management Project Draft DN, FONSI, EA and supporting documents. Responsible official: District Ranger Mary Yonce, reviewing officer is Joby Timm, Forest Supervisor; proposed project to be implemented on the GWNF North River RD 36 C.F.R. § 218.8(d)(4) . As per 36 CFR 218.8(d): I, Steven Krichbaum, am the Objector; address and phone number as above. Legal notice published February 3, 2020.

Clear Statement of Objection as required by 36 CFR 218.8(d)(5) - (6)

For the reasons provided and explained in more detail below, the Objector listed above Objects to the USFS's proposed NSM project: The project's Environmental Assessment and BE do not satisfy the legal requirements of NEPA, the project violates the USFS's 2014 Forest Plan for the GW National Forest, the draft DN and FONSI are arbitrary and capricious, the decision to implement this project as currently configured is unreasonable and threatens to violate "Federal, State, or local law or requirements imposed for the protection of the environment", *e.g.*, the Administrative Procedures Act, National Environmental Policy Act, and National Forest Management Act.

Introduction:
The project at issue in this Objection, the North Shenandoah Mountain Restoration and Management Project, is a major federal action with a significant impact on the environment.

The remnant temperate mixed and deciduous forests on the public lands of the Appalachians offer a unique opportunity for ecological recovery, an opportunity certainly unmatched in the East, perhaps anywhere in the world. The wild old-growth forests that

not long ago naturally blanketed this region have been extirpated, devastated, and dismembered. In 300 years, less than the life span of many a tree, we have gone from pockets of human development occurring in a matrix of natural landscape to natural areas – habitat fragments – eking out a living in a sea of human development. Now, in today's world, islands of habitat like the George Washington National Forest have paradoxically become the floral and faunal source pools of the region.

Shenandoah Mountain is the largest massif in the Ridge and Valley Ecoregion, rising above the valleys of the Shenandoah and South Fork of the South Branch Potomac Rivers to elevations over 4000 feet. Shenandoah Mountain provides some of the most rugged and remote land still left in the Appalachians. With ever increasing population and development pressures, places to escape to the sounds of silence and bask in nature's song are increasingly rare in our landscape. Places to be treasured, they are where the wild things are. These sanctuaries are our natural heritage and a vital necessity for sustaining the health of not only ourselves, but also all that we call home. *In a sea of noise and development, this place we call Shenandoah Mountain is nothing less than a modern-day Ark, precious and irreplaceable*.

Here are twenty-three identified "Mountain Treasures" (roadless areas) totaling around 262,000 acres (see Virginia's Mountain Treasures: The Unprotected Wildlands of the GWNF available from The Wilderness Society) – probably the greatest amount of roadless areas and back-country recreational lands to be found in any single site between the Great Smoky Mountains National Park (NC-TN) and the Adirondack State Park (NY). Here too are rare habitats such as shale barrens and tracts of old-growth forest, with around 75,000 acres in this condition. Here are endemic species such as the Cow Knob Salamander, Shenandoah Mountain Millipede, and Virginia Least Trillium, as well as Wild Trout streams, quality Black Bear habitat, and the southernmost Wood Turtle populations in the world.

The North Shenandoah Mountain project area is 128,000 acres in size, of which 103,000 acres is GWNF. There are seven Mountain Treasures totaling almost 60,000 acres on the NF in the project area. None of this roadless acreage was "inventoried" by the FS. Three of these Treasures are threatened by this timber sale: Hogpen Mtn. (9,229 acres) – logging, thinning, burning, road building; Little Cow Knob (5,335 acres) – logging, thinning; and Beech Lick Knob (17,152 acres) – logging, thinning, and burning, including 355 acres of logging and 371 acres of burning within the agency's own identified 14,085-acre Potential Wilderness Area.

The FS intends to inflict upon 9,223 acres of National Forest in this project area some sort of "restoration treatment". Below is a partial rundown of what is proposed:

. 1) 3,878 acres of "timber harvest" – this includes around 1,500 acres of intensive "even-age management" and around 2,278 acres of "variable density thinning" (up to 70% of a logging site could be removed),

. 2) 1,174 acres of "timber stand improvement" – this will be accomplished by the application of one of the most virulent biocides on the planet, glyphosate (the EA

does not disclose impacts to all the non-human animals) – plus another 200 acres of invasive plant treatment sites,

. 3) 5,249 acres of burning – Wood Turtles and countless others killed or maimed,

. 4) 6.7 miles of dozer lines smashed through the forest to accomplish the above burning, some in Mountain Treasures,

. 5) 15 miles of "temporary" roads smashed through the Forest,

. 6) 2.5 miles of new permanent roads "constructed",

. 7) 19 miles of road "reconstructed",

. 8) 56 miles of bladed skid trails for logging smashed through the Forest of course, all the above, 1-8, will facilitate the spread and abundance of invasive species, so then there is proposed – ,

. 9) around 5000 acres of "herbicide management of non-native invasive species within treatment stands" and

10) around 2250 acres of "herbicide management of non-native invasive species along roads".

Requested Remedy:
I request that the Forest Service amend the decision. Proposed cutting units and portions of proposed units within the 300m boundaries of perennial streams should be dropped. These areas should not be burned or have biocides applied or have roads or skid trails in them either. If these changes are not made, then prepare an environmental impact statement (EIS) for the activities within these boundaries.

The issues and concerns discussed in this Objection were raised in my previous comments of Sept. 15 and Oct. 24, 2019 and Nov. 5, 2017. Comments specifically on the Biological Evaluation for this project were not included in my previous filings because the BE was not issued until after the comment period was over. Accordingly, my Objection regarding the BE satisfies 36 CFR 218.8(c): "Issues raised in objections must be based on previously submitted specific written comments regarding the proposed project or activity and attributed to the objector, unless the issue is based on new information that arose after the opportunities for comment."

Considering that the FS has a regulation that requires that an interested party raise an issue in written comments to be eligible to file a written objection about it, how can one write a comment about something that one hasn't seen? In other words, if comments/issues are now rejected, the FS can forever avoid any objections by only issuing environmental

reports as part of the final and rejecting specific issues raised in objections because they weren't raised in the comment period. This would be a violation of due process, of the public participation expectations in the NEPA and NFMA, and of democratic standards of justice.

Due to my concern about content and assertions in the draft EA that were inexplicable to me, I was compelled to submit a FOIA request. The documents in response to that request were also not available to me during the previous comment period. They are now indubitably part of the administrative record.

It is a good idea to decommission Spruce Lick Run (240B) and Root Run (235A) roads and Gate Run road (1134). It is also a good idea to drop the huge thinning at Shoemaker River and not smash a "temporary" road through old growth at Gobble Mountain. Good also is the dropping of proposed logging at German River and Paint Lick Run. This Objection does not apply to those actions. Nor does it apply to placing large woody debris and root wads into the stream channel to provide over-wintering habitat for Wood Turtles as appropriate.

The remainder of this Objection provides specific arguments regarding this proposal.

Argument

Objector objects to the Draft Decision Notice because the Environmental Assessment for project does not support a Finding of No Significant Impact and violates the requirements of the National Environmental Policy Act (NEPA). The FS also violates the National Forest Management Act (NFMA) as this decision is not in compliance with the GWNF LRMP/FEIS. As this decision is arbitrary, capricious, unreasonable, or not in compliance with law or regulation, the agency violates the Administrative Procedures Act (APA).

As the administrative record clearly shows, the Wood Turtle (*Glyptemys insculpta*) is officially a "Species of Greatest Conservation Need", a species of "critical conservation need", and a Priority 1 species in both VA and WV. How plain must it be made for the critical importance and necessity of effective management consideration and measures for this species? If this project is typical of how a species of critical and greatest conservation need is treated, one despairs when thinking of the treatment meted out to all the other species of not-so-greatest need.

The FS does not give a logically coherent explanation for its decision to ignore or meaningfully respond to information and reasoning brought to its attention, fail to develop practical alternatives, rely on inadequate mitigation measures ("design elements"), ignore potential significant direct, indirect or cumulative impacts, fail to acknowledge controversial issues, and ignore significant uncertainty – actions which in sum do not safeguard the Wood Turtle on this Forest. The decision must be amended (as outlined in this Objection) or otherwise an EIS prepared.

The Environmental Assessment for the Project remains deficient. The responses provided in the "DEA comments responses", such as at pg. 42, also do not adequately address concerns raised regarding the insufficient information and analysis provided in the draft EA. Nor were potential impacts analysed sufficiently in the BE either. The FS has not fully and fairly considered relevant and important information. Design features have been agreed upon by the interdisciplinary team that do not ensure that impacts to resources will not be significant.

The NEPA requires federal agencies to "present complete and accurate information to decision makers and to the public to allow an informed comparison of the alternatives."[6] USFS has issued its Draft Decision Notice without all necessary information needed to make an informed and well-reasoned decision. Accordingly, I object to USFS's Draft Decision Notice and its accompanying Finding of No Significant Impact because, inter alia, the underlying NEPA evaluation (EA and BE) lacks the necessary information upon which the agency can properly make that conclusion. NEPA requires the agency to "make explicit reference by footnote to the scientific and other sources relied upon for conclusions".

If the action *may* have a significant effect, the agency *must* prepare an EIS. In other words, the threshold issue for determining whether or not to prepare an EIS is not whether significant effects will in fact occur, but instead whether there are substantial questions about whether a project will have a significant effect on the environment.

A project's "intensity" requires evaluation of various factors, including specific adverse impacts on the project area's officially listed "Sensitive" species, " t he degree to which the effects on the quality of the human environment are likely to be highly controversial , " ... " t he degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks , ... " t he degree to which the action may establish a precedent for future actions with significant effects , " ... " w hether the action is related to other actions with individually insignificant but cumulatively significant impacts . "

An agency must prepare an EIS if substantial questions are raised as to whether a project may cause significant degradation of some human environmental factor (LaFlamme vs. FERC,1988). See also 42 USC 4332(2), 40 CFR1508.27.

My Objection focuses on the Wood Turtle. The International Union for the Conservation of Nature ("IUCN") classifies the Wood Turtle as an "endangered" species on its Red List

due to range-contraction and increased threats and impacts from human encroachment (Van Dijk and Harding 2011). A petition advocating the species' listing under the federal Endangered Species Act is currently before the US Secretary of the Interior (CBD 2012, USDI FWS 2015). The Wood Turtle is state listed as "threatened" in Virginia and a Tier 1 species ("(critical conservation need) Species of Greatest Conservation Need" within the Virginia State Wildlife Action Plan) (EA-114), while West Virginia also considers it a "species of greatest conservation need" (a Priority Group 1 species) in the state's wildlife conservation strategy (WVDNR 2015). On the GWNF it is officially listed by the Regional Forester as a "Sensitive Species".

"The GWJNF and adjacent properties afford the most immediate, and possibly the best, opportunity for conservation of wood turtle populations in Virginia because of its public ownership, overall size, contiguity, and relatively low degree of land conversion." (EA-67) But the DNN and EA-34 show little deference to WTs.

The factors identified by my research can be used for well-informed decisions regarding management practices, protective measures, and habitat enhancement or restoration (*e.g.*, fabrication of small canopy gaps), as well as make predictions as to the suitability of sites as potential Wood Turtle habitat. This work also serves to incite further explorations into the mysteries of Wood Turtle ecology. In short, we need to develop our understanding of the Turtles, not develop their habitat. A multitude of other flora and fauna, including human communities, will benefit when we accord Wood Turtles enhanced on-the-ground protections.

There is an objective reality to how Wood Turtles make a living, and there are habitat requisites to sustaining that living. Hopefully, embracing that reality will inspire us as a society to attain the worthy goal of meaningful long-lasting recovery of the GWNF's Wood Turtles.

The Forest Service has in the past rationalized prescribed burning and other habitat alterations of Wood Turtle habitat with the assertion that the species is "adapted to fire" or is somehow "tolerant of disturbance" (also see DEA comments responses at pg. 42). In the past when their populations were much greater and more distributed across the landscape and dispersal was easier, losses due to fire and other local disturbances could perhaps be absorbed and recovered. However, the fragmented ("disjunct, isolated" Bowen & Gillingham 2004), reduced, and declining status of contemporary Wood Turtle populations (Jones and Willey 2015) makes assertions of adaptation and resiliency superficial and misleading.

Fossil remains of Wood Turtles have been dated to 6 million years old (Harding 2002). **Here are a few other things the Turtles were/are adapted to over their evolutionary history**: expansive areas of old growth forest with great niche complexity, ecosystems without thousands of miles of roads and millions of cars, much smaller numbers of meso-predators, ecosystems not overrun with White-tailed Deer and invasive species, waterways running without pollutants and other impairments, ecosystems with numerous

Beavers, Wolves, and Cougars, landscapes not overwhelmed with anthropogenic edge effects and fragmentation, landscapes with a high degree of connectivity, clean air and a lack of acidic deposition, habitats without millions of recreationists and others who like to collect or harm turtles, and habitats not despoiled by tens-of-millions of people and our industrial, agricultural, commercial, and residential development, *ad nauseum*.

Clearly, the Turtles present day environment is far different from that which they adapted to over the course of their evolutionary history. **In the face of all this, is it reasonable to inflict upon our remnant populations of Wood Turtles – populations with tenuous and vulnerable viability – actions bearing the potential to bring them significant direct and indirect and cumulative harm?** To rationalize away concerns for these actions with the expedient that the Turtles' are "adapted" to them is not just glib, it's dangerous.

In short, with regard to the Wood Turtle, "the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment." Namely NEPA, the APA, and the NFMA.

The FS is required to take a "hard look" at the potential environmental impacts of the NSM project. NEPA demands the agency give full and fair consideration to information and ensure the scientific integrity of their analysis. Here, possible effects are "highly uncertain and or involve unique or unknown risks" and are "controversial". In addition, this project involves "Unique characteristics of the geographic area" (e.g., proximity to the southernmost populations of WTs on Earth put at unique risk – we do not know why these are southernmost). Thus, the project "may cause loss or destruction of significant scientific, cultural, or historical resources".

"**Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment."**

1. SIGNIFICANT UNCERTAINTY

If we are going to assume that WT adults and juveniles and/or hatchlings are at sites, then we must assume that some will be killed during operations – how many? And how was it determined that this mortality is not significant to distribution, abundance, and viability? From a population biology perspective, WTs are at razor's edge, one of the most sensitive chelonian species in the United States.

What is the current status of populations on the National Forests? What were the effects of the previous logging at these sites to their populations? How many Turtles are currently lost from road kill, collection, and depredation? What is the recruitment into

the populations? What density of Wood Turtles is needed for ensuring reproduction and sustaining viability? How many may be lost if a project was implemented? How and to what extent would collection or mortality by Forest recreational visitors be exacerbated by a project? What are the cumulative impacts in conjunction with other stresses upon the population? How many can be lost/killed without significantly harming the viability and sustainability of the affected population(s)?

On all this and more the Forest Service does not have the basic information, yet it charges ahead with projects 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 can a population absorb and still be healthy and viable for the long term?

The agency does not have fundamental information on the Turtles' populations, nor has it conducted population viability analyses (see Reed *et al*. 2003), yet somehow the FS *does* know that its decisions are having "no significant impact" (see the Decision Notices, Decision Memos, and Findings Of No Significant Impact for numerous projects affecting the Turtle on the GWNF, including this one, the NSM proposal). The validity and scientific integrity of such findings are dubious to say the least.

The agency implies it is somehow improving habitat – but the impacts are at best significantly controversial and uncertain:

No WT population numbers
No population trends,
No MIS (for small, ectothermic, amphibious, ground-dwelling, long-lived, late-maturing omnivore of limited mobility) numbers/trends for here
No estimates of predator numbers
No estimates of WTs potentially killed by fires
No estimates of WTs potentially killed by logging operations at the cutting sites – trees on felled on and dragged over them; crushed by dozers, skidders, trucks
No estimates of WTs potentially killed by vehicles on roads
No estimates of WTs potentially collected by humans (poachers)
No estimates of WTs potentially killed by ATVs on closed roads and dozer lines
No estimates of WTs potentially harmed (directly and indirectly) by herbicides

Charging ahead with this project in the midst of all this uncertainty does not positively address the need of this creature for "critical" and "greatest" conservation praxis.

How the direct, indirect, and/or cumulative losses accruing from the above does not reach the bar of significance is not explained – instead we have conclusory assertions.

