Shenandoah National Park
Amend Chronic Wasting Disease Detection and Assessment Plan to Include Response Actions Environmental Assessment

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CONTENTS

SHENANDOAH NATIONAL PARK

CHRONIC WASTING DISEASE DETECTION AND ASSESSMENT PLAN AMENDMENT

INTRODUCTION

The National Park Service (NPS) proposes to amend the 2013 approved *Chronic Wasting Disease Detection / Assessment Plan, Shenandoah National Park, Virginia* to include actions necessary to respond to the presence of chronic wasting disease (CWD) within five miles of or within Shenandoah National Park boundaries. Initial public scoping meetings in 2013 focused on CWD response alternatives under a potential environmental impact statement (EIS) framework. Given how rapidly the disease has moved toward the park since then, the National Park Service reconsidered that approach and decided to simply amend the existing plan to include response actions. This environmental assessment (EA) describes the proposed response actions that will be incorporated into the current CWD plan and discusses the potential environmental impacts of those actions.

BACKGROUND AND CURRENT STATUS

In 2009 and 2010, chronic wasting disease, an infectious, self-propagating, neurological disease of white-tailed deer, mule deer, Rocky Mountain elk, and moose, was diagnosed in the region surrounding the park, the nearest positive case at the time being within 23 miles of the park boundary. Because chronic wasting disease represents a potential threat to the park's white-tailed deer and the proximity to known positive CWD cases represents a risk factor for disease introduction, the National Park Service prepared and adopted a chronic wasting disease detection and assessment plan.

The CWD detection and assessment plan established a framework for the detection and assessment of chronic wasting disease in the park's white-tailed deer that

- allows the National Park Service to detect the presence of chronic wasting disease; i.e., determine with a high level of confidence whether chronic wasting disease is present in the park's white-tailed deer population
- allows the National Park Service to assess chronic wasting disease in the park's deer population; i.e., understand the prevalence and distribution of chronic wasting disease if it is detected in the park
- allows the National Park Service to cooperate/coordinate to a greater degree with the state in its surveillance efforts
- supports future decision-making relative to long-term management of chronic wasting disease in the park's white-tailed deer population

The CWD detection and assessment plan was evaluated in an environmental assessment that was released for public review in July 2012, and which is incorporated herein by reference. The final plan was approved in October 2013.

CWD detection and assessment actions began in late 2013, immediately after final approval of the plan. In addition to beginning detection and assessment actions, the National Park Service also initiated an environmental impact statement process to evaluate actions for managing the disease, anticipating that the disease would continue to spread in the region and would eventually enter the park.

To date, no positive cases of chronic wasting disease have been detected inside park boundaries. However, chronic wasting disease appears to have spread in the surrounding area more quickly than anticipated. By the time that detection and assessment was implemented inside the park, a total of 133 deer tested positive for chronic wasting disease in Hampshire and Hardy Counties, West Virginia, 5 deer tested positive in Frederick County, Virginia, and the closest case of chronic wasting disease was within 20 miles of the park. There have been additional positive cases in 2014, the closest of which was approximately 12 miles from the park.

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to reduce the likelihood of CWD establishment and spread within Shenandoah National Park.

As noted during development of the park's CWD detection and assessment plan, the risk of CWD introduction, spread, and establishment in the park's deer population is high primarily because the density of white-tailed deer populations is high in specific areas of the park, and deer enter and leave the park without restriction. Although chronic wasting disease has not been detected in the park as yet, the spread of the disease to within relatively close proximity of the park boundary indicates that occurrence of the disease inside the park is probably imminent.

There is no treatment for chronic wasting disease and there are limited management actions to slow the progression of disease spread across the landscape. In general, once chronic wasting disease becomes established within a population disease prevalence slowly increases. Preventing the establishment of the disease or limiting its spread by minimizing disease transmission is the only known disease management action that has been used with some success. Current thinking is that maintaining deer densities in those high-density areas that are similar to deer densities observed in the backcountry areas is the best way to minimize the risk of disease transmission and disease amplification in the park. The current CWD detection and assessment plan allows lethal removals for sampling purposes but does not include actions needed to respond to a positive diagnosis of chronic wasting disease near or inside the park; specifically, lethal removal of healthy-appearing deer to reduce density in areas where deer persist in very high numbers, increasing the risk of establishment and spread of the disease in the park population.

The initial CWD management plan / EIS process focused on reducing deer density in specific areas as the most effective tool for managing chronic wasting disease in the park. However, the scoping and analysis completed to date have shown that the impacts of reducing deer density in specific areas for CWD management would not be substantially different than the impacts that were previously analyzed in the 2013 CWD detection and assessment environmental assessment. The CWD detection and assessment plan allows for the lethal removal of up to 300 deer for the purposes of detection and assessment, and specifies the same high deer density areas as proposed for managing chronic wasting disease. Therefore, the National Park Service determined that the impacts of density reduction actions—i.e., CWD response actions—do not warrant analysis in an environmental impact statement. Further, the National Park Service determined that a separate CWD management plan was not needed; rather, it would be more efficient to expand the range of tools in the existing CWD detection and assessment plan to include response actions for the purpose of managing chronic wasting disease inside the park. It was also determined that an environmental assessment was the appropriate level of environmental review necessary to evaluate any differences in environmental impacts as a result of amending the approved CWD detection and assessment plan to include CWD response actions.

