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College of

Arts and Sciences

Biodiversity, Earth & Environmental Science

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Carleton Montgomery
Executive Director
Pinelands Preservation Alliance
17 Pemberton Road
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Dear Mr. Montgomery,

We provide the following comments on the pending CAFRA permit application and wetlands LOI for development of a Walmart Superstore in Toms River and Manchester Townships in order to provide critical information relevant to the Department of Environmental Protection's consideration or approval of the anticipated degradation and destruction of known northern pinesnake habitat associated with the development. The northern pinesnake (*Pituophis m. melanoleucus*) is a state threatened species. Any further loss of pinesnake habitat will exacerbate a population already in decline. We have again reviewed the Department's Habitat Evaluation Model (HEM) and wish to raise concerns that we believe invalidate its use in this case in light of the growing scientific understanding of northern pinesnake behavior, habitat needs, and conservation in New Jersey.

Since last reviewing this matter in 2012, we have collected new data on the spatial ecology, movement behavior, and landscape ecology of the northern pinesnake that provides additional support to our original opposition to the HEM and proposed Wal-Mart construction. It is our professional opinion that the HEM does not adequately address key aspects of pinesnake biology and fails to meet needed pinesnake habitat requirements that follow from this work.

In summary, we wish to highlight the following points:

1. Since the HEM was first proposed, there is available additional and highly relevant scientific data indicating that the assumptions on which the HEM is based are not well-founded and are incorrect.
2. There is no evidence that the HEM will be effective for mitigating pinesnake habitat. Experience shows it is difficult to re-create or modify habitat to facilitate value for a species, and impact on pinesnakes of any given habitat manipulation project is entirely speculative. A recent, very intensive attempt to mitigate pinesnake habitat at Stafford Forge Wildlife Management Area proved difficult and apparently was unsuccessful from a conservation perspective.
3. Because the northern pinesnake is a state threatened species, any habitat that supports a population should be considered critical habitat. There is a direct relationship between the loss of known, critical habitat and the decline of pinesnakes. It is probable

that with the continued loss of critical habitat there will be the need for the NJDEP to change the protective status of the pinesnake from threatened to endangered.

The following provides detail on the points above:

1. The Walmart site should not be considered marginal habitat if it supports pinesnakes. By NJDEP definition, the site is critical habitat given the documented presence of pinesnakes. Research on pinesnake habitat has demonstrated that if pinesnakes are present, the habitat is critical to species survival (Smith 2013; Smith et al. 2015). Because pinesnakes have the potential to move in all possible directions upon emerging from hibernation, a hibernaculum should ideally have a buffer in all direction, and of an area of 2388 ha. Anything less than this areal size would limit the number of snakes fully protected, thus impacting survivability and fitness of the population (Ward, 2015; Smith et al., in review). Every effort should be made to protect and conserve hibernacula and all current and historical pinesnake habitat, including marginal habitat that may not support large pine snake populations but is essential for buffering and protecting critical habitat. This is especially important because there has been a steady loss of pinesnake habitat in New Jersey since 1979 as a result of development (NJDFW 2009; Ward 2015).
2. Contiguous habitat is critical considering pinesnake dispersal behavior.
 - a. Pinesnakes are capable of moving in any direction (Smith et al., in review; Ward 2015.) Landscape surrounding known pinesnake habitat serves an important habitat resource because some snakes shift the boundaries of their home ranges between current known locations and adjacent undeveloped forest. Disturbance associated with urban development (i.e., paved roads, developments, etc.) has severe and long-term impacts to snakes (Hansen et al. 2005; Andrews et al. 2008). It is necessary to protect large tracts of undeveloped land around disturbed areas in order to ameliorate any negative effects that impact pinesnake spatial and habitat requirements (Smith, 2013; Smith et al., 2015)
 - b. The proposed development will severely reduce landscape connectivity between landscape habitats that are used by the extant snake population (Ward; 2015).
3. Available pinesnake habitat is adversely spatially separated by roads in New Jersey (NJDFW 2009; Ward 2015). The proposed mitigation parcels are separated by a highway barrier that will impede gene flow and migration between parcels. Thus, it is very unlikely that extant pinesnake populations within these isolated patches will interact as a metapopulation as stated in the HEM.
 - a. Our research has demonstrated that it takes an adult pinesnake 2.09 minutes to cross a two lane paved (asphalt) roadway (11 meters straight across including paved shoulders). Roadways with vehicular traffic greater than 10 cars per two minutes would result in a 95% probability of snakes being struck and killed. Because a busy (i.e. high traffic density) highway exists between the planned mitigation parcels, it is likely that any snakes attempting to travel between parcels will be killed. Thus, it is improbable that snakes within the

separated parcels will interact as a metapopulation dynamic as stated in the HEM.