Even under the best of circumstances people can be very bad at gauging risk (witness the corona virus). In this case, **the information base is meager and the lack of full and fair consideration demanded by NEPA is inadequate for issuing a FONSI regarding WTs**. In

this situation with such significant uncertainty it is only reasonable for the decision-makers to err (if it indeed is an error) on the side of caution. We have to admit our lack of information on and understanding of Central Appalachian forest ecology and the Wood Turtle – In the face of uncertainty the prudent decision is to risk erring on the side of protecting too much. (conservation biologist Dr. Reed Noss).

This **precautionary approach** (Cooney 2004) of minimizing human impacts, thus allowing forest conditions at Wood Turtle core habitat to develop through natural processes (*i.e.*, restoration by "purposeful action and inaction" (Trombulak 1996)), is beneficial to not only Wood Turtles. Aside from their ecological functionality, the flowers, fruits, nuts, leaves, roots, bark, and sap of many of the herbaceous, woody, and fungal taxa found where Wood Turtles occur have significant human nutritional, medicinal, and application value (Angier 1974, Horn and Cathcart 2005, Strauss 2014, United Plant Savers 2017).

The issue is not solely about Wood Turtles, but about preserving the integrity of entire ecosystems (North Shenandoah Mountain), of which the Turtles are an integral part. We are not even close to knowing about all their connections and understanding their ecological functionality and impact upon our world. The ecological threads connecting all living things together, along with the abiotic environment, extend far beyond our spatial and temporal horizons. This vast uncertainty about the complexity of their interrelationships is further reason to be concerned about the potential impacts to the Forest and our human environment resulting from a severing of these connections.

What is the Turtle's rightful role as an apex omnivore in the complex web of wild ecosystems? What about co-extinctions? We simply do not know the significance of their roles in ecosystem dynamics.

I have spent 15 years studying the Wood Turtles of the GWNF and my ignorance is great. Nonetheless, the information I have gathered is useful and must be fully and fairly considered and acted upon. This work, my field studies and analyses, as well as that of others, can bring into coordinated focus the elusive nature of Wood Turtle ecology and conservation.

WTs are a sensitive aquatic (and terrestrial) species. Where they live should be considered priority watersheds. Some roads should at the very least be decommissioned there; this is happening at some sites. But instead, at other sites nearby, the agency is proposing to build more roads, permanent and so-called temporary, where they live (see, *e.g.*, Slate Lick working area). The FS claims that the actions of Alt. 1 "primarily serve to promote ecological restoration by enhancing habitat conditions for declining early successional species and other species of greatest conservation need" (EA-114) The road building proposed, especially at a site already so degraded (see predator impact section above), does not promote or enhance the species of greatest conservation need. Nor does the agency's desire to "create conditions needed for a perpetuation" of common species, *e.g.*, Pitch Pine, Short-leaf Pine – species so common that people are paid/subsidized to cut them to the ground and kill them. How does that desire supersede the public's interest in

creating/allowing natural conditions needed for a perpetuation of WTs? **The FS does not explain/disclose their rationale regarding this issue in the EA/BE/DNN.**

2. CUMULATIVE IMPACTS

Cumulative impacts analysis requires "some quantified or detailed information. *Ocean Advocates v. U.S. Army Corps. Of Eng'rs,* 402 F.3d 846, 868 (9th Cir.2004). Conclusory statements about "possible effects" or "some risk" do not satisfy the "hard look" required under NEPA. *Klamath Siskiyou Wildlands Ctr. v. Bureau of Land Management,* 387 F.3d 989, 996 (9th Cir.2004).

A CEQ guidance document recognizes that "the most devastating environmental effects may result not from the direct effects of a particular action, but from the combination of individually minor effects of multiple actions over time.7 CEQ, *Considering Cumulative Effects Under the National Environmental Policy Act,* at 1 (Jan.1997), http://energy.gov/ sites/prod/files/nepapub/nepa documents/RedDont/G-CEQConsidCumulEffects. pdf; *see also Kern,* 284 F.3d at 1078

For this project, there are:
No estimates of WTs potentially killed or nests destroyed
No estimates of WTs potentially killed by fires
No estimates of WTs potentially killed by logging operations (trees on them, dozers, skidders)
No estimates of WTs potentially killed by vehicles on roads
No estimates of WTs potentially killed by illegal ATVs
No estimates of WTs potentially collected by humans (poachers)
No estimates of predator numbers or of WTs

Nor are there estimates of the above harms from the <u>past</u> projects that have taken place in the "working areas" here.

And these sources of harm/take are not just a one-time occurrence. Logging has occurred here in the past and the FS will foreseeably prepare timber sales here in the future (it is "suitable" – GWNF FS personnel have told me to my face that for suitable lands, "it is not a question of if, but when timber harvest will occur."). More cutting will occur, aside from even-age logging, actions such as "pre-commercial thinning" and "stand improvement". The burning here has occurred in the past and is to be repeated (GWNF "silvicultural systems" paper). Roads are to remain open here and more are being constructed. Illegal ATV use has occurred here in the past and can be expected to continue (EA).

Also see all the potential heavy-handed management schemes being considered that are disclosed at FOIA document 5.8.

How the potential direct, indirect, and/or cumulative losses accruing from the above potentialities does not reach the bar of "significance" is not explained by the agency.

The agency discloses NO WT population numbers - no population trends or viability analysis.

Nor does it disclose information for any MIS that it may be using for WT numbers/trends/monitoring here (for small, ectothermic, amphibious, ground-dwelling, long-lived, late-maturing omnivore of limited mobility).

The cumulative impacts of concern involve harms to both habitat and populations.

Also see my 2009 "WT Strategy" comments, *e.g.*:

"**Prominent by its omission is any mention of the habitat loss and/or degradation that may occur as the result of logging** (particularly the large scale even-age management such as occurs on the GWNF). What are the **critical thresholds** involved with such aggregating and chronic degradations of habitat?"

The cumulative impacts accrue not just to the populations living at this project area, but also to maintaining the species distribution and viability on the greater GWNF. The cumulative impacts from all these USFS actions serve to harm the health of populations and the long-term continuing existence and self-perpetuation of the species across the Forest (not just mere "persistence" – this occurs right up until there is only one individual left).

These potential cumulative impacts of this project are precisely what can "cause a trend to federal listing or a loss of viability for the WT ", contrary to the statement at DNN-25, and will "contribute to a trend toward federal listing of these species under the Endangered Species Act". The FWS found that the petition to list the Wood Turtle presented substantial scientific information suggesting that listing may be warranted.

There have already been numerous timber sales on the GWNF, in this project area and others, that have negatively impacted Wood Turtles (e.g., the Canbe and Sours Supin projects in this project area). **Cumulative impacts to the Turtle's viability on the Forest** are of particular concern as this is not the only place the Forest Service is (or proposing to) degrading or destroying or fragmenting suitable habitat, and perhaps directly killing Turtles; other examples are the recent Maybe, Slate, Marshall Run, Sandy, Great Little, Paddy, Breakneck, Barb, Molly's Hill, Laurel Road, and Sandy Ridge timber sales. This is no doubt a very incomplete list; I was out of the loop for ten years when I was doing my doctoral work and do not know the names of other projects.

Further, and perhaps most significantly, **the discussion fails to properly analyze the effects of the various activities *in combination* at a single site and across the project area**. This CI discussion does little more than reiterate what the FSEIS has already discussed in the direct/indirect effects analysis. The Forest Service never comes up with a cumulative assessment, *i.e.*, there is no attempt to analyze the effects of A, B, C, and D together to determine whether the sum of these incremental disturbances will create a significant detrimental effect.

The GWNF does not even attempt to analyze the effects of all of the proposed actions as combined and accumulating in the same location(s). They analyze the cumulative impacts of biocides, the cumulative impact of logging, the cumulative impact of repeated burning, and the cumulative impacts from roads separately. But they will be doing all of these actions in the same areas within a very close time frame (certainly within the life span of Wood Turtles). And intend to do them in the future at the same sites.

And how can the agency make any cumulative impacts analysis about what the impact of significant disturbance upon Wood Turtle populations here will be (which may be "**sinks**") without having data on what the status of the species is, and what the past and planned actions in areas that may be "**source**" areas for the species are/were/would be (**source-sink dynamics**)

If the agency is going to rely on a scenario whereby they can inflict additional harm on a species that is already on decline but claim that they will recover in the long run, it has to be certain that there are areas within the vicinity that will produce a surplus population that could possibly repopulate the sites in the future. Where are those surplus individuals (*i.e.*, the sources) going to come from? And how easily is it for them to get here?

Cumulative impacts from ATVs, collection, edge predators, vehicles, repeated logging and burning, and pesticide applications to thousands of acres – all these may significantly alter the permeability (viscosity) or resistance to movement in the matrix between habitat patches or populations – thus potentially significantly adversely affecting Wood Turtle population viability and distribution.

Shoemaker River on the GWNF, site of proposed permanent road construction, various cutting units, and tsi, is "Impaired" (EA-56) – It is NOT upstream from sources of degradation: "given bacterial sources (fecal coliform and *E.coli*) are the result of concentrated livestock grazing or wildlife foraging along waterbodies, which has relatively low occurrence in the project area and is upstream from agricultural practices on private lands." Here is an example of cumulative impacts piled onto cumulative impacts.

2.a. BURNING

Burning is said to have various beneficial effects, such as diminishing invasive species – but it must be repeated (*e.g.*, 3 times in 10 years). **Resulting in still more potential injuries and deaths, and other harm to Wood Turtles** – *e.g.*, if it kills or diminishes invasive species, what about particular native flora (Matlack 2013)? Will the burning diminish or destroy herbaceous and woody plants that WTs prefer (Exhibit 5)? Direct, indirect, and cumulative impacts may accrue from this.

There is no citation to monitoring information from the GWNF on effects to native and invasive species in previous burning project areas. Are the standards and guidelines working and being followed? Are the potential results of the burning worse than 'no action'? There should be decades of data, with moderate precision, regarding invasive and

native species management in timber cuts and burns to see if your assertions are true. For instance, how many dead Box Turtles (*Terrapene carolina*) show up in burn units post-project? **Has the GWNF ever monitored and surveyed burn units for animal mortality?**

I have previously submitted comments to the agency about the harms from burning. Here they are again; the issues and concerns (except for the use of a CE) are the same as for here at NSM – please see **Exhibit 10 (pp. 6-8, 11-20) and Exhibit 11 (appeal) (*e.g.*, pp. 29-32).**

2.b. ATV/ORV USE

This project will foreseeably greatly facilitate illegal ATV use and concomitant poaching and road kill. "The primary management challenge identified for Beech Lick is known occurrences of illegal all-terrain vehicle use in the area. These occurrences happen on closed roads, and off of existing open roads in the area." (EA-114) These problems are certainly not exclusive to the Beech Lick area. I have personally witnessed this activity on the GWNF, and I have personally called the LEO. I can testify to this significant problem. I have also observed its aftermath. For example, it is obvious at Turner Run (Slate Lick area).

The discussion on impacts to WTs totally leaves out that there is a serious problem with unauthorized Off Road Vehicle use in this area, and FS law enforcement is pretty helpless to do anything about it (few officers covering a large territory). This project authorizes repeated logging, burning, and pesticide applications to thousands of acres. It improves roads, and bulldozes road-like paths through large blocks of forest for firebreaks. Do you think the ORVers aren't going to use them?

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 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, 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 JRRD, as well as at Potts Pond SBA.

2.c. ILLEGAL TRADE

From my 2009 comments, still apropo:

"Wood Turtles are perhaps the most valuable legally traded native species of turtle in the country (see Reed & Gibbons 2003 and Ernst 2001). Their monetary value, in addition to their desirability as pets, makes them very vulnerable to collection.

Yet on more than one occasion, the agency, through promulgation of public decision documents (DM and EAs) containing explicit reference to Wood Turtles, has broadcast the location of a species highly vulnerable to illegal collection.

In addition, a member of the public at the Woodstock public meeting organized by the Forest Service in March 2007 stated he called the Lee RD office to ask about a temporary road closure and was told by them it was due to the Turtle.

The Forest Service must ensure that harmful actions such as these do not occur again."

And now here it happens again. **Broadcasting WT locations to poachers** - with no estimates of past, current, or future illegal collection.

The Draft Decision Notice states, "Bennett Run, German River, North Fork Shenandoah River and Shoemaker River within the project area; and the Bible Run, Carr Run, Cold Spring River, Little Dry River, Seventy Buck Lick Run, Slate Lick Branch and Spruce Lick Run within two miles of the project area have been designated by the Virginia Department of Game and Inland Fisheries (VDGIF) as "Threatened and Endangered Species Waters" for the Wood turtle." DNN-16

However, the map of the "project area" clearly shows that all these streams are WITHIN the project area, not just within two miles of it. **And you have made it clear to Wood Turtle poachers PRECISELY where to go**. This agency's utter contempt for the poor vulnerable creature under its thumb is beyond the pale of common human decency. This form of take, and the agency's complicity in its facilitation, and its concomitant direct, indirect, and cumulative impacts are not properly considered or mitigated in the EA/BE/DNN/FONSI.

Even though various states within the Turtle's range have enacted some type of protected legislation or designation, collection is ongoing. The Wood Turtle featured prominently in several recent high-profile busts of illegal wildlife sellers by the USFWS and the VDGIF. In the summer of 2008 a poacher was arrested in West Virginia with over 100 wild-caught Wood Turtles in his possession (J.D. Kleopfer, VDGIF, pers. comm. to SK August 2008). Poacher Ellard, owner of a Florida reptile exporting business, had already been busted previously for collecting Spotted Turtles (*Clemmys guttatta*) in North Carolina). Ellard and his associates were charged with violating the Lacey Act and Ellard pled guilty to charges on 31 July 2009 (Hollowell 2010). For his conviction he was sentenced to serve one year of home detention, five years of probation and pay $12,000 in restitution for his participation in the illegal capture and transportation of protected turtles, a violation of the Lacey Act. The sentence meted out to Ellard amounted to little more than a slap on the wrist.

And in March of 2009 eight-teen individuals were charged in New York for the illegal sale of reptiles and amphibians, including Wood Turtles (NYDEC 2009). This poaching activity involved the poaching and sale Wood Turtles via the internet and commercial reptile shows. In addition, New York turtles were being laundered through middlemen in other states (such as Pennsylvania), then getting exported overseas for meat and other uses.

The magnitude and impact of the illegal wildlife market illustrated by the New York bust is significant. "'Our investigators began this operation with a simple question: Is there a commercial threat to our critical wildlife species? What they found was alarming,' Commissioner Pete Grannis said. 'A very lucrative illegal market for these creatures does exist, fostered by a strong, clandestine culture of people who want to exploit wildlife for illegal profit.'" (*id*.)

In August 2015 an Illinois man was convicted in the Eastern District of Louisiana federal court for violations of the Lacey Act regarding the Wood Turtle (see http://www.justice.gov/usao-edla/pr/illinois-man-sentenced-violating-lacey-act,

http://annamiticus.com/2015/08/18/louisiana-court-sentences-turtle-trafficker-to- prison/). He attempted to purchase 100 Wood Turtles for $40,000 ($400/Turtle). This individual, Keith Cantore, has a history of illegal turtle dealing.

Actions that take in a very short time-period may have permanent or long- term effects. For example, one population in Ontario was predicted to be extirpated within 50 years, because over only a few days collectors removed about 60% of the adult population (COSEWIC 2007). A turtle researcher in Wisconsin tracked a transmittered turtle to a dumpster and found remains of over 60 other Wood Turtles that had been killed for food by one individual (COSEWIC 2007).

And collection by profiteers is certainly not the only collection that impacts the Turtle. Wood Turtles are so beautiful, bright and active that they are highly desired for pets. Who knows how many are removed from populations by private individuals not to sell, but simply to take home for "personal use". Burger and Garber (1995) stated that humans find Wood Turtles "irresistible" and generally remove them or at least displace them when they are found. The Turtle's apparent intellect (Tinklepaugh 1932) and "striking appearance" (Carr 1952) have certainly boosted its popularity as a pet. Wood Turtles fetch high prices both domestically and overseas. On Kingsnake.com turtle classifieds (http://market.kingsnake.com/index.php?cat=39) pairs of adult Turtles were priced at $500-750 (Hollowell 2010). While in Tokyo, Japan, prices of $3,786 were being asked for individuals (*id*.). Obviously, values such as these are huge incentives for illegal trade.