This environmental assessment has been prepared in accordance with the requirements of the National Environmental Policy Act of 1969, as amended (NEPA) and its implementing regulations (40 CFR 1500-1508); the Department of the Interior NEPA regulations (43 CFR Part 46); and NPS Director's Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-Making* (DO-12 2011) and the accompanying *DO-12 Handbook* (2001).

PROPOSED CWD DETECTION, ASSESSMENT, AND RESPONSE PLAN

What Is Included in This Plan

The proposed CWD detection, assessment, and response plan would include all of the following actions necessary to monitor and manage chronic wasting disease in Shenandoah National Park:

- Detection – actions taken for the purpose of determining whether the disease is present or absent within a biologically defined population.
- Assessment – actions taken for the purpose of determining the prevalence and distribution (i.e., proportion infected and extent) of the disease once it has been detected within a biologically defined population.
- Response – actions taken for the purpose of reducing the risk of establishment and spread of the disease within a biologically defined population.
- Communication and Coordination – actions taken for the purpose of coordinating and sharing data with the state, and for educating and informing park staff, volunteers and the public about chronic wasting disease and CWD management efforts.

It should be noted that the focus of this environmental assessment is the proposed addition of CWD response actions and any changes in environmental impacts that may result. The detection, assessment, and communication/coordination actions described below are those that are currently being conducted in accordance with the 2013 CWD detection and assessment plan and have been included simply for the convenience of the reader in understanding how the proposed addition of response actions would fit into an overall CWD detection, assessment, and response plan.

Scope of the Actions

Biological Population. Deer at Shenandoah National Park largely interact with the part of a larger regional deer population that includes deer often found near but outside of the park. Because biological population boundaries are vague and often influenced by environmental factors (e.g., winter weather conditions, forage availability) and human factors (e.g., hunting pressure) that are difficult to predict or control, we have chosen to define the biological population as deer found within the park or neighboring county lands.

Limits on NPS Actions. It should be noted that while this plan includes actions that will lethally remove deer from the park, these removals are specifically for the purposes of testing deer for chronic wasting disease and reducing the risk of CWD transmission in certain areas of the park with high deer density. Lethal removal is limited to federal lands within the legislated boundaries excluding wilderness areas. Designated wilderness areas were removed from consideration for CWD sampling due to limited access and because park observations indicate that density reductions are probably not necessary in wilderness areas, as deer densities seen in wilderness generally appear similar to deer densities observed outside the park.

Lethal Removal Actions. Lethal removal activities would be conducted by qualified federal employees or authorized agents. Training will include actions related to firearms safety, protecting human and property safety, sample collection, carcass disposal, and decontamination. Lethal removal may be conducted at any time of the year as approved by the superintendent to allow flexibility to take these actions whenever thresholds are met. Minimizing disruption and impacts on visitors will be a high priority in these decisions. Lethal removal with firearms may be conducted from stands, blinds, and vehicles. Lethal removal actions conducted at night may also be conducted using spotlights or night vision equipment. The National Park Service will coordinate the timing of lethal removal with the state to maximize efforts by both agencies. Comprehensive safety measures will be taken before any removal action to maximize employee and visitor safety.

During lethal removals, if necessary, park staff would clear or close an area to all visitors to protect visitor health, safety, and experience. The park would use public postings, web notices, and press releases to notify the public of the closure.

Descriptions of Actions Included in This Plan

Detection Actions.

- Opportunistic surveillance — Opportunistic surveillance includes taking diagnostic samples for CWD testing from deer found dead—that is, deer that have died in the park due to disease, predators, vehicle collisions, other trauma-related mortality, or those killed in the park for other purposes (e.g., injured deer euthanasia). If an employee finds a dead deer in the park or along Skyline Drive, it is reported to the Park Biologist or Chief of Natural and Cultural Resources and a determination would be made as to whether or not samples should be taken and sent for CWD testing as part of opportunistic surveillance. Presently, approximately 90% of the deer found dead in the park are tested. Due to staffing limitations, not all samples are located or collected.

- Enhanced opportunistic surveillance — Enhanced opportunistic surveillance increases the number of diagnostic samples by testing all deer found dead (that includes all deer from the South District). In addition, park staff would coordinate with the state and/or county that samples be taken from carcasses found on state/county roads either by state or park employees. Park neighbors will also be encouraged to report the location of any deer found dead in neighboring counties or the park.

- Targeted surveillance — Targeted surveillance involves lethal removal of deer that exhibit clinical signs consistent with chronic wasting disease for testing. In all instances, park staff will contact the Park Biologist or Chief of Natural and Cultural Resources to report clinically suspect deer. A Biologist or Chief of Natural and Cultural Resources decides if the animal has clinical signs consistent with chronic wasting disease and is appropriate for lethal removal. Law enforcement rangers are authorized to kill a suspect deer.