- b. The only way to determine if snakes are interacting between parcels, is to either radiotrack snakes or conduct a genetic study to determine if a metapopulation dynamic is taking place. Thus, without scientific data it should not be assumed that the snake populations within these separated patches are a metapopulation.
- c. We disagree with the NJDEP's statement that the HEM facilitates "no net loss of habitat." This statement is not supported with scientific data. We concur that if pinesnakes cannot migrate between the fragmented parcels, it will have a long term impact on the pinesnake population as a result of "net habitat loss."

4. Metapopulation (HEM Point #2)

- a. HEM Figure 1 Table 1 regarding 607ha habitat patch size has now been shown to be arbitrary and inaccurate:
 - i. It is inaccurate to state that a metapopulation exists without scientific data that demonstrates there is a genetic exchange among snakes within the spatially separated parcels. If snakes cannot successfully navigate crossing roads (NJ DFW 2009; Ward 2015), then snakes within each habitat patch (parcel) must be a non-interacting sub-population where each population would require independent conservation management.
 - ii. Our data supports that a minimum patch size of 200ha is required to marginally support a limited pinesnake population and that larger patches are required to sustain a long-term viable population.
 - iii. Our data supports that patches smaller than 200ha still have ecological value as these patches buffer core pinesnake habitat and are commonly used for dispersal and migration between patches.
- b. The use of the term metapopulation should not be used if it only assumes a metapopulation dynamic without analyzing genetic structure, observed physical migration, or mating between populations (Manel, 2003; Storfor et al. 2007; Frankham et al. 2010)

5. Population structure and dynamics

- a. The plan to build a walled corridor to direct snakes from "harms way" would severely impact adult pinesnake programmed dispersal behavior. This idea is clearly flawed and demonstrates a lack of understanding of snake biology. Once an adult pinesnake has successfully dispersed from its hibernacula, it has a tendency to disperse in the same direction year after year and reuse a large portion of its learned home range. Redirecting all pinesnakes in the same direction and funneling them to the same location will adversely increase snake density. Increased density puts a strong pressure on carrying capacity, intra- and inter-specific competition (prey, space, site selection), and survivorship. Increased density increases pressure for both native and translocated snakes competing for resource requirements (i.e. forage, shelter, den, bask, and reproduce).

- b. There is strong evidence that translocated snakes have a higher mortality than resident snakes. Since translocated snakes are unfamiliar with their new area they expend excessive energy navigating the new landscape (Reinert and Ruppert 1999). Thus, we suspect that redirected snakes will have a higher mortality since they will behave as if they were translocated (Ward & Bien, unpublished data).
 - c. The proposal needs to more clearly address the potential impact to the connectivity corridors between conservation zones. There is strong evidence in the literature that it is important to maintain gene flow among metapopulations in order to sustain population fitness (Clark et al. 2010; Marshall Jr. et al. 2009; Noël et al. 2007; Telles et al. 2007).
6. Ecological cascade of degradation
- a. The uncertainty of the disposition of the landscape surrounding the proposed construction site lends to the question of the long-term viability of the extant pinesnake population. Protecting surrounding marginal habitat helps protect core habitat from the negative effects of urban disturbance. Once marginal habitat is developed, adjoining habitat soon becomes degraded thus creating a “domino effect” and eventual loss of more pinesnake habitat in the long term (Smith et. al., in review; Ward, 2015).
 - b. We strongly suggest that the Walmart and Hovnanian sites be incorporated into a long-term conservation area to protect the extant pinesnake population.
7. The Stafford Forge pinesnake mitigation effort proved a failure, showing that even intensive, long-term management programs aimed at manipulating habitat in order to offset harm to known pinesnake habitat is likely to fail and is, at best, entirely speculative in its impacts.
- There is an inherent difficulty translocating mobile snakes. Snakes are capable of making maps, laying down scent trails (Smith K.P.W., 2014) and remembering landscape features. Snakes that are translocated to a new location outside their known home range will expend excessive energy to relocate or to familiarize to new surroundings. There is a great deal of scientific evidence to support that translocated snakes have increased mortality and do not do as well when removed from familiar surroundings.
 - Adding snakes to the existing pinesnake population (or removing habitat) temporarily increases local population density (i.e. more snakes per unit area). Increased density puts added environmental pressure on the existing population as well as the new recruits to compete for resources. Studies have demonstrated that increased density can have an adverse impact on carrying capacity that leads to population decline.

Even after the passage of several years since it was completed, the HEM remains without any scientific support. On the contrary, recent data and experience undermines the assumptions of the HEM and suggests it would be irrational for the Department to use the HEM to justify adverse impacts to known habitats. Because the HEM lacks any scientific basis for assuming it will have any given level of net positive effect, it cannot rationally be used to justify the impacts on pinesnakes and their habitats that the development will cause.

Based on this information, we respectfully request that the proposed CAFRA permit application for development be denied due to the impacts of the proposed development on pinesnakes and their habitats, and the unreliability of the HEM on which the application relies.

Respectfully submitted,

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