The export market to Asian countries, particularly to China, has exploded in recent years. Turtles are being vacuumed up in vast numbers for food, traditional medicine, and pets. Turtles in the United States are certainly not immune to this legal and illegal trade (see Hylton 2007). "Demand for turtle meat and their body parts deriving from wild caught turtles has been on the rise in growing Asian communities in Houston, Dallas Fort Worth, Oklahoma City, Atlanta, San Francisco and New York City (S. Haitao, pers. comm. 2007). Chinese turtle dealers frequent online commercial reptile websites and post solicitations to recruit American sources to export "huge number" of freshwater turtles from the United States" (CBD *et al*. 2008). Recently convicted Wood Turtle poacher/trafficker Cantore wanted the turtles for Chinese customers.

Also see pp. 70-72 of "The Ecology and Conservation of the Wood Turtle" document in the NSM project's administrative record.

For discussion of **logging/cutting** impacts also see section 4.a.

The EA/BE fails to adequately consider treats from **airborne pollutants, such as acid deposition and ozone depletion, and climatic warming trends**. Scientists recognize the need to provide biotic communities mobility and flexibility to respond to these threats by providing unfragmented elevational and latitudinal gradients for migration. For discussion of these impacts see Exhibit 8 pp. 43-47 and Exhibit 14.

From my 2009 WT Draft Conservation Strategy comments:
"**The draft conservation strategy fails to adequately consider and positively address cumulative impacts to Turtle populations on the Forest**. What are the **critical thresholds** involved with such aggregating and chronic impacts? The conservation strategy is silent about this salient issue. In other words, a degradation that may by itself be in some sense tolerable can, in conjunction with other impacts, actually contribute to harm. Management activities do not occur in isolation from other aggregating sources of problems.

**** ***Build from strength:*** **Efforts to improve the status of Wood Turtles should begin by strictly protecting habitat that supports existing populations that are relatively healthy and productive.** The next step would be to expand adjacent habitats that have been historically productive or have a likelihood of sustaining healthy populations by reconnecting or improving habitat. In a similar manner, this strategy applies to the restoration of weak/small Wood Turtles populations; the restoration should focus first on the specific sites where populations occur, and then extend to adjacent habitats (see Huxel, G.R. and A. Hastings 1999).

Beyond this and perhaps of greater significance is **the failure on the part of this overall conservation strategy to admit that logging activities even have the <u>potential</u> to have harmful cumulative and/or indirect impacts to Turtles** (*e.g.*, by significantly degrading habitat in the short and/or long terms). See my January 9, 2009 WT conservation submission for discussion of this issue. Essential evidence has been improperly excluded and unjustifiably overridden."

There appears to be a tacit presumption that logging and burning of terrestrial summer habitat are good for Wood Turtles? How was this determined? Precisely what studies substantiate this presumption?

Similarly, **the DCS appears to tacitly presume that logging and burning of terrestrial summer habitat do not have the potential to be harmful in various ways.** How was this determined? Precisely what studies substantiate this presumption? A detailed discussion of the potential harmful effects from such activities is in my WT conservation submission of January 9, 2009. How is it that the rationale, research, and potential impacts I outlined do not apply to Wood Turtles on this Forest?"

So, this NSM project is not the first time I have raised these cumulative/direct/indirect impact issues and harms (including to me) to the agency. Since the above comments were written and submitted in 2009, **I undertook intensive studies of Wood Turtles on the GWNF. The evidence gained from this research does not support the agency's presumptions.** I have submitted much of this dissertation work to you previously, but here

it is again (with some slight editing *in re* grammar and syntax) – **See Exhibits 1-6**. Also see the submission to the USFWS (**Exhibit 8**) and the 2009 submissions to the GWNF (**Exhibits 9 & 12**). The exhibits contain supportive discussion, evidence, citations, rationale, and argument relevant to the instant case.

3. INDIRECT IMPACTS and CIs

Indirect impacts that may occur were this project to be implemented as presently configured include or involve some of the issues previously outlined in the above section on cumulative impacts. **These indirect impacts include:**

altered foraging sites availability by logging/cutting etc.,
altered microclimates of temperature and humidity by logging/cutting etc.,
alteration of WT movement patterns to compensate for the above,
increased exposure to predators from habitat alterations and moving more,
reduction in WT numbers means fewer reproductive opportunities (Allee Effect),
increased presence of WT predators due to edge effects – and predators are attracted to water courses nearby proposed actions,
herbicides may detrimentally impact plants or invertebrates WTs eat,
prescribed fires may reduce plants or invertebrates WTs eat,
increased availability of ATV/ORV access – with accompanying take of WTs

These potential impacts to the Wood Turtle were not analyzed in detail, if at all, or disclosed in the Biological Evaluation or the EA.

4. HARD LOOK – FULL AND FAIR CONSIDERATION, SCIENTIFIC INTEGRITY, APA

The agency misleads and obfuscates when it represents to the public that "Several proposed units are adjacent to streams known to support Wood Turtles" and "no harvest activity will occur in the riparian corridor." (EA). But comprehensive surveys throughout the project area have not been done for Wood Turtles (see information in FS response to Krichbaum 2020 FOIA). Indeed, some streams in the project are "known to support Wood Turtles", nine of them according to information from the VDCR and WVDNR. And **eight (8) of those nine streams have various kinds of logging projects (even-age, thinning, pine restoration/conversion, tsi) and/or burning around them** (those around German River were dropped). That is more than what I would call "several".

But these eight are just the streams *known* to support WTs. As was noted to/by the FS: "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." ("Wood Turtle Surveys – West Virginia April 16, 2019" document 2.17 in SK FOIA). The same reasoning applies to Virginia as well. So, **in actuality this project has units adjacent to twenty-three (23) named perennial streams on the GWNF in VA and WV that may support WTs. That too is more than what I would call several.**

Further, though "harvest activity" might not occur in the "riparian corridor", Wood Turtles typically occur in uplands far outside what is considered to be a "riparian corridor". Harvesting and other actions could certainly occur in these lands. And the definition of what constitutes a "riparian corridor" can vary and is not clear. According to the plan, it depends on soils, landform, and vegetation. In addition, burning is definitely proposed for riparian areas (see EA, BE, and supporting documents). Statements to the effect that only "several" streams will be affected and implying that WTs are solely "riparian" creatures misinforms the public and taints the decision.

See Exhibit 7 for a synopsis of actions proposed for the NSM project (*e.g.*, cutting and burning units) that are in Wood Turtle core habitat.

There is no indication that the information I have submitted was meaningfully considered by the agency – this violates the NEPA and also is arbitrary and capricious, unreasonable, or otherwise not in accordance with law or regulation; *i.e.*, a violation of the APA.

NEPA demands full and fair consideration of scientific information and expertise, thus ensuring well informed decision-making, maintenance of scientific integrity, and taking the requisite hard look. The BE makes clear that the agency did use Sweeten's master's thesis on the Wood Turtle, 34 pages of narrative and tables/figures. And then, misleads and misinforms the public and the court by labeling it a *doctoral* work.

That my actual doctoral work that took place on this specific National Forest was disregarded manifests the gross insufficiency of scientific evidence used to support the FONSI.

That this was not simply an oversight was made clear in the response to my FOIA request. One would think that at some point somebody in the agency would say something to the effect, "hey didn't some guy do a bunch of research on Wood Turtle habitat use here, maybe we should get a hold of him?" This is an instance of something being prominent by its absence. And then when I sent much of this information to the agency during the earlier comment periods, it is still neglected – not a mention in the final EA/BE.

In addition, when another commenter, the Southern Environmental Legal Center, even pointedly urged the agency to consult with me, the comment was brushed aside by labeling it "non-substantive" (FOIA 5.5) That shows the extreme bias operant here. According to official definition: "Substantive comments provide factual information, professional opinion, or informed judgment that is relevant to the action being proposed. Substantive comments are specific, comparative, or solution oriented. A substantive comment provides the reasons why and goes beyond just expressing an opinion. While all comments will be considered, substantive comments related to the alternatives are the most useful." **The comment and its supporting statements from SELC, a nationally**

renowned organization, meets all the qualifications of being substantive. **And it certainly would have been very "useful" and "solution oriented" if treated as such and positively acted upon.**

But regardless if that comment was correctly or honestly labeled substantive or not, **as it has pointedly ignored relevant information/evidence, the agency has not taken the requisite hard look with regarding significant impacts and harm to the Wood Turtle.**

The agency has not fully and fairly considered my localized or site-specific info information, but instead relied on generic range-wide documents prepared elsewhere – but conditions differ here. In addition, sites detrimental in the south may be more suitable in the north and vice-versa. In other words, what is beneficial for or preferred by Wood Turtles in Quebec, Maine, or Massachusetts may not apply in Virginia or West Virginia. Perhaps Wood Turtles in more northern climes are more inclined to use large logging openings? Furthermore, due to differences in life history characteristics, habitat preferences of animals at the periphery of their geographic ranges (such as the NSM Wood Turtles) may differ from those at the core (Kapfer *et al*. 2008, Rollinson *et al*. 2012).

For example, just as the location or quality of optimal thermal patches may change seasonally or daily, so too may the availability or quality of food patches. Net energy gain (and hence growth and reproduction), and even survival, depend not only upon food availability but on other considerations as well; consequently, patches may be selected that are "suboptimal" for either food or thermal resources (Huey 1991). Turtles face tradeoffs in resource allocation to various compartments of their energy budget, choices that ultimately have significant implications for reproductive output (Congdon 1989, Penick *et al*. 2002). At these VA and WV sites the period of year when Wood Turtles may feed (*e.g*., when water and air temperatures are at least 17.2° and 23°C, respectively (Ernst 1986)) could be 7 months or more. In the years 2006-2015 I observed Wood Turtles foraging at various VA and WV sites in all months from March to October. This means that in the spring females may feed before nesting. By not having to rely on stored body lipids from the previous year, energy and time allocations here (*e.g*., parental investment), and thus habitat use, may differ from those at more northern populations (Rollinson *et al*. 2012).

During the post-nesting period the radio-tracked Wood Turtles at my GWNF sites tended to avoid areas of anthropogenic early successional habitat (*i.e.*, recent tracts of even-age logging) as well as roadside edge habitat. I never found them using roadside habitat. And the Turtles would go right to the edge of the recent cut units, but no further. With one exception, 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 shading understory (*e.g*., blueberry bushes (*Vaccinium* spp.)) was undisturbed. The one exception was a female turtle located *ca*. 30m into a 5-year old regenerating modified shelterwood cut who was eating blackberries (*Rubus*) growing there. I never found Wood Turtles in the regenerating clearcuts 5-35 years old with a high stem density of tree saplings. Part of the reason for this may be that the closed-over canopy at such logging sites, resulting from both the high density of

regenerating saplings as well as the lack of canopy gaps, makes for constantly shaded conditions that preclude spatially efficient shuttling in addition to manifesting a scantily developed ground floor herbaceous layer (Roberts 2004) that both decreases foraging opportunities and exacerbates exposure to predators. The roadsides present the opposite problem, with consistently high temperatures outside of the "preferred body temperature range". Except for nesting or staging females, I never observed a Wood Turtle using roadside open/edge habitat. In short, all these lines of evidence indicate that from a thermal perspective, at least in some parts 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). There are other reasons to not cut mature forest as well. See Exhibits 1-6 for further details, evidence, and discussion.

Relying on a so-called site-specific NEPA analysis that ignores localized data such as the above, but instead relies on generic recommendations in a range-wide document (see DEA comments responses – pg. 42), is not a hard look, is not detailed, and does not comply with NEPA.

Ignoring thIS localized data and expertise (my own) that are available also violates the APA. This has been an ongoing concern of the Objector for years.

The "NSM DEA comments responses" at pg. 42 states, "Potential impacts to Forest Service Southern Region (R8) Regional Forester's Sensitive species, including the wood turtle (*Glyptemys insculpta*), were analyzed in detail in the Biological Evaluation (Forest Service, 2019d.)". The so-called detail, however, is greatly lacking.

The agency does not do an adequate job of explaining how they came to their conclusions (*i.e.*, the FONSI *in re* the Wood Turtle). And they provide scant scientific evidence to back up their conclusory assertions. These assumptions and conclusions and the rationale for disregarding my work were not explained in detail in the EA/BE.

4.a. LOGGING AND CUTTING, FOREST TYPE AND SERAL STAGE

I have personally observed Wood Turtles in all the forest types such as are found in the project area's WT 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 have suitable habitat for WTs from the standpoint of forest types. My personal observations on visits to these areas confirms this.**

Overall, 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).

Almost 90% of the total VA turtle and random 400m^2 plots were composed of three forest type groups, Dm (21.8%), Od (31.0%), and Om (37.6%). Plots at the WV site were also mostly composed of the same six broad forest types, with the addition of a small number of points in brushy and Eastern Red Cedar (*Juniperus virginiana*) habitats. Around 81% of the total WV turtle and random plots were composed of three forest type groups, but unlike in VA the most prevalent groups were M (45.1%), P (19.1%), and Om (16.7%) (Appendices 2 & 3B).

In concordance with this finding, the analyses of individual taxa indicated Wood Turtles tended to avoid sites with high importance values for Chestnut and Scarlet Oaks (Table 5.9, Figs. 5.9 & 5.13). Domination by these taxa is generally indicative of nutrient poor sites (oligotrophic) (Ashe 1922, Burns and Honkala 1990, Fleming and Coulling 2001, Weakley *et al*. 2012).). At plots with a component of Chestnut Oak, the CART results indicated VA Wood Turtles preferred sites with relatively higher importance values for Sugar Maple and White Oak and relatively lower values for Hickories (Fig. 5.10).

The preference for Sugar Maple in VA and Red Maple in WV may have to do with site productivity (higher nutrient availability) and/or moisture regimes. The forests are different in each state, with Red Maple, a generalist, typically found in more mesophytic associations at the WV site, while in VA it is more widespread, being abundant also in drier oligotrophic sites as well as in tracts of both older (mature and old growth) and younger age (early and mid-successional seres). Locations with high importance values for White Oak, White Ash, Sugar Maple, Elm, Basswood, and Serviceberry can be mesic or sub-mesic sites that are generally productive (Burns and Honkala 1990, Fleming and Coulling 2001, Weakley *et al*. 2012) and have high herbaceous species richness (Fig. 5.17).

As with edible herbaceous flora, the abundance or presence of mushrooms or invertebrate prey or the amounts of ground cover (facilitating avoidance of predators) might also be correlated to the predominance of different tree taxa (*e.g.*, increased earthworm activity on sites with higher pH). My study presents evidence that some forest types are avoided or preferred more than others. If this is indeed factual, one must not automatically conclude *a priori* that it is acceptable to cut down stands of a relatively avoided forest type (*e.g.*, Chestnut Oak or White Pine). It must be kept in mind that just because a site 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 dense understories. In fact, at the plot with the highest importance value for any single tree species, a value of almost 98 for Chestnut Oak, a Wood Turtle was present. Because of this welter of interacting confounding conditions, Wood Turtles overall are labile in their use of different forest types; for example, *ca*. 16% of Wood Turtle plots were pine or oligotrophic oak (Table 5.3).

As for coarse-filter structural differences (*viz*., seral stages), Wood Turtles exhibited a tendency to avoid mid-successional and early successional habitat (Figs. 5.7 & 5.8); by esh I refer here to young stands of forest regenerating after logging, not to shrubby or grassy ruderal sites or natural openings in the forest. Wood Turtles showed a preference for small natural or anthropogenic clearings dominated by shrubs (*e.g.*, Autumn Olive (*Elaeagnus umbellata*)) or herbaceous ground cover, including dry as well as moist sites (*i.e.*, seeps) (Fig. 5.2). **These types of shrubby or grassy clearings with few or no overstory trees are**

lumped into the early successional rubric under some land cover classifications. However, they are structurally and often compositionally different than young sites of regenerating forest with high stem densities of saplings. Managerial mishaps are possible when relevant distinctions of pattern go unrecognized within categorical coalescence. The age (seral stage) of forest tracts influences the herbaceous community present there; generally, disturbance sensitive species are underrepresented in secondary forests (DeMars and Runkle 1992, Dyer 2010, Matlack and Schaub 2011).