- Enhanced targeted surveillance — Enhanced targeted surveillance involves dedicating employee time (National Park Service or contractor) to look for animals displaying clinical signs of chronic wasting disease as frequently as possible. The individual would be qualified to kill deer and take appropriate CWD samples. In addition, the park will encourage local visitors, volunteers, and other NPS staff or researchers working in the park to look for deer with clinical signs of the disease.

- Live testing and removal of positives — A live CWD test available for deer will be used as part of detection actions if the opportunity arises through other research opportunities. The live test requires anesthetizing the animal, conducting a tonsillar biopsy or a rectal mucosal biopsy, and marking the animal so it can be tracked and removed if the test is positive for chronic wasting disease. Live-testing would only be used for detection efforts when animals are being captured in the park by either NPS staff or researchers as part of other projects.

  Live testing for CWD detection would be conducted on both male and female deer. Live tests would typically be taken in the fall/winter to avoid causing an animal heat stress or handling late-stage pregnant females. Samples would only be taken once every one to two years to avoid undue stress on a given animal and to avoid retesting deer that were CWD-negative before the disease may have had the chance to emerge. Positive, marked animals would be relocated and lethally removed from the population.

- Enhanced live testing and removal of positives — Live testing would be conducted as described above and positive animals would be lethally removed. However, under enhanced live testing, sampling may be done at other times of the year and live testing could be enhanced by testing any deer in hand and pursuing additional opportunities (e.g., research projects, Biological Resources Management Division assistance) for live testing.

- Lethal removal of healthy appearing animals — Lethal removal of healthy appearing animals involves killing deer that appear healthy and testing them for chronic wasting disease because chronic wasting disease can remain clinically undetectable for many months after infection. This differs from targeted surveillance which lethally removes and tests only deer that show clinical signs of chronic wasting disease. Lethal removal will contribute to disease detection sampling in order for managers to be 95% confident of identifying the disease if it is present in at least a 1% of the deer population (95/1) within three years (appendix B).

  During detection efforts, lethal removal will concentrate on testing deer from high density areas (e.g., Big Meadows and other locations along Skyline Drive). To achieve the numbers required to ultimately meet the 95/1 goal during the sampling period, the National Park Service will conduct generally distributed testing of both male and female deer with emphasis given to those samples that will give the largest amount of information on a weighted sampling scale (e.g., adult males greater than one year of age).

Assessment Actions.

- Enhanced opportunistic surveillance — Enhanced opportunistic surveillance for assessment would occur in the same manner as previously described under detection. The goal of enhanced opportunistic surveillance as an assessment action is to provide samples to assess the distribution of the disease.

- Enhanced targeted surveillance — Enhanced targeted surveillance for assessment would occur in the same manner as previously described under detection. The goal of enhanced targeted surveillance as an assessment action is to provide samples to assess the distribution of the disease.

- Enhanced live testing and removal of positives — Enhanced live testing for assessment would occur in the same manner described under detection. The goal of enhanced live testing as an assessment action is to provide samples to assess the prevalence and distribution of the disease.

- Lethal removal of healthy appearing animals — Lethal removal of healthy appearing animals for assessment would occur in the same manner described under detection. The goal of lethal removal as an assessment action is to provide samples to assess the prevalence and distribution of the disease. Park staff would coordinate with the state regarding the number of samples required to assess the distribution and prevalence of chronic wasting disease within a given area. The park would maximize the number of samples taken from enhanced opportunistic surveillance, targeted surveillance, and live testing before taking samples by lethal removal. Test results from deer sampled by the state within five miles of an index case would be pooled with park samples to assess disease prevalence. Park sample contribution would be appropriate to land mass or proportion of the park within five miles of the detected CWD positive animal, and deer density estimates in that area of the park. The maximum number of deer removed to estimate disease prevalence ± 2% with a 95% confidence interval is 69 animals for the first positive CWD detection (see appendix B).

Response Actions. The response actions described below are not currently being conducted by the park and would be added to the approved CWD detection and assessment plan in order to expand the range of CWD management tools available under an amended CWD detection, assessment, and response plan.

The purpose of adding CWD response actions is to reduce the risk of amplification and spread of the disease as early as possible by minimizing conditions conducive to CWD transmission through a reduction in deer densities. For example, a single infected buck can travel more than 30 miles and bring the disease into the park. Under the current conditions, a single infected animal has the potential to contact and infect a substantial number of deer because of the high density of deer in some areas. The high density of deer in these areas would also allow the disease to spread more quickly. The deer densities in the identified high density areas would be reduced to approximate the densities in nearby undeveloped, largely forested (backcountry) areas of the park. Thus, this strategy would reduce the risk of CWD transmission in these park areas to roughly equal to the risk outside the park by reducing the amplification risk in the park due to high deer densities.

- Continued assessment testing — Testing for CWD prevalence using the assessment actions described above would continue within five miles of the first positive (index) case over a two-year period.

- Targeted density reductions — Deer would be lethally removed to reduce the number of animals in specific areas in the park with relatively high deer density (table 1). Sharpshooters (authorized agents) would be used to accomplish density reductions quickly and effectively. All deer lethally removed would be tested for chronic wasting disease.