Moreover, the scale at which forests are typically intensively logged (individual tracts of 5-20ha or more) is not the spatial scale at which Wood Turtles typically move about in the summer (*ca*. 1-2 ha). One cutting unit could destroy an entire home range for one or more individuals. In addition, stands that may be of a relatively non-preferred type can have many inclusions of smaller tracts of preferred forest.

So, since forest "stands" are not homogeneous (Fig. 5.6), this scale should not be used when managing Wood Turtle habitat from a silvicultural perspective. If a decision is made that forested tracts of a certain composition can be logged without negative impacts to Wood Turtles because they are of a relatively non-preferred type (*e.g.*, Chestnut Oak or White Pine), such habitat removal must still be accomplished at the appropriate scale, meaning small tracts of individual selection or small group selection, and appropriate time (implemented only during winter months when Wood Turtles are totally aquatic).

See Exhibits 5 and 6 for further details, evidence, and discussion.

Though for my study the shapes and sizes of activity areas did not differ between sexes, males tended to locate closer than females to the main streams (Table 1.1). Tingley and colleagues (2009) found a similar pattern for Wood Turtles in Nova Scotia, Canada (95% of female locations were within 235m of water, while 95% of male locations were within 43m), as did Tuttle and Carroll (2003) in New Hampshire (95% of female locations were within 188m of water, while 95% of male locations were within 61m), Parren (2013) in Vermont (276m mean maximum distance for females and 107m for males), and McCoard *et al*. (2016) in West Virginia (mean maximum distance from the river for females was 140 ± 26m, while that for males was 86 ± 20m). Thus, male summer activity areas may include more stream length than do females (Jones 2009). Though many expansive female movements pertain to nesting behavior, post-nesting females also may locate distant from water (Tuttle and Carroll 2003, Akre and Ernst 2006, Jones 2009, Flanagan *et al*. 2013, Parren 2013).

Although often found near the main streams, **in my study of Wood Turtles on the GWNF both sexes were 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) study areas in Virginia were found to be similar and consistent with this and other studies (*e.g.*, Compton 1999, Arvisais *et al*. 2002). At the agricultural site, 90% of all locations were within 250 m of the stream, while at the forested site (which makes up part of my VA study area), 95% of locations were within 300 m of the stream, and at the moderately altered forest site, 95% of locations were within 200 m of the stream.

These roving movements are presumably a critical component of Wood Turtle behavior and demography and somehow confer fitness benefits. For Turtles to maximize

survivorship, selection of preferred environments, such as that for thermoregulation, must be successfully coupled with foraging and predator avoidance behavior (Tamplin 2006). Behaviors can have opposing habitat selection patterns, thus obscuring the statistical detection of habitat preference (Roever *et al*. 2014). For instance, a patch may provide optimal cover from predators or osmo-regulatory benefits, but sub-optimal provision of food resources (Downes 2001). Depending upon the taxa and the spatial scale, nutritional requirements and avoidance of predators may be greater drivers of habitat selection than thermoregulation (Willems and Hill 2009).

A typical explanation for differences in home ranges between sexes is based upon differences in life history strategy, with female patterns based on metabolic needs (eggs are energetically expensive compared to sperm) and male patterns structured by efforts to increase reproductive success (mate with more females; Schoener and Schoener 1982). My results support this explanation.

The minimal energetic requirements of turtles can result in other extrinsic factors, such as predator avoidance or topography, having greater effect on home range size than does energy acquisition. The apparent high habitat quality at my study sites (suggested by the observed philopatry and high survival over the years – Krichbaum pers. obs. and unpublished MARK analyses) in concert with the low Wood Turtle densities (*e.g.*, an estimated 0.35 adults/ha or 1 WT per 2.88ha at the WV site – calculated from an estimated adult population of 76 at an area of 219ha) may serve to provide suitable habitat without any limiting resource across broad areas, thus obviating any overt discrepancy between the areal extent of habitat use by the different sexes.

The DDN cites to no scientific citations for assertions regarding effects of alteration by cutting and burning of Wood Turtle habitat such as found here. The DDN cites to no scientific citations for assertions that alteration by cutting and burning Wood Turtle habitat such as found here would actually in-the-balance be an "improvement". **The DDN cites to no scientific citations for assertions that short-term losses of Turtles can be overcome because of long-term habitat "improvement".** The science delving into demographic problems faced by this species has been disregarded (see, *e.g.*, Siegel 2005, Gibbs & Amato 2000, Reed & Gibbons 2003, all of which have been previously submitted to the Forest Service; attached). The agency discloses no research and rationale that validates disregarding this relevant and available science.

In failing to ensure the scientific accuracy and professional integrity, including scientific integrity, of the information contained in the DDN/EA/BE, the Forest Service violates the NEPA (see, *e.g.*, 40 CFR 1500.1(b) ("information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA.") and 40 CFR 1502.24), abuses its discretion (APA violation), and violates the NFMA (failure to meaningfully consider the best available science).

Neither the project's effects nor its rationale are adequately and fairly disclosed. In this way neither decision-makers nor the public are well-informed.

4.b.IMPACT OF PREDATION and DISEASE – NO HARD LOOK – DIRECT, INDIRECT, and/or CUMULATIVE IMPACTS

The predators of concern include Raccoon (*Procyon lotor*), Gray Fox (*Urocyon cinereoargenteus*), squirrel species (*e.g.*, *Tamiasciurus hudsonicus* and *Sciurus carolinensis & S. niger*), 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 1994, Ernst and Lovich 2009).

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 project area or near to it. All these known Turtle depredators listed above can be expected to occur at the project area (except for perhaps Otters). Along with domestic Dogs (*Canis familiarus*). These predators can kill adult, juvenile, and/or hatchling WTs, as well as destroy turtle nests. 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).

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 with Turtles with the greatest proportion of major injuries (*e.g.*, missing limbs) was the most developed/degraded (Krichbaum, pers. obs). At this site, there are open and roads (including paved), residential development, fishing & hunting, previous recent forest cutting, invasive plant species, and agriculture (this is the Slate Lick "working area").

I brought this up to the agency over ten years ago (2009 "Strategy" comments): "The location where I have observed the proportionately greatest number of Turtles with severe mutilations (such as missing limbs) is Shoemaker River. And it is relevant that this site is the most degraded Turtle occurrence location I know of on the Forest: with an open road, agricultural development, forest cutting, invasive plant species, and residences all within the Turtle habitat corridor associated with the River."

The logging projects (which usually include some type of road construction and/or reconstruction) implemented by the Forest Service serve to increase edge and facilitate ingress and impacts from meso-predators such as Raccoons, Skunks, and Opossums (see "subsidized predators" in Mitchell and Klemens 2000). These species are known to predate Wood Turtles (Mitchell 1994). And the affiliation of Raccoons with stream corridors is well known (Spackman and Hughes 1995). **The FS realizes that forest cutting will facilitate increased depredation in project areas by these small predators**: see, *e.g.*, "increase predation" and "resulting edge" at EA-44 and "additional woodland edge" at EA-54 of the 2008 GWNF Laurel Road timber sale Environmental Assessment.

The impact of depredation upon Wood Turtles cannot be overemphasized. It is believed that many of the smaller predator species have experienced great population increases due to direct and indirect human subsidy (see Mitchell and Klemens 2000). Predation pressure is having devastating impacts upon nesting success and subsequent

recruitment throughout the Wood Turtle's range at various site conditions (see, *e.g.*, Brooks *et al*. 1992, Hunter, M. *et al*., 1999, Siart 1999, Harding, J.H. 2002, Paradis, S. *et al*. 2004, Bowen & Gillingham 2004, Jones & Willey 2015).

At present, landscape-scale forest fragmentation/perforation characterizes most of the Wood Turtle's range (Riitters *et al*. 2004, Harper *et al*. 2005, Riitters 2007, Tkacz *et al*. 2008); for instance, vast areas of the USA, particularly in the East where Wood Turtles reside, are within 382m of a road (Riitters & Wickham 2003). This condition exacerbates exposure to depredation. Given the amount and scale of habitat and forest fragmentation/perforation, most Turtle occurrence locations are within the approximate daily cruising range of many mammalian meso-predators, such as Raccoons and Foxes (*Vulpes vulpes*) (Oehler and Litvaitis 1996).

See narrative at pg. 65 of "The Ecology and Conservation of the Wood Turtle" document in the NSM project's administrative record and Exhibit 8.

Perhaps this is a primary reason (and that confers fitness benefits) that Wood Turtles move out far from the streams – predator avoidance.

Wood Turtles seem more risk averse than syntopic Box Turtles (*Terrapene carolina*): Except for gravid females during the nesting season, I never observed Wood Turtles on roads or roadsides (in the fifteen years of observing turtles at this National Forest), whereas I observed Box Turtles sitting on closed roads out in the open many times. Presumably the adaptive advantage of having a closable shell makes Box Turtles less averse to being in open habitats where detection by predators is more likely. Costa (2014) found differences in flight distance between two aquatic species of Emydid turtles and Lopez *et al*. (2005) found escape decisions by the Mediterranean Terrapin (*Mauremys leprosa*) to be influenced by habitat-related visibility.

Wood Turtles here on the GWNF use at least ten different forest types, including Chestnut Oak – Scarlet Oak, Virginia Pine, Upland Hardwoods – White Pine, and White Oak – Northern Red Oak – Hickory (Exhibit 5 - Table 5.4). The costs and tradeoffs involved with using patches may involve not competition or limited availability, but perceived predation risk.

I have observed numerous adult Wood Turtles with what appear to be respiratory infections (runny noses) (see, *e.g.*, Krichbaum 2009). Iridoviruses and upper respiratory tract diseases (Mycoplasmas) are increasingly affecting other turtle populations, including sympatric Box Turtles (*Terrapene carolina*) (see Allender 2007, Johnson 2006, Wendland *et al*. 2004, and Tangredi and Evans 1997; also see "Deadly ranavirus hits box turtles, tadpoles in Montgomery County, Maryland" by Katherine Shaver, Feb. 12, 2012, Washington Post). I do not know if such pathogens as the above have attacked Wood Turtle populations or if they may attack in the future. We do know, however, of herpes viruses in Wood Turtles (Ossiboff *et al*. 2015). Viruses such as these can potentially result in significant disease.

4.c. DIRECT AND INDIRECT IMPACTS – HARMS from LOGGING, BURNING, etc.

Direct impacts from logging/cutting operations include mortality and injury — crushed by dozers and skidders and trucks, buried alive, trees felled on them. Crushing their living guts out with skidders, and tractors, and dozers, and trees. Turtles are often hidden or cryptic, so, even if somebody wanted to, they could not get them out of harm's way. The mitigation/DEs are ineffective and will do little if anything to stop this.

The FS offers NO estimates of deaths or of their impacts to population viability.

The prescribed fires can be expected to burn some Wood Turtles to death or to seriously maim them. And this could go on repeatedly at the project area. The FS offers NO estimates of deaths or of their impacts to population viability.

Ongoing, and even increased vehicular traffic (such as from the Dominion electric transmission line replacement project) can be expected at the project area. The FS offers NO estimates of deaths from roadkill or of their impacts to population viability.

How and to what extent will application of herbicides and insecticides, such as from Gypsy Moth suppression which regularly occurs on the GWNF, directly impact the Wood Turtles here? And more future tsi is foreseeable here.

The FS offers NO estimates of deaths or injury or of their impacts to population viability.

The effects of herbicides and pesticides on reptiles and amphibians are largely unknown. And this is not the only place that the US Forest Service has applied herbicides at locations where the Turtles occur on the GWNF. The "fact sheets" in USFS project files contain no information on the effect of the herbicides upon Wood Turtles or any other reptile. Relevant issues such as the herbicide's persistence in the environment, its water solubility, and its effects to non-target organisms were simply ignored in the disclosure.

There can be little doubt that situations such as the above example occur on a regular basis elsewhere throughout the Turtle's range. The US Council on Composting has identified 4 persistent herbicides, Clopyralid and Picloram being 2 of the 4.

Immunosuppressive effects of low-level exposure to organochlorines have been implicated in pathologies observed in Eastern Box Turtles (*Terrapene carolina carolina*) (Tangredi and Evans 1997). Researchers found that Map Turtles (*Graptemys ouachitensis* and *G. pseudogeographica)* "deriving from atrazine- treated eggs had a significantly lower success in several of the long-term behavior trials, such as eating ability, time to first consumption, and escape. These findings reveal persistent fitness-reducing impacts on neonatal turtles of atrazine exposure during embryonic development, providing a new perspective on herbicide management." (Neuman-Lee Biggs and Janzen 2008) And Blanding's Turtles (*Emydoidea blandingii*), a close relative of the Wood Turtle, in Nebraska were found to be highly susceptible to the pesticide Dieldrin that was applied to cornfields for insect control and accumulated in wetland habitats. Although the use of this pesticide was halted in 1974, the chemical is very persistent in the environment (Congdon *et al*.

2006). Even in a 'protected' area, such as a National Wildlife Refuge, PAH (polycyclic aromatic hydrocarbons) contamination can lead to a high incidence of lethal deformities in turtle embyros as well as adults (Bell *et al*. 2006).

See Exhibit 8 pp. 24-25

What evidence has the FS that the canopy openings and esh resulting from a variety of natural disturbances at the project area are not a beneficial alternative for the Wood Turtle? What evidence has the FS that the canopy openings and esh resulting from application of even-age logging and intensive thinning and burning at the project area are optimal for or do not significantly harm the Wood Turtle? The EA/BE are silent on this significant issue/concern. Harms to Wood Turtles from having their habitat destroyed or degraded have not received the requisite hard look.

See Exhibits 1-6 – the paragraphs immediately below are from this material

During the post-nesting period, 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. The Turtles would go right to the edge of the recent cut units, but no further. With one exception, 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 shading understory (*e.g.*, blueberry bushes (*Vaccinium* spp.)) was undisturbed. The one exception was a female turtle located *ca*. 30m into a 5-year old regenerating modified shelterwood cut who was eating blackberries (*Rubus*) growing there.

I never found Wood Turtles in the regenerating even-age management cutting units 5-35 years old with a high stem density of tree saplings. Part of the reason for this may be that the closed-over canopy at such logging sites, resulting from both the high density of regenerating saplings as well as the lack of canopy gaps, makes for constantly shaded conditions that preclude spatially efficient shuttling in addition to manifesting a scantily developed ground floor herbaceous layer (Roberts 2004) that both decreases foraging opportunities and exacerbates exposure to predators.

The roadsides present the opposite problem, with consistently high temperatures outside of the PBTR. Except for nesting or staging females, I never observed a Wood Turtle using roadside open/edge habitat. In short, all these lines of evidence indicate that from a thermal perspective, at least in some parts 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).

Mature forests are often characterized as "closed canopy" habitats. This characterization is not precisely accurate; a mature forest can be "intact" or "contiguous" yet have numerous small canopy openings due to a variety of natural disturbances (McCarthy 2001). 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).

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 forests with such naturally provided fine-scale structural complexity and heterogeneity, and concomitant thermal diversity, should be encouraged in Wood Turtle habitat. At some places, fabricated small canopy gaps, such as some group selection cuts of *ca*. 6 overstory trees per hectare at points with desired species advanced regeneration, could possibly improve thermal site conditions for Wood Turtles.

Depending upon the taxa and the spatial scale, nutritional requirements and avoidance of predators may be greater drivers of habitat selection than thermoregulation (Willems and Hill 2009). Though decreases in environmental temperatures can decrease ingestion and digestion rates in turtles (Gianopulos and Rowe 1999), changes in energy requirements wrought by cooler temperatures may also diminish nutrient quality and quantity requirements (Seebacher and Franklin 2012). Therefore, the use of lower temperature microhabitats, such as those under some sort of cover (*e.g.*, litter or woody debris, or underwater), could result in advantageous lower resting energy expenditure (Beaupre 1995, Polo-Cavia *et al*. 2012). As Wood Turtles may have access to foods such as berries, insects, and mushrooms only seasonally or intermittently, perhaps they utilize an energy minimizing strategy whereby cool microhabitats are selected to reduce overall metabolic costs when food is less abundant (perhaps such as in mid- to late summer) and energy costs are elevated by high ambient temperatures (see Penick *et al*. 2002 regarding Box Turtles).