Table 1. Locations With a High Density of Deer That Could Be Subject to Reduction Activities

Area of Park	Area (mi^2)	Estimated				
		Deer Abundance	Deer Density (per mi^2)	Deer Density in Adjacent Backcountry Area (per mi^2)	Percentage of Deer to Be Lethally Removed to Match Density of Surrounding Area	Number of Deer to Be Lethally Removed to Match Density of Surrounding Area[a]
Big Meadows Area[b]	1.0	175	150–180	25–45	(77–81%)	130–150
Skyland/Limberlost[c]	1.0	35	30–50	20–30	(17–50%)	10–20
Matthews Arm / Piney River / Elkwallow	0.75	20	27–35	20–30	(8–29%)	5–10
Dickey Ridge	0.33	18	40–60	20–30	(38–85%)	10–15
Loft Mountain[c]	0.5	16	25–35	10–25	(30–50%)	5–10
TOTAL		280				150-200

SOURCE: Gubler 2013a

a. equal to the percentage of deer to be lethally removed times the estimated deer count

b. based on nighttime fall spotlight counts from 2008 through 2012

c. estimate is uncertain due to recent decreasing densities, variable seasonal use, and small sample size

Note: Deer will continue to be removed on an annual basis to maintain these lower population targets for at least five years.

Density reduction efforts would be focused on areas that are closest to the positive case or cluster of cases. In these areas, a percentage of the deer would be lethally removed, based on current deer density and the particular area involved (table 1) The rate at which removals could be accomplished would depend on factors such as deer densities, the ease of finding and lethally removing deer, and the availability of funding. The park would plan to complete the reductions over a two-year period; however, given the uncertainties, it is possible that reductions could take up to five years to achieve.

Precise deer densities in backcountry areas of the park are not known, but they are estimated to range from 10 to 35 deer per square mile, based on best professional judgment of park staff and cooperating scientists. It is likely that the largest number of deer would be removed in the initial year of reduction and that fewer deer would be removed in subsequent years. Table 1 shows the estimated range in the number of deer that would be removed from each area; however, it should be noted that these numbers are estimates. The actual number of deer removed would vary, as shown by the estimated ranges in table 1.

To develop a refined estimate of the deer density in a particular area, the National Park Service would examine the data available for decision-making. Collaborators and park staff are developing a new refined, calibrated estimate of current population sizes for a few key areas (and may need to create new population monitoring in others). Using these estimates and the estimate of deer densities in adjacent backcountry areas of the park, the National Park Service would determine how many deer would need to be lethally removed. As described above, a set number of deer would not be lethally removed in each area. Instead, the removal goal for each area would be a range of animals to account for the variability and error in the estimates. This range could vary depending on new data received by National Park Service from the monitoring conducted as part of this plan or from the Virginia Department of Game and Inland Fisheries (VDGIF). Table 1 provides estimated removal ranges in each high-density area currently identified.

The percent of deer lethally removed could also vary depending on the effects of VDGIF-managed harvest actions outside the park or if new data about deer densities in the local area became available. However, adjustments to the planned removals would be made as part of the adaptive management approach to taking action. The "Incorporation of Adaptive Management" section below explains in more detail how monitoring results can influence the number of deer lethally removed.

Once desired densities are achieved, the National Park Service would continue to lethally remove deer to maintain smaller, balanced population levels in these areas for at least five years. Annual removals during that time could be higher or lower depending on how deer respond to reduction and maintenance activities. For example, deer may leave the area to avoid authorized agents (which would lower the number that need to be removed each year) or the number of fawns per doe may increase (which would increase the number that needs to be removed annually). However, in general, the number of deer removed annually is expected to be within the 150 to 200 range, as shown in table 1, or lower.

At the end of the initial five-year period, the National Park Service would evaluate current conditions to determine if it would be appropriate to continue to maintain the reduced deer densities, even if no additional positive cases are found. If additional positive cases were found in the park or within five miles of the park during the initial five-year period, the National Park Service would continue to lethally remove deer to maintain lower deer densities and would expand lethal removals to the next closest high density areas as appropriate.

Coordination and Communication.

- Data sharing — The National Park Service coordinates with the Virginia Department of Game and Inland Fisheries to determine the number of samples required both inside and outside the park to assess CWD distribution and prevalence within a given area of the park, and share data from targeted surveillance and lethal removal.

- Training, education, outreach actions — The National Park Service provides training for park staff and volunteers conducting observations for targeted surveillance in identifying the clinical signs of chronic wasting disease in deer. Information is also made available to staff to improve interpretation for the public. Updates regarding disease management and spread are also shared.

  The park conducts public outreach and education regarding chronic wasting disease using a variety of posters, publications (including state brochures on chronic wasting disease), and personal interpretation and by guiding individuals to resources such as the Virginia Department of Game and Inland Fisheries and Chronic Wasting Disease Alliance websites. Information may also be made available on the park website.

  The National Park Service coordinates with VDGIF education/outreach programs related to chronic wasting disease (e.g., participates in meetings held by the state on the subject).