The agency fails to sufficiently address impacts of reduced carrying capacity or population viability due to decimation of critical food resources. It is not clear what the dominant high-quality food resources are for Wood Turtles in the project area. Have any of these significantly declined in abundance? **Replacing mature forests with esh regen may have resulted in decreased carrying capacity, increased dispersal, dramatic increases in WT mortality, or reductions in reproduction or recruitment**. These issues have not been realistically and sufficiently addressed in the FS analysis and disclosure, and this lack of scientific integrity produces significant uncertainty. See, particularly, the flora discussed in Exhibit 5.

"The Ecology and Conservation of the Wood Turtle" document (pg. 64) (in the NSM project's administrative record) refers to "small scale or selection forestry" that may be beneficial for Wood Turtles – **Such cutting is not the case here**.

The large-scale and intense **thinning** that is proposed could result in various conditions. Your own picture demonstrates this ("Dear Stakeholder" letter Fig. 4). You may desire grassy understories, but what you get can be something quite different. As I stated in previous comments, there is much more to this than simply reducing canopy cover (see, *e.g.*, Runkle, J.R. 1991. "Natural disturbance regimes and the maintenance of stable regional floras", pp. 31-47 in Restoration of Old Growth Forests in the Interior Highlands of Arkansas and Oklahoma. Ouchita National Forest, Hot Springs, Arkansas).

The on-the-ground changes may change from site to site and are unpredictable due to multiple conditions and vagaries. Will there be dense regeneration of canopy tree species? An expansion of shrub cover? More grass? More herbs? It is not clear what and where the results would take place. **Nor is it clear that all these potential results of thinning would necessarily be beneficial to Wood Turtles, directly, indirectly, or cumulatively**. **This type of cutting should be avoided in the Turtle's core habitat as well.** Thinning can have drastic and unexpected undesirable effects to not just Wood Turtles, but overall forests well – even so far as converting forests to invasive grass systems (Kerns *et al*. 2020).

The same concerns apply to the fabrication of Pine communities in the core habitat (involving, Short-leaf, Pitch, or Table Mountain Pines). This is not likely to be beneficial to Wood Turtles either (see, e.g., Exhibit 5). This is particularly bad since it would involve numerous entries and other activities, such as burning these sites. And, from the information in the EA, some of these proposed Pine sites are at present Mixed or Oak forest types. How is it that this conversion, especially in the WT core habitat, is desirable when elsewhere we are constantly told how important oaks are here and how they must be encouraged? The agency is not clear with its rationale or disclosure.

In 2009 I sent this to USFS:
"What evidence is there that logged-over even-age management areas are high quality habitat for Wood Turtles? In the short term? And in the long term? I am not aware of the evidence for this. However, the radio-tracking work conducted by Dr. Akre in Virginia indicates that the Turtles tend to avoid recently logged areas (see information and maps in Akre, T. and C. Ernst 2006). The September 2006 FEIS for West Virginia's Monongahela National Forest states: "The commenter states that wood turtles require mature or old growth forest habitat and that recently logged areas are not good habitat for this species. We generally agree with this contention . . ." (MNF FEIS I-126) As another example, in Maine the Turtles are considered to not use regeneration sites of the forest-types they inhabit (see Bryan, R.R. 2007 at pg. 62)."

Subsequent to the immediately preceding comments, I had the opportunity to engage in an intensive study of Wood Turtle habitat use and preferences on the GWNF. My research project on the GWNF (which culminated in a PhD dissertation) corroborates the findings and reasoning in the preceding paragraph. See Exhibits 1-6.

Wood Turtles do not need large clearings for thermoregulation. They are not large animals, nor do they travel in herds. A sunlit space a foot-square is easily of sufficient size for basking. In fact, using a large open site could increase their exposure to predators or human collectors. Wood Turtles cannot run away, nor can they slip out of sight into water as do aquatic turtle species that prominently bask. Exposure on land can easily lead to injury or mortality; camouflage, cover, and inconspicuity are key to survival for this species.

Use of Habitat – with a thermal perspective (see Exhibits 3 & 13 – the FS raised the issue of thermoregulation in the LRMP/FEIS to which this project tiers)

Clearly, daily temporal heterogeneity of the thermal environment exists at my study areas (and, by inference, at this project area). Except for a need to sometimes avoid (if only for brief periods) direct sun in open microhabitats with temperatures ≥ CT_{ax}, what is not so clear are the constraints imposed by the costs and benefits of fine-scale thermal patchiness upon Wood Turtle summer spatial ecology. **According to activity budget theory regarding allocations of time and energy (Dunham *et al*. 1989), perhaps the most efficient use of time and space 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**. Under this scenario, higher quality thermoregulatory microhabitats would also have food and cover available (or at least immediately adjacent), thus diminishing biophysical constraints (such as resource availability or harvesting and processing rates) on energy acquisition (Congdon 1989).

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, *i.e.*, provide for more modes and vigour (*sensu* Gunderson and Leal 2016) at a single site. As turtles of the opposite sex may also be attracted to such sites, they could additionally facilitate mating opportunities. Microhabitats open to the sun could provide access to high temperatures, while the under litter/LWD and the under ground-vegetation microhabitats could provide cooler and more stable (less variable) temperatures. This propinquitous multimodality can be conceived as provision of consilient opportunities to thermoconform to different within-site microclimates. **The possible advantages of such multitasking quasi-thermoconformity are the reduction in exposure to predation, 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.**

As with chelonians living elsewhere in habitats with a high degree of forest cover (*e.g.,* the Serrated Hinge-back Tortoise (*Kinixys erosa*) of West Africa – Luiselli 2005), there is not much risk of overheating for Wood Turtles in the relatively intact forest at these study sites (Exhibit 3 - Table 3.3). **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); for turtle locations it was even higher, 19.6% (se = 0.97) for 123 WV turtle points and 20.1% (se = 0.96) for 197 VA turtle points** (Exhibit 6). These proportions should not be interpreted as implying that usable basking sites are significantly limited to Wood Turtles here. Canopy gaps and broken canopies created by natural disturbances in mature forests furnish numerous openings in a variety of sizes that provide access to solar radiation for Wood Turtles and other small chelonians *ca*. 20cm length and 1kg in mass (Donaldson and Echternacht 2005, Luiselli 2005, Remsburg *et al*. 2006, Krichbaum this study). **Mean amount of ground area beneath canopy gaps ≥ 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); these numbers do not include all those smaller areas under 9m^2 created by broken canopies that can also supply sun splotches and flecks for basking (such areas are incorporated into the canopy openness measurements). The behavioral exploitation of within-habitat patchiness through basking has been observed in other reptiles (Carrascal *et al*. 1992).

Small canopy gaps provide opportunities for basking, while the LWD and other ground cover there provide thermal refugia that allow escape from high midday temperatures. The microhabitat array sites all had varying degrees of canopy openness and amounts of canopy gaps (Table 3.1). It is important to remember that greater canopy openness in the overstory tree stratum does not necessarily translate to more open conditions or higher temperatures on the ground (*i.e.*, at the scale/level that a Wood Turtle lives). In fact, the density of ground vegetation could actually increase under conditions of greater overstory canopy openness (Krichbaum pers. obs.). **In this way, 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. In addition, by providing a greater range of forest floor light levels and temperature regimes, gaps can allow for more floristic richness and/or abundance, *i.e.*, increased foraging opportunities.**

At the VA deciduous forest location with anthropogenic alterations, the array locations with the highest proportions of temperatures $\geq CT_{ax}$ for all three microhabitats were a roadside and a scrubby anthropogenic opening with high degrees of canopy openness; these sites also had the highest minimum, maximum, and mean temperatures, as well as the greatest variance. Conversely, the only site with no recorded temperatures $\geq CT_{ax}$ was a high stem density early successional habitat (clearcut 30 years before); for the open microhabitats this site also had the lowest minimum, maximum, and mean temperatures, as well as the least variance.

In WV, the only site that recorded no open microhabitat temperatures $\geq CT_{ax}$ was in mature forest with a northern aspect and below average degree of canopy openness; this site had the lowest average daily maximum and mean temperatures and least variance. For the under veg microhabitats, the pattern was clearer, as temperatures $\geq CT_{ax}$ only occurred in mature tracts with SW aspects, steep slopes, and high degree of canopy openness, all of which are typical correlates of warmer ground-level temperature regimes (Cantlon 1953, Pringle *et al*. 2003, Fridley 2009, Suggitt *et al*. 2011). The lowest average daily maximum and mean temperatures, and lowest SD for WV under veg microhabitats occurred at an eastern aspect mature forest site with below average degree of canopy openness. For the WV under litter microhabitats, the highest average maximum and highest average mean temperatures, and highest SDs occurred at a location with a northern aspect (but with little inclination) and the highest degree of canopy openness of any array site. The lowest under litter temperatures and the least variance occurred at a NW aspect site with below average degree of canopy openness.

All these outcomes, as well as the correlation test results for temperature and environmental attributes at array sites, reveal that mature forests in these Central Appalachian forested locales can have diverse temperature regimes and indicate amount of canopy openness as a primary driver of fine-scale thermal patterns, with some influence

from aspect as well. Sites with high degree of canopy openness, such as roadsides or recently logged sites, have the highest temperatures and greatest temperature variance (Collins *et al*. 1985, Currylow *et al*. 2012), while sites with very closed canopies, such as a regenerating clearcut with high stem density, offer the least thermal diversity

Though sites that are too open can be potentially problematic regarding CT_{ax} for Wood Turtles in the summer, such risk changes with the season, geographic location, and behavior. Habitat of limited suitability for use by adults in the summer due to excessive temperatures, such as some roadsides (depending on aspect, slope, and soil conditions), may nevertheless provide valuable nesting sites earlier in the year (Krichbaum pers. obs.). In addition, sites detrimental in the south or summer may be more suitable in the north or spring and vice-versa. 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).

At the southern latitude of my study and this project area, perhaps the main diurnal thermal driver/constraint for Wood Turtles is not basking opportunities, but the avoidance of excessive heat gain. The risk of high heat loads can force a restriction of a reptile's activity time (Grant and Dunham 1988, Kearney 2013). In the spring and fall, canopies are less leafy and more open, thus providing even more plentiful basking opportunities.

Avoidance of overheating presumes the existence of vegetation, LWD, or litter that can provide the cover necessary for equable temperatures below CT_{ax}. Ground temperatures are buffered from extremes by plant canopies (Oke 1997), both overstory trees (Cunnington *et al*. 2008) and understory grass, herbs, and seedlings (see "under veg" at Table 3.2). Wood Turtles here were only intermittently exposed to temperatures $\geq CT_{ax}$ during 10:30-15:30, and this was only for a very small amount of time in a few microhabitats. Hence, unlike for some tropical or desert reptiles (Grant and Dunham 1988, Moulherat *et al*. 2014), at these forested sites thermal constraint upon summer Wood Turtle activity time and habitat use appears minor (Figs. 3.3 & 3.4).

The microhabitat iButton data indicate that diurnal temperatures in the T_{op} range (27.5-30°C) are available in exposed microsites as well as those shaded by ground floor vegetation, while cooler temperatures (almost always under 30°C) are available under nearby litter and woody debris. **Thus, any necessary thermoregulatory shuttling can be accomplished at a fine spatial scale, with broad-scale movements being seldom if ever necessary unless a turtle was exposed to site conditions that were drastically altered across large extents, *e.g.*, removal of a high proportion of overstory or understory vegetation across an area as large as or larger than its activity area, such as by logging or burning.** These anthropogenic disturbances can substantially change a thermal landscape (Currylow *et al*. 2012, Howey 2014). Wood Turtles can use forms under leaf litter not just for cool retreats diurnally, but for warmer refugia at night as well. During cold snaps they could also maximize heat conservation by moving to aquatic locations.

Both natural and anthropogenic disturbances that alter vegetative conditions can influence thermal conditions on the ground (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 CT_{ax} here 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 $\geq CT_{ax}$ was in a thickly regenerated 30-years-old clearcut.

4.d. CONTEXT and INTENSITY

First, as a general matter, Shenandoah Mountain itself is the largest massif in the entire Ridge and Valley Ecoregion, which is approximately 29 million acres in size (WV SWAP). The area is topographically unique within the Ridge and Valley Physiographic Province in that rather than being a narrow linear ridge of resistant sandstone it is a broad dissected ridge of interlayered sandstones and shales. The crown jewel of the Central Appalachians, Shenandoah Mountain constitutes the largest single contiguous tract of National Forest in the entire eastern United States. As such, it is of national significance as one of the largest relatively intact wildlands of any kind in the entire East. Here is probably the greatest amount of roadless areas and back-country recreational lands to be found in any single site between the Great Smoky Mountains National Park (NC-TN) and the Adirondack State Park (NY).

Geology, weather patterns, latitude, elevational gradients, and slope steepness and aspect converge and combine to compose a diverse array of deciduous and coniferous forest communities. Its high relief – elevations range from 1500 to over 4400 feet in height – and a terrain dissected with numerous perennial, intermittent, and ephemeral streams make for great habitat complexity. Shenandoah Mountain is distinguished by its interspersion and juxtaposition of ecosystems, watersheds, and species ranges. Southern species approach the northern limits of their ranges here, while northern species, such as Bunchberry and Wood Turtle, reach their southernmost distribution.

Secondly, and of particular significance in the instant case, these sites on the GWNF harbor the southernmost WT populations in the world (or if not, they are extremely close to it) – the FS does not seem to recognize this unique situation.

The FS does admit that the GWNF is of critical importance in the state/region for the conservation of WTs ("possibly the best, opportunity for conservation of wood turtle populations" – EA-67). The agency is also well aware that the WT is a "Species of greatest conservation need" (EA-114) These two factors are further illustration of the contextual significance that needs to be meaningfully and legally addressed.

Loss of these populations is precisely what leads to and is meant by "range contraction", one of the criteria for listing decisions under the federal Endangered Species

Act. The fact that someone somewhere somehow did not think them worthy of being considered as "regionally significant" does not alter the facts of the matter. These southernmost populations are of significant importance biogeographically. In addition, such peripheral populations are often of significance genetically.

Further, it is precisely actions such as this proposal that cumulatively lead to loss of viability and distribution. And if allowed to stand, this decision is evidence that existing regulatory mechanisms are inadequate for protecting Wood Turtles, another criterion for listing under the federal ESA. In addition, it would violate the NFMA. Viability is inextricably bound to distribution.

The project is proposed in and adjacent to **ecologically critical areas**, including the core habitat for known (and probable) population(s) of Wood Turtles.

In addition to the above factors, "the effects on the quality of the human environment are likely to be **highly controversial**" is an absolute certainty – there is a "substantial dispute about the size, nature or effect" of the project.

"The degree to which the possible effects on the human environment are **highly uncertain or involve unique or unknown risks**" has been addressed above and in the section of this Objection dealing with uncertainty.

The FS has not meaningfully addressed these factors and has not disclosed their rationale regarding them.

Thus, the project "may cause loss or destruction of significant scientific, cultural, or historical resources". Use of the area by Wood Turtles is in need of much greater scientific study. This species is an important element of Virginia's, West Virginia's, the Forest's and the nation's cultural heritage. The project would harm the natural heritage resources in the project area.

Due to their significant impacts or potentially significant impacts, **these contextual and intensity issues militate for the preparation of a full Environmental Impact Statement**.

5. WOOD TURTLE SURVEYS

The EA implies that surveys for Wood Turtles were accomplished throughout the project area. In actuality, however, the information in the FS response to Krichbaum 2020 FOIA reveals that comprehensive surveys throughout the project area have not been done 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 are actually occupied by WTs. The habitat at these sites appears to be suitable for Wood Turtles**; based on Krichbaum pers. obs. of project area and observations of over

200 WTs in the wild on the GWNF, information regarding forest types at the site in the EA, and Oxenrider statement in "Wood Turtle Surveys – West Virginia April 16, 2019" FOIA document. **These suitable sites should be managed as if they are occupied.** The FS presented no evidence and information to the contrary in the EA/BE. On-the-ground surveys should be performed by a qualified biologist(s) during appropriate times to detect the presence of the species. When/if the Turtles are found, wouldn't those streams be designated by the Virginia Department of Game and Inland Fisheries (VDGIF) as "Threatened and Endangered Species Waters" for the Wood Turtle?