Incorporation of Adaptive Management

Adaptive management is based on the assumption that scientific knowledge and current resources are limited and that a certain level of uncertainty exists. The Department of the Interior requires that its agencies "use adaptive management, as appropriate, particularly in circumstances where long-term impacts may be uncertain and future monitoring will be needed to make adjustments in subsequent implementation decisions" (46 CFR 46.125). Thus, adaptive management attempts to apply available resources and knowledge and adjust management techniques as new information is revealed which, in turn, allows resource managers more flexibility and a better chance of achieving the desired condition stated in the plan.

Thresholds for Taking Action. The approved CWD detection and assessment plan incorporates an adaptive management approach in which the specific actions for detection and assessment are implemented according to a series of "action thresholds." The action thresholds define points at which the park decides which actions are appropriate based on the current status of CWD occurrence and the relative risk of infection and spread.

The amended CWD detection, assessment, and response plan would continue this approach. With the addition of response actions, the amended plan would use five distinct action thresholds based on the distance of the nearest positive CWD detection to the park, keyed to the level of CWD-associated risk to white-tailed deer populations within the park.

- **60+ miles from the park**: The first threshold is defined when the nearest positive CWD detection occurs more than 60 miles from the nearest park boundary. No CWD actions inside the park are indicated at this distance.
- **30 to 60 miles from the park**: NPS guidance recommends certain CWD-related actions for NPS units located within 60 miles of a positive CWD case, and therefore, the second action threshold is met when the nearest positive CWD detection is between 30 and 60 miles from the park.
- **5 to 30 miles from the park**: The third action threshold is defined to be consistent with the mean maximum distance traveled by deer in the region, and is met when the nearest positive CWD detection is between 5 and 30 miles from the park.
- **5 miles or less from the park**: The fourth action threshold is defined to be consistent with the 5-mile radius distance around a known infected animal applied by Virginia and neighboring states. The threshold for taking action related to CWD assessment is the nearest positive CWD detection less than 5 miles from the park or within the park (figure 1). When a positive CWD detection occurs within 5 miles of the park, it is assumed that chronic wasting disease is within the park.
- **5 miles or less from the park with additional positive cases:** An additional action threshold is defined when there is positive CWD case within 5 miles of the park, or in the park, and either (1) the closest cluster of CWD positive cases is within 30 miles of the park, or (2) there is a second positive case within 5 miles of the park. Either of the latter two conditions indicates that chronic wasting disease is likely to occur in or near the park and response actions may be warranted. Figure 1 illustrates this scenario. For the purposes of this alternative, a "cluster" of cases is defined as three or more positive cases within 5 miles of each other, and a cluster is considered current or valid if it has occurred within five years.