The NFMA contains clear inventory and monitoring requirements. See, *e.g.*, 16 U.S.C. § 1604(g)(2)(B): "provide for obtaining inventory data on the various renewable resources" and "Insure research on and (based on continuous monitoring and assessment in the field) evaluation of the effects of each management system to the end that it will not produce substantial and permanent impairment or productivity of the land." 16 U.S.C. § 1604(g)(3)(C). See also 16 U.S.C. § 1604(g)(3)(B) and 1604 (g)(3)(F)(v). The Forest Service has failed to collect and maintain adequate population inventory data and monitoring on the Sensitive Species Wood Turtle in the proposed project area and/or Forest. Without consideration of this essential information, the agency cannot possibly make accurate well-informed or reasonable findings regarding impacts to this species and to their distribution and/or viability, as required by NEPA and the NFMA. Nor is it possible to reasonably determine if the substantive NFMA mandate for maintaining their viability or the Forest's diversity is being ensured. The hard look at site-specific data has not occurred. Monitoring the results of management actions is an essential element of adaptive management. Monitoring of the effects of past and future actions requires hard survey/inventory data.

6. INADEQUATE MITIGATION

The agency asserts, "For Forest Service sensitive species, the project actions may impact individuals but are not likely to cause a trend to federal listing or a loss of viability for the following species, and will not contribute to a trend toward federal listing of these species under the Endangered Species Act" (DNN-25) But the syntax employed here is ambiguous. What about significant impacts to the populations here? Loss of these populations is okay as long as Wood Turtles exist somewhere else on the GWNF? The agency has not clearly disclosed its conclusions and rationale to the public.

The decision lacks effective mitigation. Neither the temporal nor spatial bounds of the proposed mitigation effectively protect Wood Turtles from significant harm. Significant harm to Wood Turtles may occur as the agency intends to burn and log where the Turtles occur and when they are active on land. This is an abuse of the agency's discretion. The Forest's diversity is not adequately protected. **And human interactions are NOT being "managed to minimize impacts to wood turtles."** (LRMP and FEIS)

The agency must document that mitigation measures will be effective and will reduce significant effects and the agency must support its findings with "substantial evidence." National Audubon Soc'y v. Hoffman, 132 F.3d 7, 16-17 (2nd Cir. 1997); see also F.S.H. 1909.15 § 15. Also see 1999 USDA OIG timber sale report (attached on flash-drive). As explained below, the mitigation measures/design elements proposed in the DDN are not sufficient under NEPA. Case law has established that mitigation must not only compensate for forseeable adverse harms, but that the effectiveness of these measures must also be clearly explained and substantiated. See Idaho Sporting Congress v. Thomas (1998) and Neighbors of Cuddy Mountain v. United States Forest Service (1998). In the instant case, the proposed mitigation measures for the Wood Turtle do not comport with the facts before the agency and are not adequate to protect the Turtle.

The DDN/FONSI and EA appear to rely in large part on mitigation measures to reduce what would otherwise be significant impacts to the level of insignificance. Assumptions are made that various measures would be effective at preventing impacts to recreation, wildlife, TESLR species and the aquatic environment. **Such an approach is allowable for reaching a FONSI only where the agency has adequate assurance of implementation and effectiveness of mitigation, and that it provides an adequate buffer to make impacts insignificant. The Forest Service, in myriad specific ways that are identified in this Objection, relies on unsupported and ineffective mitigation measures to reach the FONSI, in violation of NEPA.** Where mitigation depends on the actions of others, particular duties attach. An agency should not commit to mitigation measures necessary for a mitigated FONSI if there are insufficient legal authorities, or it is not reasonable to foresee the availability of sufficient resources, to perform or ensure the performance of the mitigation (76 FR at 3848). Public involvement is particularly important with regard to mitigation. Public involvement is a key procedural requirement of the NEPA review process, and should be fully provided for in the development of mitigation and monitoring procedures (76 FR 3843, 3850).

The Forest Service has not accomplished this full public involvement in its development of mitigation procedures here – it has pointedly rejected my expertise and meaningful involvement. Thus, the necessity of this Objection.

Nothing in the EA or Appendix 3 shows that project operators have committed to measures to avoid or reduce impacts to WTs found on the project site, and are competent for implementing measures, or that these measures would be effective in reducing or avoiding significant impacts. See DDN-16

The scale of the proposed mitigation (*i.e.*, design elements = DEs) is inadequate both spatially and temporally for the avoidance of significant impacts from this NSM project.

The FS has proposed no seasonal road closures here in order to protect Wood Turtles. At another project area seasonal road closures are implemented to protect Wood Turtles during May-October, their nesting, foraging, and hatching times of greatest movements (see 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.). **I have seen Wood Turtles killed on roads in the GWNF, including at this project's Slate Lick working area.** The FS knows this and has implemented such closures elsewhere. Cumulative impacts accrue from this neglect here.

"Several proposed units in the project area are adjacent to streams known to support wood turtles. As previously stated, no harvest activity will occur in the riparian corridor." (EA-77 "Effects to Sensitive Species" section, see also pp. 66-67) – **The problem here is: Wood Turtles are NOT confined to riparian areas.**

"Forest Plan standards to protect riparian corridors" (EA-55) are entirely insufficient. Stream buffers are generally applied so as to protect some aspect of water quality (Wenger 1999, Phillips *et al*. 2000). It is crucial to recognize and address the fact, however, that riparian zones are not just buffers for aquatic habitat, but are themselves core habitat for various taxa (Reese and Welsh 1997). Hence, the riparian zones/areas themselves need to be buffered from, for example, edge affects or recreation or roads. And beyond this, Wood Turtles range far outside of "riparian corridors" and use habitats that are not riparian or wetlands (detailed in Exhibits 1, 5, & 6). Therefore, for this species we must expand our consideration and our protective measures beyond "riparian areas" or "wetlands". See Burke and Gibbons 1995, Semlitsch and Jensen 2001, Semlitsch and Bodie 2003, Crawford and Semlitsch 2007, Congdon *et al*. 2011, Quesnelle *et al*. 2013.

For Wood Turtles, the terrestrial zones that generally extend out to *ca*. 300 meters from waterways certainly can be considered "**core habitat**" (*sensu* Semlitsch and Jensen 2001, and Semlitsch and Bodie 2003, Congdon *et al*. 2011) where conservation efforts for this species can be focused (see information and references at Exhibits 1, 5, 6, 8) (this is not to say that other portions of their habitat might not also be considered as core habitat). For instance, Vermont recognizes that "the wood turtle uses streams and rivers for overwintering, and uses adjacent riparian areas up to 300 meters from the water's edge for foraging, breeding, nesting, and dispersal." (Vermont 4 – 68) And New Jersey uses a 322-meter stream buffer to identify Wood Turtle habitat (NJ Landscape Project at http://www.njfishandwildlife.com/ensp/landscape/index.htm).

One of the reasons expansive (relative to current stream buffers) **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**. 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).

Turtles often remain near or in waterways during the early spring and late autumn (when water temperatures may be warmer than air temperatures), but move much farther afield during summer – up to 300-700m from waterways (Kaufmann 1992, Arvisais *et al*. 2002 & 2004, Flanagan *et al*. 2013, Parren 2013, my study). **From the above citations and empirical data, it is clear that Wood Turtles are not confined to narrowly defined "riparian**

corridors". They typically use upland forests far from streams at sites with woody and herbaceous plants that are not strictly "riparian" or "wetland" species.

Maximum distance from the main streams differed between males and females pooled for both states in my study. Within state comparisons between males and females for this metric did not differ (Tukey HSD p-values = 0.23 (VA) and 0.70 (WV)). Mean distance to the main streams was 93.2m ± 6.1m for all terrestrial turtle points, with females locating farther away from the main streams than did males (Tables 1.1, 1.2 in Exhibit 1 and Table 6.6 in Exhibit 6). **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.**

In VA, ninety-five percent of 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 turtle location points were within a 290m buffer zone around the main stream.** This zone extending out 290 meters from both sides of the stream included 148ha of National Forest. See Exhibits 1, 5 and 6.

The study of Akre & Ernst (2006) showed that the mean maximum the Turtles' range from streams at their VA forested site was 350 meters (about 1050 feet) and the maximum distance is 650 meters (about 2,145 feet). At their forested study area "Ninety-five percent of all terrestrial locations were within 300 m of the stream." (Akre and Ernst 2006). This, the 300 meter zone, is similar to the findings of others elsewhere, such as Kaufmann (1992), Compton *et al*. (2002), and Arvisais *et al*. (2002).

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); all these taxa can be expected to occur in the NSM project area. **An obvious pattern was the relative paucity of wetland species both in the overall herbaceous species lists as well as those that serve as indicators. Though the Wood Turtle is often characterized as a riparian species or denizen of wet areas (see, e.g., McCoard *et al*. 2016b or USDA FS EA), they clearly use dry uplands a great deal. Most of the indictors for Turtles were upland or facultative upland taxa (Tables 5.13, 5.17, 5.19).** Turtle $400m^2$ and $1m^2$ plots had greater herbaceous richness than did random plots in both states (Figs. 6.4, 5.14, 5.15); which pattern was also the case at another WV Wood Turtle river site (McCoard *et al*. 2016b). Another salient result involved herbaceous cover; in both states $1m^2$ plots positioned at turtle points had significantly more herbaceous cover (combining both forbs and grass) than did those at random points (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 placed at the perimeter of the $400m^2$ plots suggests that the turtles are selecting for higher levels of 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. Though Spicebush (useful for VA females) prefers moister site conditions (Weakley *et al*. 2012), most of the seedling taxa

useful as indicators for Wood Turtles (Ironwood, Greenbriar, Serviceberry, and Blackberry) are found in various types of forested settings (Hutchinson *et al*. 1999, Burns and Honkala 1990, Weakley *et al*. 2012); further indication that Wood Turtles commonly use different types of forest. Turtles may have been feeding on the leaves of seedlings (such as Greenbrier) or on the fruits of species found in the shrub or tree layer (*e.g*., Serviceberry or Spicebush) that had seedlings in the understory.

The FS uses Sweetan's finding of 90m (BE). But her study took place in all seasons. In the winter the WTs were zero (0) meters from the stream. And in the spring and fall, depending on the weather and date, they might be in or not far from their stream. So, of course, when averaged out for an entire year, "most" might be within 90m. This is a way to deceive with statistics. And it is not even clear what is meant by "most" – 51% of locations, 75%, 95%? During the summer, when various actions in this proposed project could be implemented, "most" Wood Turtles may be far beyond 90m from the perennial streams. Akre & Ernst's (2006) and my findings (2018) are clear about this significant issue.

The use of the 100m buffer zone dimension in the DEs is apparently also based 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. 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. 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, WT ecological conditions, WT population statuses, profit motives, practical considerations, and legal landscapes. In the instant case, we are dealing with biogeographically significant WT populations on public lands that 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.

The time frame for the mitigation/DEs is insufficient. Logging/cutting, burning operations, herbicide application, fire line and road construction are allowed during the time the Turtles are terrestrially active; the agency uses May 1- October 15 for their DE. Turtles are typically terrestrial before and after those dates; I have personally witnessed this. Those activities, such as burning, felling, skidding, dozing, and mowing operations, are proposed for areas within which the Turtles can be expected to occur (*e.g*., the forested zone within 300 meters of various waterways). Their shells do not protect them from these harms. Vehicular use of roads is allowed during the time the Turtles are terrestrially active. Various roads and lines

are within the area foreseeably used by the Turtles. Even within the agency's 100m zone, hand felling and cabling would occur; no mention of other activities such as burning, herbiciding, or road building/reconstructing, just "mechanical logging activities" (EA-34). By the way, 100m is not equivalent to 300 feet; it is more like 330 feet. Page 20 of the GHM refers to harvesting occurring within 1000 feet of high-quality riparian areas only when the Turtles are inactive "(late October to late February)". These project area sites contain such high-quality habitat.

The document 5.12 in the FOIA response voiced concerns, uncertainties, and inconveniences about the DEs for timber purchasers and loggers. There was nothing about it from the WTs point of view. But all the concerns, uncertainties, and inconveniences would be solved by simply keeping the purchasers/loggers out of the 300m zone all the time.

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. That "conservation measure" also uses the dates April 1 – November 15. As is noted in the document 2.7 (FOIA request), during the summer Wood Turtles are typically on land $\leq$1000 feet from streams.

The agency's hands are not tied by recommendations made in a Wood Turtle document from Massachusetts. It can expand buffer zones – such as, for example, in the Los Padres NF in CA where it claims in court that the Wildland-Urban Interface is three times larger (1500') than what the local Community Wildfire Protection Plan says it is (500').

7. ALTERNATIVE NOT FULLY AND FAIRLY DEVELOPED AND ANALYSED

NEPA requires that agencies "shall * * *study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." **There are obviously unresolved conflicts here regarding Wood Turtles** – comments to this proposal, in addition to all my past submissions to the agency over the last 15 years, make this abundantly clear. The agency has not "to the fullest extent possible: u se the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment." 40 C.F.R. § 1500.2(e)

The EA"s improperly narrow project "purpose" also undermines its analysis. We the public are impeded in making well-informed comments and meaningfully participating in the process when we are not sure how and cannot compare ways the agency proposes to avoid, reduce, and mitigate harms. **Meaningful public participation is thwarted when a range of alternatives is not developed and considered. This makes for improperly constrained and tendentious decision-making**.

The USFS has failed to disclose why the alternative of locating the project's intensive ground-disturbing activities (logging and burning and road building) outside of the WT 300m buffer zone would not be in the public interest. Considering that the proposal has 5000 acres of logging and 5000 acres of burning – the reduction in the agency's activities would be minimal and desired conditions would still be attained. This alternative was suggested here (see, *e.g.*, my October 2019 comments) and at the Forest Plan level (see Appendix), but there is no mention of it in EA.

Overall in general, the available research generally indicates that the best way to treat WTs is for humans to leave them alone. Totally. And that includes not making a public issue out of their presence here, and certainly not broadcasting information about their locations. They would get along just fine without us. So, the very best thing we could do is drop the entire project and close the roads where they live. And somehow keep humans away from them and not draw public attention to where they live.

Of course, that is unrealistic and will not happen. But what we can do, if the FS really wants to help the Turtles, is to **at least stop disturbing them in the 300m (*i.e.*, 1000 feet) zones around the streams, *i.e.*, the Turtles' "core habitat". This is reasonable, pragmatic, relatively simple to implement, scientifically truthful*, legally defensible, and effective to a significant degree.**

Doing this is also a large compromise. This 300m zone is a bare minimum, as it may not be expansive enough to include all used summer habitat (I can testify that Wood Turtles at GWNF sites in VA and WV sometimes are 500-700m from the streams), extensive pre-nesting movements of females, or connectivity to other populations (metapopulation dynamics) (see, *e.g.*, Congdon *et al*. 2011).

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. 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). Because the condition of the matrix within which occupied patches reside may influence turtle abundance and population viability, effective restoration and protection must 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).

For instance, stream communities at sites with stringently protected riparian buffers can still be significantly degraded by intensive development 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).

"There are approximately 5,249 acres planned to be silviculturally treated in this

alternative" (EA-56), plus 5,249 acres of burning. So, implementing the WT buffer alternative is a relatively minor modification. **The acreage foregone is far more important to the Wood Turtles and their limited distribution. The amount forgone to the timber supply can be easily made-up by private lands elsewhere in VA and WV** (see estimated amounts in Exhibit 7).

The FS at least says it recognizes the importance of the GWNF as a refugium for Wood Turtles (EA). That, plus the above information on landscape context, are cogent argument that the 300m core habitat protected zone is minimal and a significant compromise.

WTs actually only occupy a very small area of the National Forest. Nonetheless, GWNF managers refused to designate SBA areas with WTs in the 2014 Forest Plan – "MA prescription 4D-Special Biological Areas are areas that serve as core areas for conservation of the most significant and rarer elements of biological diversity identified on the Forest. These areas or communities are assemblages of diverse habitat for threatened and endangered species, sensitive and locally rare species that occupy a small portion of the landscape, but contribute significantly to biological diversity (Forest Plan, p. 4-53)." – EA-157 The FS can designate these places as SBAs now as part of the decision, and subsequently amend the Forest Plan – another way that we can stop this major conflict. The Turtles would not have to be the focus of public attention; there are numerous TESLR species that are part of the communities gaining protection. As SBAs it could still be appropriate to put LWD in streams, initiate seasonal road closures, and fabricate some small nesting sites. See Appendix.