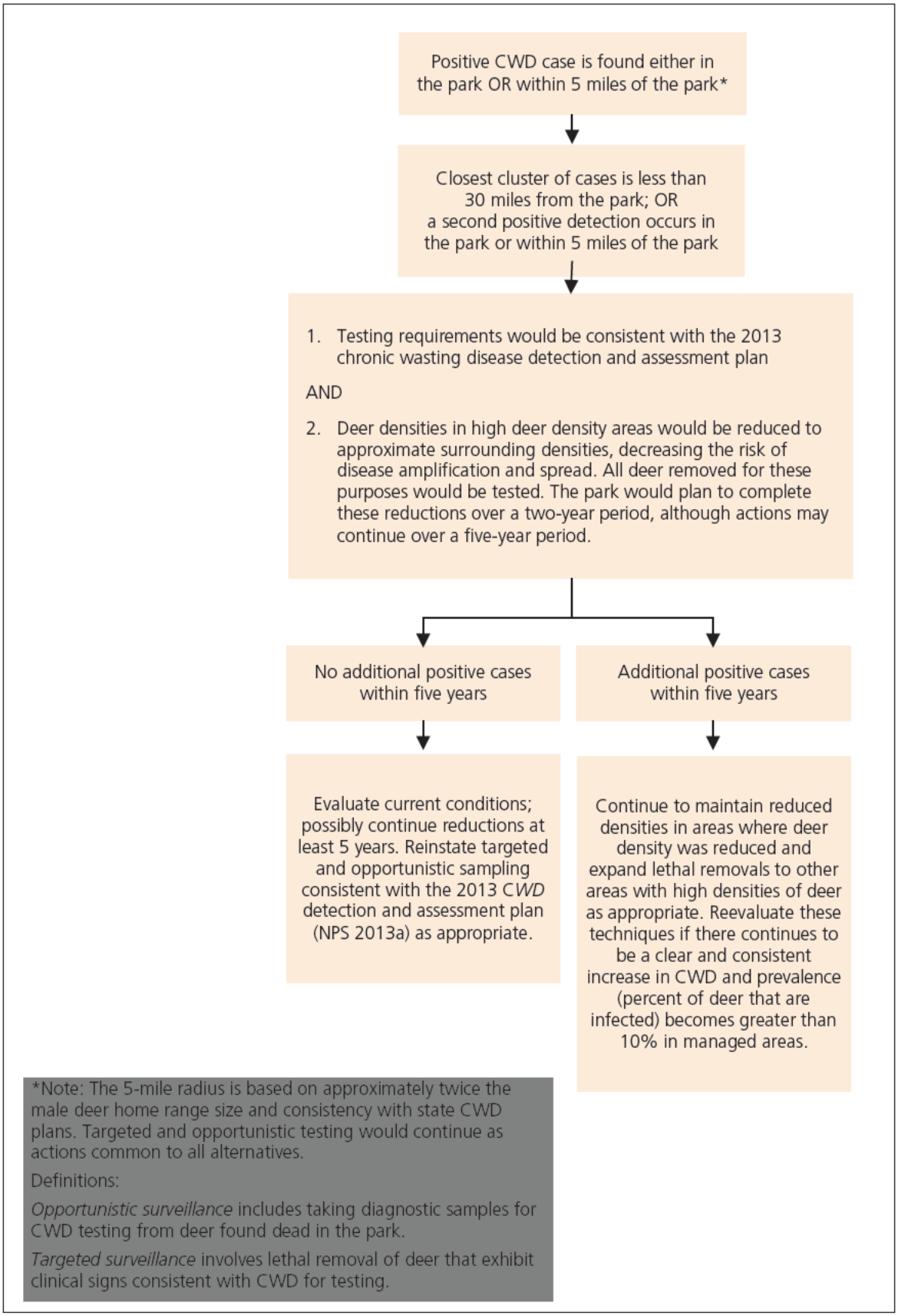

FIGURE 1. ACTION THRESHOLD FOR IMPLEMENTING RESPONSE ACTIONS

Table 2 illustrates how action thresholds would be used to determine the appropriate CWD management actions to be implemented, whether detection, assessment, or response actions, or some combination of these.

As noted in the description of response actions above, adaptive management would also be used to adjust the numbers of deer lethally removed if new data are obtained about the deer density in the park and in surrounding areas.

- The premise being applied is that CWD transmission is correlated with white-tailed deer density, which is supported by studies on prevalence.
- The proposed CWD response actions would reduce the deer densities in selected high-density areas to approximate those in adjoining backcountry areas of the park.
- Monitoring would be conducted to determine whether this reduction has had an effect on CWD prevalence and spread—proxies for disease transmission.
- Deer would be monitored over a five-year period, and the threshold for taking subsequent actions would be the presence of chronic wasting disease.
- If additional cases were found, density reductions would continue in order to maintain lower populations around the areas being monitored.
- If no new cases of chronic wasting disease were found after a five-year monitoring period, additional reviews would be done to assess the disease situation at that time and determine appropriate actions, which could range from ceasing lethal removals for density maintenance purposes to continuing such actions. For example, if areas outside the park with higher deer densities are clearly facilitating further establishment of chronic wasting disease, it would be logical to continue to maintain lower densities inside the park.

The proposed approach of reducing deer densities in high-density areas to approximate those in surrounding backcountry areas is based on best professional judgment of scientists and managers. If future monitoring is funded and it provides useful deer density data, or if the Virginia Department of Game and Inland Fisheries provides more accurate background data about deer density, the removal goals could be adjusted.

An adaptive management approach would also be used in the event that the number of infected deer exceeds 10% of the population in managed areas, which would indicate that the CWD management actions were having little or no effect on reducing transmission, based on current knowledge of the disease and professional judgment. In this case, the underlying management assumption would be reevaluated because of the lower likelihood that rising CWD prevalence in these areas would be influenced by density, indicating that some other course of action may be warranted, based on the information available at that time.

TABLE 2. ACTION THRESHOLDS FOR IMPLEMENTING APPROPRIATE DISEASE DETECTION, ASSESSMENT, AND RESPONSE ACTIONS

Threshold	Disease Detection Actions	Disease Assessment Actions	Disease Response Actions
Positive CWD detection greater than 60 miles from park.	No required detection actions, although park units are encouraged to conduct opportunistic and targeted surveillance of susceptible populations, regardless of their distance from a known case (NPS 2002).	No assessment actions	No response actions
Positive CWD detection 30 to 60 miles from park.	Opportunistic surveillance throughout the park Targeted surveillance throughout the park Live test if opportunity arises throughout the park	No assessment actions	No response actions
Positive CWD detection 5 to 30 miles from park.	Enhanced opportunistic surveillance throughout the park Enhanced targeted surveillance throughout the park Enhanced live test throughout the park Lethal removal of healthy appearing deer if needed to meet sample size requirements in districts and counties within 30 miles of the CWD detection. ▪ All activities will be used to obtain a statistically valid sample size (95/1) for disease detection over a period of three years (Walsh and Miller 2010), and will be repeated if positive cases of chronic wasting disease continue to be found outside of the park. ▪ Deer sampled by VDGIF from counties bordering affected park districts during the same time period will be considered part of the sample. ▪ If no other contribution, plan allows for lethal removal of maximum of 217 deer for a sampling area of 79 square miles.	No assessment actions	No response actions