Look at the difference between the treatment of Cow Knob Salamanders (*Plethodon punctatus*) and Wood Turtles by the FS here – both are considered G3, and S2 in VA, both are priority 1 species in both states, and are of greatest conservation need. Wood Turtles are even listed as "Threatened" (and we know even more now about their threats and vulnerabilities than when they were listed). The rationale behind the intense resistance to meaningfully protecting Wood Turtles on the GWNF (their most important site) is not explained by the agency. Can it be that the upper elevations inhabited by the Salamander have smaller less valuable trees that are harder more expensive to access and are less desired by the taxpayer subsidized timber industry than do the sites inhabited by the WTs?

One of the drivers for this project is said to be the need for esh – "the actions of Alt. 1 "primarily serve to promote ecological restoration by enhancing habitat conditions for declining early successional species" (EA-114).

Over two years ago I wrote in response to the "Dear Stakeholder" letter:
"If this agency can scientifically and logically establish that there is not enough esh in this project area and that more is needed in order to "restore" it, then **develop and completely analyse an alternative that turns already existing early- and mid-successional stands into new esh**. There are thousands of acres in the 11-30 year age classes (called by some the "biological desert" seral stage; the FS admits these early seral sites "provide minimal benefits in regards to herbaceous undergrowth and bugging areas for wildlife." (JNF FEIS 3

- 108)) (DS-6). See Reynolds-Hogland, M. *et al*. 2006 for such a proposal and the science behind it. Such an alternative complies with the NFMA and MUSY.

"The DS makes no mention of population monitoring data for esh-dependent taxa in the project area. The evidence in support of the "need" to fabricate more is not disclosed; a programmatic non-site-specific "desire" is not evidence in support of a well-reasoned site- specific decision.

"A major problem with this proposal is that the FS does not properly consider the contribution of natural processes to maintaining wildlife habitat, such as "early successional habitat", on the project area. The FS planners fail to properly consider and analyse natural esh patches, particularly those under two acres in size (the scale of many canopy gaps) (there is no mention of this in the DS). As a consequence, the GWNF managers use an invalid "need" to fabricate such habitat as a rationale for cutting down valuable and important mature and old-growth forest habitat. Until this natural habitat is fully and fairly considered and assessed this proposal does not have a valid foundation."

There are still no population inventory and monitoring information/data that show that early successional species here are actually declining, that validate the "need" here for all the planned fabrication of esh. And there are still no data and estimates for naturally occurring esh, nor analysis that validates its claimed insufficiency here.

*** Science** is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence (oftentimes quantified). Or, "a never-ending search for truth" (Ann Druyan). Then what is truth? **Truth** means being in accord with **fact** and **reality.**

8. VIABLE POPULATIONS - D, I, C IMPACTS - LACK OF HARD LOOK – NFMA, MUSY

The National Forest Management Act (NFMA) establishes the goals of maintaining species' diversity and ecological productivity; these goals are consistent with the concept of ecological sustainability. The NFMA calls for maintaining the diversity of plant and animal communities to meet multiple-use objectives, which in the regulations implementing the Act have been stated as providing habitat to maintain viable populations of existing native and desired nonnative vertebrate species.

The FS cannot ensure the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of these resources without impairment of the productivity of the land (**sustained yield**). Planning for the multiple use and sustained yield of the resources of national forests and grasslands should operate within a **baseline level** of ensuring the sustainability of ecological systems and native species. What is the baseline level of Wood Turtles on the GWNF?

What is the current status of WT populations on the Forest and at this project area? What were the impacts of previous actions upon these populations? Nothing in the EA/BE or in the agency's response to my FOIA request on this significant issue/concern of population numbers and trends. Then how were conclusions reached as to the FONSI? **Cumulative impacts could drive populations into an "extinction vortex".**

The only analytical information available right now on the GWNF as far as I know is my study on WV WTs nearby this project area – See Exhibits 3 and 8. This site has no open roads and is without recent logging. The estimated population trend there (λ) was hovering on a somewhat stable state. Using an adult dataset of 9 years of mark-recapture data in MARK, I estimated population size, lambda, and survivorship with open population Cormack-Jolly-Seber and Pradel models.

Population persistence involves a balance between exogenous ecological factors (that influence carrying capacity – "K") and endogenous evolutionary & demographic factors (vital rates that contribute to "r" or λ) (Kinniston & Hairston 2007). Demography can affect various evolutionary processes (Harts *et al*. 2014). **The self-sustainability of populations in the long-term is a function of population size** (Willi & Hoffmann 2009, Reed & McCoy 2014). Gene flow via dispersal is a key evolutionary process (Hoffman & Sgro 2011), so dispersal/ connectivity may be essential for maintaining MVPs and/or populations approaching K (Kinniston & Hairston 2007). Small populations are subject to greater stochastic impacts (genetic, demographic, environmental) that can erode viability (Lande 1993). Generally, a large N_e is needed to maintain genetic variation (Frankham 2003, Reed 2005); for example, Fridgen *et al*. (2013) reported lowered genetic diversity in reduced populations of Wood Turtles (*Glyptemys insculpta*) in southern Ontario.

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, due to such factors as difficulty in finding mates (Belzer and Seibert 2009), *i.e*., an Allee effect producing further reductions in population size. **It is essential that conservation practitioners not address these multiple/synergistic stressors to population viability individually in isolation** (Crawford *et al*. 2014).

In general, turtles are unusual among vertebrates in that slight increases in adult mortality or removal can lead to large declines in populations. **Field studies and statistical analyses clearly show that even modest rates (intentional or incidental) of take of adult turtles can lead to strong declines in populations** (Enneson, J.J. and J.D. Litzgus 2008, Gibbs, J.P. and G.D. Amato 2000, Compton, B. 1999, Heppell, S.S. 1998, Herman, T.B. 1997, Congdon, J.D. *et al*. 1994, Congdon, J.D. *et al*. 1993, Brooks, R. *et al*. 1991, and Doroff, A.M. and

L.B. Keith 1990). "The Wood Turtle may be equally, or even more vulnerable than certain other well-studied turtle species (such as *Emydoidea blandingii*) in this regard" (Harding, J. 2002).

Populations cannot sustain heavy adult mortality. After reaching maturity, Turtles must then survive and reproduce for decades more just to replace themselves. **And because of their long lives, if recruitment is inadequate many years could pass before attrition would become evident in the population** (Beuch, R.R. *et al*. 1997). Old adults might be visible for decades while, unbeknownst to observers, the population is slowly dwindling away.

A critical question to ask is **how much cumulative mortality can a population absorb and still be healthy and viable for the long term?** In the absence of detailed site-specific demographic data and analysis this cannot be established. Nonetheless, actions take place on top of Wood Turtle populations, on the Forest and elsewhere, that can and do lead to direct and indirect mortality or take of Turtles.

Scientists have recently examined the elasticities of North American freshwater and terrestrial turtle species (see Reed, R. and W. Gibbons 2003, Gerber, L. and S. Heppell 2004, Enneson, J. and J. Litzgus 2008, and Heppell, S.S. 1998). "Elasticity in population growth rate is the proportional change of the rate of population growth in response to a proportional change in a matrix element (de Kroon *et al*. 1986). It can be calculated analytically, giving the response of the growth rate to very small changes in elements of the matrix (de Kroon et al., 1986). Thus, stage-classified modeling has the potential to determine to what extent changes in vital rates will affect population size, growth rate, and persistence. . . ." (Enneson and Litzgus 2008)

As the research of Drs. Reed and Gibbons (2003) shows, **of all North American turtle species, Wood Turtles 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 above natural attrition can be devastating. The Turtles may not reproduce enough or survive long enough to make up for the losses from collection, depredation, and being killed on roads or by logging operations.

The precariousness and vulnerability of Wood Turtles are borne out by Dr. Richard Seigel's research on "feasible demography": "The phrase 'feasible demography' refers to a suite of life history characteristics that must exist in a population in order for that population to remain stable through time. . . . A species that reaches sexual maturity at nine years requires a greater than 95% adult survivorship rate and a reproductive life span of a minimum of 20 years depending on annual egg production. . . . The impact of increased mortality and general habitat degradation is the gradual decline in the size of a population and a disruption of a 'feasible demography.'" (Seigel 2005)

The studies of W. Belzer (2002) on Box Turtles (*Terrapene carolina*) are apropos to the Wood Turtle: "How can adults sustain a population? . . . In long-lived species like *Terrapene*, the key to population stability is retaining aged adults in the habitat for their full, long lives (e.g., Congdon et al., 1993; Crouse, 1999; Musick, 1999; Miller, 2001;

Yeoman, 2002)."

The problems for Box Turtles referred to by Dr. Seigel and W. Belzer are even more acute in Wood Turtle populations. Not only do they exhibit low annual egg production and high mortality of young, they also do not reach sexual maturity until at an even more advanced age than Box Turtles, on average 14-18 years old (see, *e.g.*, Akre, T. 2002 and Brooks, R. *et al*. 1992).

Compton (1999) "built a simple demographic model to estimate the effect of the annual removal of a small number of adults from a hypothetical population of wood turtles. **The model indicated that removal of a single adult annually from a stable population of 100 adult turtles would cause a 60% decline in over 100 years, and that removal of two animals annually would extirpate the population in less than 80 years**."

Enneson and Litzgus (2008) studied the demography and life history of the Spotted Turtle (*Clemmys guttata*), a close relative of the Wood Turtle. They found "that only a 3% decrease in adult survivorship could cause decline in spotted turtles (Table 2). . . . Given similarities in life history, it is likely that our results for spotted turtles can be applied to many other freshwater turtle species, including the numerous species that are considered at risk and in need of recovery action."

This is not to say that the protection of early life stages is not also important. The intensive loss of hatchlings or eggs can cause significant population decline (Tomillo *et al*. 2008). Chronic reductions in adult survivorship require increases in juvenile survivorship in order to maintain stable populations (Congdon, J. *et al*. 1993 and 1994, Enneson and Litzgus 2008). However, unlike many other animal species, **late-maturing turtles appear to lack such a density-dependent response** - meaning increased reproductive output in response to a decreased population density (Brooks *et al*. 1991, and Galbraith *et al*. 1997). Exogenous sources (*viz*., of human-induced origin) of adult mortality may inexorably lead to the extirpation of populations.

What density of Wood Turtles is needed for ensuring reproduction and sustaining viability? **The "minimum viable population density" is unknown**. However, **the fewer Turtles there are, the less the chances of having mating encounters** (Belzer, W. 2000). Thus "**negative density dependence** can cause sparse populations to continue to decline even after the original cause of decline is removed." (Strayer *et al*. 2004; emphasis added) For Eastern Box Turtles, Belzer (2006) noted: "The published studies on native populations noted in this paper reveal that densities which many would regard as normal and adequate for long term population stability, have turned out (in hind sight) to be too low to enable rebound from losses, and the time for intervention (to try to slow the population's inevitable demise) was passed decades before."

Wood Turtles in VA and WV may exist as **metapopulations**, meaning a non-contiguous set of local populations that may interact on occasion by migration (Buhlmann *et al*. 1997). It is the low dispersal rates between local populations (which develop a significant degree of demographic independence) that characterize metapopulation organization (Smith and Green 2005).

"Protection" of known sites of occurrence is not enough. Thorough and comprehensive surveys to verify the Turtle's occurrence locations throughout the project area have not occurred yet. In addition, conservation strategies for metapopulations must

consider not only occupied habitat, but also unoccupied suitable habitat and intervening habitat that may be occasionally used during infrequent migration events (Simandle 2006, and Huxel and Hastings 1999).

Full protection of the Forest's extant individual populations is important as it may be that GWNF Turtles serve or may serve as **critical source populations that subsidize sink populations** at more heavily developed sites off the Forest. Or is it vice versa (*i.e.*, are Wood Turtle populations on the Forest subsidized by emigration from off-Forest?) Disruption of individual colonies in a metapopulation may jeopardize the entire metapopulation (Hanski, I. and D. Simberloff 1997). Even apparent strongholds may be in need of strict protection and/or restoration (Bulman, C.R. *et al*. 2007).

Landscape permeability and maintenance of movement corridors are essential to ensure metapopulation dynamics of herpetofauna (Marsh and Trenham 2001). How permeable (amenable to movement) is the intervening habitat between Turtle populations both on and off the Forest? It may be that movements between populations are already significantly impeded by landscape modifications such as roads, development, and elevated populations of predators.

Perhaps we are killing off the wanderers. Because the modern human-dominated landscape is actually in a degraded and fragmented condition for Turtles, those that are more mobile may actually be harmed more since their movements expose them to sources of harm (Cushman 2006 and Fahrig 2001). In this sense, dispersal can serve to imperil population viability.

While the "naturalness" of the Turtle's present sporadic distribution is certainly debatable, this condition is nevertheless currently an empirical fact. Evidence indicates that Wood Turtle populations may be quite localized within its range, with large gaps occurring among populations (Litzgus and Brooks 1996, Ernst 2001b, Amato *et al*. 2008, Willoughby *et al*. 2013, Jones and Willey 2015). **Dispersal is currently impeded or hindered within a landscape exhibiting varying degrees of permeability or resistance such that metapopulation dynamics are affected.** Research on Wood Turtles in Ontario indicates that isolation of Turtle populations may lead to lowered hetrozygosity and increased inbreeding (Fridgen *et al*. 2013).

For example, in West Virginia according to a "viability outcome" the Wood 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." (FEIS, Monongahela National Forest, USFS 2006) The fragmented condition referred to on the MNF repeats itself across the Turtle's range and certainly places the species in a precarious position. Low population numbers in general are problematic, but this concomitant distributional fact exacerbates the Turtle's vulnerability to disturbances or disruptions with the potential to harm their viability. Fragmentation creates isolated subpopulations that, because of their reduced size, have an increased probability of extinction.

The FS has not demonstrated genetic connectivity for the populations/subpopulations of the WTs here at the project area. A genetically isolated population is doomed to decline and, longer-term, extirpation. Demonstrable natural gene exchange is therefore a prerequisite for truly recovered populations.

Absent from this decision are scientifically defensible methods to estimate population numbers, and more importantly, to estimate the *effective* breeding population (except for my own MARK study), the population required to maintain long-term genetic viability.

The GWNF's reliance that the species will recover in the "long run" to justify short term losses can only be relied on if the agency has reliable and credible scientific data to indicate that there are populations elsewhere that can produce enough of a surplus population for the years where there will be a reduction in a key source, that there could still be recruitment. And, during the time when the species will be harmed, will these areas become sinks?

Persistence is deceptive – **Because they are long lived, there can be long delays (time lags) for consequences of actions**. Their reproductive strategy, **extreme iteroparity**, takes a long time for the results to work out. A complexity of positive and negative feedbacks ensues.

The Forest Service here implies/claims that short-term losses of Turtles are somehow offset in the long term. This assertion bears absolutely no citation to scientific research, no consultation with expert opinion, no disclosure of site-specific Turtle population data, and no reference to or analysis of Turtle demographic models, research, or data. It is not even clear what is meant by short- or long-term. The agency offers no studies of population dynamics to support their conclusions regarding the recovery potential of the Turtles here.

How is it that the implied greater hatching success from the nest-site fabrications, which cannot be assumed would actually occur, somehow makes up for the losses incurred to the population from the cumulative impacts discussed in this Objection?

In the absence of specific data on Wood Turtle populations/trends in this project area, then is the FS using a MIS? What MIS is the GWNF using as a proxy to monitor and gauge WT populations and impacts to them here? But the WT's life history and physiology and ecological role not the same as the MIS used on the GWNF. And according to statements made by the agency, the MIS trend findings only apply Forest-wide.

The Multiple-Use Sustained Yield Act (MUSYA) of 1960 directs the Forest Service to conduct management actions "without impairment of the productivity of the land." See 16 U.S.C. 531. The broad discretion and vague permissiveness found in this decision does not ensure that such impairment of National Forest lands would not occur. Project implementation may foreseeably result in a significant impairment of the productivity and/or sustainability of the Wood Turtle population, in violation of the MUSYA and NFMA.

I wrote to the GWNF over 10 years ago on this issue (see Krichbaum 2009):
"From my surveys and observations of the past five years, it appears to me that most of the **populations/colonies of Turtles on the Forest are already very small. Which means their persistence is already at risk** (O'Grady, J.J. *et al*. 2004). The extremely low genetic variability found within the species as a whole means that anthropogenic threats may

overwhelm the capacity of Wood Turtles to withstand environmental changes (Amato, M. *et al*. 2008).

"At multiple scales Wood Turtle habitat and populations are diminished, fragmented, and altered by roads, logging, residential, commercial, and agricultural development, and other factors. An effect of this loss and disruption is to make the Turtles more susceptible to environmental stochasticity, demographic stochasticity, and genetic stochasticity. All of which serve to decrease the long-term viability of populations (see Soule, M.E. 1987 and Lande, R. 1993). An insidious mutual reinforcement of these biotic and abiotic elements occurs that serves to deteriorate population dynamics and collectively drive a population downward to extinction (see Gilpin, M.E. and M.E. Soule 1986, and Fagan, W.F. and E.E. Holmes 2006)."

9. COMPLIANCE WITH FOREST PLAN – NFMA

The consistency provision of the NFMA requires that "Resource plans and permits, contracts and other instruments for the use and occupancy of National Forest System lands shall be consistent with the land management plans." 16 U.S.C. § 1604(i). All timber sales and other site-specific projects must be consistent with the Forest Plan. *Id*. Courts uniformly enforce this consistency requirement. See *Northwoods Wilderness Recovery, Inc. v. USFS*, 323 F.3d 405, 407 (6th Cir. 2003) ("Implementation of the forest plan is achieved through individual site-specific projects, and all projects must be consistent with the forest plan."); *Sierra Club v. Martin*, 168 F.3d 1, 4-5 (11th Cir. 1999); *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1068 (9th Cir. 1998); *National Audubon Society v. Hoffman*, 132 F.3d 7, 19 (2nd Cir. 1997).

"Desired Conditions for Species Diversity (GW Plan page 2-20): DC SPD-13: Watersheds with known populations of wood turtles are managed to maintain or enhance the terrestrial summer foraging habitat, nesting habitat and overwintering habitat of wood turtles. Human interactions, such as motorized vehicle use and recreation, are managed to minimize impacts to wood turtles."

See also the Goals and Conservation Measures in the FEIS Appendix G.

Human interactions are NOT being "managed to minimize impacts to wood turtles." (LRMP and FEIS)

As demonstrated in this Objection, the North Shenandoah Mountain project is not consistent with the Plan direction *in re* Wood Turtles.

10. NEST SITES – ECOLOGICAL TRAPS

I am concerned about fabricating nesting sites at areas where the predation pressure has been enhanced by large logging units and/or roads and their associated edge-affiliated predators – these can be **ecological traps**. The discussion/disclosure in the BE is deficient and it is not clear if the decision is well-reasoned. See Exhibit 14.

Both within and outside the GWNF, the potential for the existence or fabrication of disruptive **ecological traps** must be recognized and addressed. Traps have been termed attractive sinks, but their dynamics are fundamentally different. Sinks conceptually emphasize population consequences as a function of demography (population rescue by spillover of excess individuals into poor quality habitat) (Pulliam 1988). In contrast, traps emphasize population consequences as a function of cue-response behavior (Patten & Kelly 2010).

Preference for high quality habitats or avoidance of low quality habitats is adaptive habitat selection (Patten & Kelly 2010). In contrast, **ecological-evolutionary traps involve incorrect decision-making that results from the decoupling of selection cues and habitat quality; decoupling results in unrecognized maladaptive effects on fitness** (*i.e.*, decreased survival and/or reproduction) (Robertson *et al*. 2013). The key concept of traps in an evolutionary context is that cue–response systems shaped by past selection pressures are no longer adaptive in the face of HIREC ("human induced rapid environmental change"; Robertson *et al*. 2013).

This lack of correlation between perceived environmental cues and habitat quality is expressed in **three types of ecological traps**: 1) increased attractiveness for a low-quality habitat, 2) habitat quality is lowered but the cues remain the same, and 3) the simultaneous raising of selection cues and lowering of habitat quality (Robertson & Hutto 2006). Another type of trap (involving "undervalued resources" (Gilroy & Sutherland 2007) occurs when a habitat with high quality (*i.e.*, where population $\lambda > 1$) is actively avoided: the so-called "**perceptual trap**" of Patten & Kelley (2010) (see fig. 3)

A perceptual trap may occur when Vervet Monkeys (*Cercopithecus aethiops*) *avoid a habitat* with important resources due to a perceived **high risk of predation** from Leopards (the "landscape of fear") (Willems & Hill 2009). An ecological trap occurred when Leopards were *attracted to habitat* at the edge of reserves due to greater prey availability, but suffered **higher human-caused mortality** there (Balme *et al*. 2010). Moreover, the negative population consequences were exacerbated by a "vacuum effect" involving other Leopards being attracted to depopulated edge areas, thus driving deleterious edge effects even deeper into the patch interior (Balme *et al*. 2010). Sinks and traps are significant to conservation biology as being mechanisms for explaining (and then mitigating/preventing/rectifying) population decline, extirpation, and extinction (Fletcher *et al*. 2012).

Species that may be at increased vulnerability to traps (Weldon & Haddad 2005) include those: with small or threatened populations (Kristan 2003), that exhibit strong site fidelity (Purcell and Verner 1998), and that are unable to recognize or respond to predation threats (Weldon & Haddad 2005, Hawlena *et al*. 2010). For example, roadkill for turtles is in some ways analogous to the effect of an unrecognized predator (*e.g.,* mortality removes

individuals from a population); such vehicular mortality can cause population declines (Crawford *et al*. 2014). Particularly at risk of roadkill are females making long distance forays during the nesting season (Steen *et al*. 2012); such mortality may the most significant threat to population persistence (Steen *et al*. 2006).

Documented evidence for chelonian traps generally involves nesting sites (*e.g*., beaches, roadsides, and riverine sandbars) and foraging sites (roadsides, agricultural fields). High–quality nest site conditions are critical for species lacking parental care (Hughes *et al*. 2009). Both nesting and foraging site traps are often involved with edges and associated increased predation/mortality.

Aquatic turtle species such as *E. blandingii, P. concinna, S. minor, G. barbouri, A. spinifera* and *Macrochelys temminckii* may nest 200-500 meters from the water (Sterrett 2010, Refsnider and Linck 2012). In addition, females of various species *(e.g*., Blanding's, Painted, Wood Turtles) often make circuitous nesting movements (Akre & Ernst 2006, SK pers. obs.). Current narrowly applied buffer zones often fail to effectively protect core habitat (Semlitsch & Bodie 2003) (Fig. 5). Expansive protected buffer zones extending out 200 meters and more around corridors and steppingstones as well as wetlands and other source habitats are needed to accommodate movements and reduce edge effects, such as predation upon nests (Burke & Gibbons 1995, Steen *et al*. 2012). **It is critical that deleterious edge effects receive much more explicit consideration** if conservation networks to provide rescue responses to HIREC are to prove to be effective. Similarly, as the condition of the matrix or the habitat context within which occupied patches reside may influence turtle abundance, effective restoration and protection must encompass larger spatial scales (Quesnelle *et al*. 2013).

It is possible that female turtles can be enticed to use artificial nesting sites fabricated at safe areas instead of nesting at roadside or other trap habitat (Buhlmann & Osborn 2011). This would be an instance of increasing cues to a novel undervalued resource. The use of such artificial mounds can result in a high percentile of eggs hatching as well as healthy hatchlings (Paterson *et al*. 2013). **Care must be taken that such fabricated nesting areas are not sited in such a way that they themselves then serve as ecological traps; *e.g.,* they must not be fabricated at edges or other habitats with high or enhanced predation pressure** (Weldon & Haddad 2005).

This is yet another issue I raised in 2009:
"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, implementation of this 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, 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).

Because of vulnerability to depredation, researchers recommend " i f nesting habitats are created near ponds, they should be large enough to minimize nests being

clumped. Otherwise, nesting sites should be available at distances of at least 50 m from pond or wetland edges." (Marchand, M.N. and J.A. Litvaitis 2004b) Also see Marchand, M.N. and J.A. Litvaitis 2004a and Marchand, M.N. *et al*. 2002.

Raccoons and other meso-predators certainly exist on the GWNF. 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). I have personally witnessed Raccoons waiting beside nesting female Wood Turtles in VA. I also witnessed many nests at this location dug-up and the eggs consumed (shells were left).

Snapping Turtles (*Chelydra serpentina*) and Eastern Box Turtles (*Terrapene carolina*) are also sympatric with Wood Turtles, and syntopic at site-specific areas on the Forest. Experiences with these species can also shed light upon issues and concerns related to the Wood Turtles. See Flitz, B.A. and S.J. Mullin 2006, Robinson, C. and J.R. Bider 1988, and Kolbe, J.J and F.J. Janzen 2002."

APPENDIX

Distribution

The Wood Turtle's distribution is indeed limited, both range-wide and on this Forest. Use of range maps can significantly overestimate the actual occurrences and distribution of a species (Jetz *et al*. 2008). Range maps are misleading as to the actual extent of the Wood Turtle's distribution (*e.g.*, see map in Ernst and Lovich 2009). Although the Turtle is wide-spread in "range", it actually has a restricted distribution (see habitat constraints at section III.). Occurrence of actual populations is recognized to be localized and spotty (Jones and Willey 2015). In other words, **the actual "area of occupancy" is only a tiny fraction of the "extent of occurrence" based on range maps**. For example, the Turtle's occupied area was calculated to be only *ca*. 0.3% of the extent of its range in Canada (COSEWIC 2007).

Many factors contribute to the distribution of Wood Turtle populations within and across watersheds (Compton *et al*. 2002, Jones 2009, Jones and Willey 2015). At the landscape scale, Wood Turtle occurrences and abundance are positively correlated with amount of forest cover, and negatively correlated with amounts of impervious surface, urban development, and agriculture (Jones and Willey 2015). Among the most important aquatic factors are stream gradient, discharge rate, and sinuosity, as well as substrate composition and degree of suspended solids (*id*.) Clear, low gradient 2 ^{d} to 5 order streams with a moderate, continuous current and hard sand or gravel bottoms appear to be preferred (Ernst 2001b). Thus, compared to species such as Painted or Snapping Turtles, Wood Turtles can be viewed as stream specialists , occurring along those stream reaches offering suitable hibernacula and terrestrial habitats (Wesley 2007).

Scale (beyond 300m)

The definition of **matrix** in the context of the landscape patch model is simply the patch or landcover type that is most prevalent (covers the greatest area) in the study site's extent (Turner 2001) (see Glossary 2). The condition of the matrix plays a large role in determining the connectivity of habitat patches. In actuality, however, the matrix is a continuum of habitat quality possessing varying degrees of landscape suitability or permeability (resistance to movement, aka viscosity or friction) to particular organisms. Thus, the matrix can serve as habitat itself, as well as potentially serving as a conduit, filter, or barrier to dispersal (Harris & Sanderson 2000).

Patches, edges, and the matrix can all serve as barriers, filters, or facilitators of movement. Isolation by sheer distance, geographic barriers, or landscape resistance all influence the ability of organisms to traverse landscapes. **The overall landscape, as well as its constituent habitat patches, has varying degrees of resistance/friction, *i.e.*, permeability to movements** (Zeller *et al*. 2012). This resistance to movement between sites can vary also as a function of the organism's ontogeny, sex, or size, just as the resistance of single site may vary over time due to on-the-ground changes from such factors as disturbance or seral stage. Functional isolation impedes both the rescue (augmentation) of imperiled populations, as well as the recolonization/colonization of vacant habitats (range expansion) (Baguette *et al*. 2013).

The potential difficulties of crossing landscapes with differing land-cover/habitat mosaics can be analysed through least-cost path modeling (Cushman *et al*. 2009, Hagerty *et al*. 2011). This algorithm based output is a non-Euclidean distance metric, in that the shortest or most direct route may not be the best route. Even aquatic turtles, such as *Chrysemys picta* (Bowne 2008) and *Emydoidea blandingii* (Refsnider & Linck 2012), may traverse long distances terrestrially and use or encounter a wide variety of upland habitat types when moving, particularly during nesting forays (Steen *et al*. 2012).

For long-term viability, large populations are necessary, which in turn require habitat in large amounts and/or high quality for all life stages (Reed & McCoy 2014). Large populations are more likely to provide the high amounts of standing genetic variation needed to facilitate both phenotypic plasticity/buffering and genetically adaptive responses (Reusch 2014). Therefore, to decrease extinction risk, increase K or abundance by increasing habitat area and/or habitat quality (including that of the matrix), and/or by reducing functional isolation of populations (*i.e.,* allow for dispersal/geneflow) (Lindenmayer & Burgmann 2005, Vos *et al*. 2010, Quesnelle *et al*. 2013) (see Fig. 1).

It is by now well recognized that the viability of populations within protected reserves may be dependent upon populations and ecological processes that exist or begin outside of the protected area (Harris *et al*. 1996, Hansen & DeFries 2007). Examples include reserves affected by **source-sink** population dynamics and off-site initiation zones for natural disturbances. Human land uses outside of even strictly protected reserves can turn the off-site source habitats into sinks, thus disrupting population viability within the ostensible refugium (Hansen & Rotella 2002).

The FS at least says it recognizes the importance of the GWNF as a refugium for Wood Turtles (cite). That, plus the above information on landscape context, are cogent argument that the 300m core habitat protected zone is a significant compromise.

Plan Revision WT Habitat Protection

From 2009 submission to USFS:

"For the above reasons, the boundaries for designating special biological areas and/or protected buffer/riparian/stream-associated habitat zones should generally (depending on topography, habitat type, and land use) encompass those areas within 350 meters of both sides of the occupied waterway (*i.e.*, encompassing core habitat). In this way, much of the habitat mosaic critical to all of the Turtle's life history needs is included and its ecological integrity sustained and buffered (see, *e.g.*, Roe, J.H. and A. Georges 2007, Semlitsch, R. D., and J. R. Bodie 2003, and Burke, V.J. and J.W. Gibbons 1995).

Implementation of the above proscriptions is also important for attempting to address metapopulation dynamics as well as movements in response to climate change.

Current knowledge and evidence on Wood Turtles and their habitat indicate that Turtles on the GWNF would benefit most from management that allows for the development of wild old-growth forest conditions (with their full complement of woody debris, canopy gaps, niche complexity, and habitat mosaic) with as little human interference/disturbance/disruption as possible. Reason and information indicate that generally **the best way for the Forest Service and just about everyone else to deal with Wood Turtles is to leave them alone and disrupt their habitat as little as possible.**

Sites that should be designated as SBAs or RNAs include [names of nine sites removed for security reasons]. These are all "special areas" on the Forest that need special attention from the Forest Service.

Though relatively minor site-specific improvements may be appropriate (*e.g.*, fabrication of small sandy/soily nesting sites), heavy-handed management such as logging and burning is not necessary, and is, in fact, harmful. **A prescription of strict protection and allowing natural processes to operate, such as occurs in National Forest Special Biological Areas, Research Natural Areas, and Wilderness Areas, will favor the Turtles**."

WTs actually only occupy a small area of the National Forest. Nonetheless, GWNF managers refused to designate SBA areas focused on WTs in the 2014 Forest Plan – "MA prescription 4D-Special Biological Areas are areas that serve as core areas for conservation of the most significant and rarer elements of biological diversity identified on the Forest. These areas or communities are assemblages of diverse habitat for threatened and endangered species, sensitive and locally rare species that occupy a small portion of the landscape, but contribute significantly to biological diversity (Forest Plan, p. 4-53)." – EA-157 Designate these places as SBAs now as part of the decision, and amend the Forest Plan so that we can stop this major conflict. As SBAs it could still be appropriate to put LWD in streams, initiate seasonal road closures, and fabricate some small nesting sites.

The FS has elsewhere raised concern about what was termed "**single species management**"; apparently, such asserted management is somehow construed to be at odds with the "multiple-use" mission. However, such management occurs all the time on the Forest. Single species, including common ones such as Grouse or MIS such as Turkeys, and now Short-leaf Pine, have driven and continue to drive numerous projects on the Forest. And other current SBAs focus on the protection of single species (such as Tiger or Cow Knob Salamanders).

Even more problematic is the implication that protecting Wood Turtles somehow does not involve numerous other taxa of fauna, flora, and fungi. This is misleading and inaccurate in the extreme. **Management that truly emphasizes Wood Turtles is beneficial for myriads of other species,** so realistically it is definitely not single species management (just as other SBAs or management areas protect and benefit numerous other non-focal species)."