Threshold	Disease Detection Actions	Disease Assessment Actions	Disease Response Actions
Positive CWD detection within 5 miles of park or in park.	Assume disease is within park and move to assessment and/or response mode. May continue detection actions in South District of park or widely separated areas.	Enhanced opportunistic surveillance (to assess distribution) Enhanced targeted surveillance (to assess distribution) Live test Lethal removal of healthy appearing animals ▪ Live test and lethal removal activities will be used to obtain a statistically valid sample to estimate the prevalence ±2% with 95% confidence interval within the population bounded by a park district(s) within 5 miles of the case within two years. ▪ Samples collected by VDGIF will be considered part of the sample if they are taken from within 5 miles of the CWD case. ▪ If no other contribution, for a 79-square mile sampling area, plan allows for lethal removal of 69 deer with first positive case and 97 deer if two positive cases found at the same time.	No response actions
Positive CWD detection within 5 miles of park or in park **and either:** (a) closest cluster of positive samples is within 30 miles or (b) second positive sample within 5 miles of, or in, park	May continue detection actions in South District of park or widely separated areas.	Assessment testing for prevalence (as described above) would continue within 5 miles of the first positive (index) case over a two-year period	Targeted density reductions ▪ Lethal removals in the identified high density areas ▪ Density reduction efforts would start with areas that are closest to the cluster of cases near the park or to the location of the second positive case ▪ Deer densities reduced to approximate the densities in nearby backcountry areas of the park ▪ Number of deer lethally removed for density reductions is estimated to range from 150–200. ▪ Number of deer lethally removed for density reduction at each area will vary and will be adjusted according to monitoring data or data from VDGIF.

Environmentally Preferable Alternative

In accordance with the *DO-12 Handbook*, the National Park Service identifies the environmentally preferable alternative in its NEPA documents for public review and comment (sect. 4.5 E[9]). The environmentally preferable alternative is the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative (43 CFR 46.30).

Based on the analysis of impacts, the proposed addition of CWD response actions to the current detection and assessment plan was determined to be environmentally preferable. The sustained lower densities that would result from the addition of response actions to the current detection and assessment actions would have a large beneficial impact on the overall deer population by reducing the risk of CWD transmission and spread. In addition, the increased opportunity for coordinating actions with Virginia Department of Game and Inland Fisheries would reduce the potential for regional amplification or spread of the disease.

Alternatives Considered But Dismissed

Other preliminary alternatives or alternative elements were considered during the planning process or brought forth by the public but were ultimately dismissed from further analysis. A brief description of these alternatives or alternative elements is provided below with the reasons for dismissal.

Use Predator Management to Reduce Deer Densities and, Therefore, Disease Transmission. Artificially supplementing existing predator populations—for example, coyotes (*Canis latrans*)—to address the purpose and need for this plan would not be feasible. Predators may show some preference for CWD infected deer (Krumm et al. 2005, Wild et al. 2011); however, this would not reduce deer densities at the high rate needed to slow the spread of the disease. Additionally, clinically ill animals have usually been infected with chronic wasting disease for 12 months or more before showing outward signs of illness while probably being capable of spreading chronic wasting disease to other animals throughout that timeframe. Artificial supplementation of existing predator populations may have undesired, broader ecological and socioeconomic implications. For example, there is already an existing population of coyotes that occupy Shenandoah and supplementation with additional coyotes could negatively affect those in the park and lead to dispersal of the existing or newly introduced animals, which could have off-park impacts such as predator-related losses of livestock or pets. The complete restoration of wolves (*Canis lupus*)—the most efficient, native predator of deer in this area—would require the support of several local, state, and federal agencies, which is beyond the scope of this plan. Thus, this alternative was dismissed from further consideration.

Decrease Deer Concentration Through Habitat Modification, or Exclude Deer with Fencing, For Example, at Big Meadows and Other Locations Along Skyline Drive Where Deer Congregate. One of the primary areas where habitat manipulation could be used is Big Meadows. Sufficiently changing habitat in Big Meadows to make it unattractive or less palatable to deer would have adverse impacts on the cultural landscape. It would be very difficult to change any habitat that would preserve the character of Big Meadows without also creating more edge habitat. Edge habitats attract deer and create areas with higher densities of deer. It would also be difficult to change habitat at or near the campgrounds or along Skyline Drive—where deer densities are also high—while preserving the character of those areas without creating additional edge habitat. Habitat modification was determined to be ineffective at managing disease transmission and was dismissed from further consideration. Similarly, fencing deer out of specific areas is not a solution by itself, is not viable with large exclosures, and would result in adverse impacts on cultural landscapes, visual characteristics, and ecology of the Big Meadows area. There would also be adverse effects on visitor access and the possibility of increased deer-vehicle conflicts if deer tried to go around the fencing and used the shoulder of Skyline Drive in an attempt to reach the meadow. Therefore, exclusion by fencing was also determined to be infeasible and dismissed from further consideration.

Use Nonlethal Methods. A totally nonlethal alternative would involve a number of the options discussed above, such as fencing and habitat modification, along with reproductive controls. All nonlethal activities require a large commitment of resources and may not be effective with a large free-ranging population. More importantly, nonlethal techniques do not reduce the deer population within a useful timeframe for disease management. The National Park Service must be able to respond quickly in order to comply with agency guidance and to act in a socially and ecologically responsible manner. Because a solely nonlethal alternative would not adequately reduce the deer population in the park fast enough to reduce the likelihood of CWD establishment or to reduce the spread of the disease, a nonlethal alternative was determined to be infeasible and was dismissed from further consideration.

Use Hunting to Reduce Deer Densities and Therefore Disease Transmission. This option was considered because other states have used it to decrease their deer populations. However, hunting did not work to control chronic wasting disease in Wisconsin because it did not sufficiently reduce the deer population on private lands. Furthermore, the NPS regulations at 36 CFR 2.2 and NPS *Management Policies 2006* state that hunting is prohibited in national parks unless specifically authorized as a discretionary activity under federal statutory law or treaty rights and may take place only after the National Park Service has determined that it is consistent with resource management principles (NPS 2006a). The enabling legislation of Shenandoah National Park specifically prohibits hunting in the park. Although the legislation could be changed, hunting is a more cumbersome and less exact method of control than removal by authorized agents. Hunting may kill too many animals not selected for removal, and the volume of hunters who would participate is unpredictable. Other potential issues with hunting are problems related to reporting deer kills and the perception of a risk to humans from handling CWD-infected carcasses, leading hunters to avoid the animals that should be collected. Therefore, this alternative was determined to be infeasible and was dismissed from further consideration.

ENVIRONMENTAL CONSEQUENCES

The environmental impacts of the proposed CWD detection, assessment, and response plan are described below. The impacts of the detection and assessment actions were previously analyzed in the *Chronic Wasting Disease Detection and Assessment Plan/Environmental Assessment* (NPS 2012a) and are incorporated herein by reference. This analysis briefly summarizes the impacts of detection and assessment actions and focuses on any new or different impacts that may result from the addition of the proposed CWD response actions.

The impact analysis incorporates the best available scientific literature applicable to CWD management and the actions being considered in the alternatives. The impact analysis addresses all of the following:

Direct impacts	Impacts that would occur as a direct result of NPS management actions.
Indirect impacts	Impacts that would occur as a result of NPS management actions but would occur later in time or farther in distance from the action.
Cumulative impacts	Defined as "the impact on the environment which results from the incremental impact of the action when added to other past, current, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Other actions at the park and the surrounding areas (as appropriate) were identified that, although unrelated to the CWD detection, assessment, and response plan, may have impacts on the same resources or values, resulting in an additive (cumulative) effect when considered in combination with the impacts of the actions in this plan. Cumulative impacts were then determined by generally assessing the impacts of those other actions and combining those impacts with the impacts of the detection, assessment, and response actions to estimate an overall cumulative impact.
Beneficial Impact	A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
Adverse Impact	A change that degrades the resource, or moves the resource away from a desired condition, or detracts from its appearance or condition.

White-tailed Deer

About the analysis. Impacts on white-tailed deer were analyzed qualitatively, using agency reports, scientific literature, and estimates of deer densities in each area of the park compared with densities of deer in areas outside the park. As with the *Chronic Wasting Disease Detection and Assessment Plan/ Environmental Assessment* (NPS 2012a), the analysis of impacts for the proposed addition of response actions focuses on how this influences risk related to amplification, spread, and establishment of chronic wasting disease, as well as exposure to possible population level effects.

Impacts of plan with addition of proposed response actions. As previously analyzed (NPS 2012a), the approved detection and assessment actions, collectively, have minor adverse impacts on deer movement, density, and health. The presence of humans actively searching for deer and the use of firearms to lethally remove deer for detection surveillance and assessment disturb deer and cause them to disperse from the area of activity. Deer are not expected to disperse further than they do naturally and movement is expected to return to pre-disturbance levels once the actions are finished; thus, the dispersal is considered to be within natural variability and has no effect on the population, as a whole.

The current approved sampling procedure (appendix B) allows for the lethal removal of up to 217 healthy-appearing deer within a period of one to three years for disease detection (varies, depending on the number of samples contributed by the Virginia Department of Game and Inland Fisheries), and a range of 69 to 97 healthy-appearing deer within a one-year period for disease assessment (varies, depending on whether there has been one or two positive CWD cases within five miles of the park). The removal of this number of individual deer has no effect on the overall survival rate of the deer population. Because lethal removals for both detection and assessment are taken from the high-density areas closest to the CWD index case, there is a long-term benefit to the deer population because lower densities are linked to decreased risk of CWD amplification and spread, reducing the potential for CWD establishment and exposure to possible population level effects.

The addition of the proposed response actions in which deer would be lethally removed from high-density areas of the park in response to the presence of chronic wasting disease within or in close proximity to the park would not substantially change these impacts. As noted in the description of response actions, the number of deer lethally removed for density reduction would vary according to the most up-to-date density information. As shown on table 2, the number of deer removed across all likely high-density areas is generally expected to range from 150–200 deer within a period of one to five years. This is within the numbers and time periods of lethal removals previously analyzed for detection and assessment actions; therefore, the impacts of lethal removals for density reduction are expected to be the same, i.e., population levels will be largely unaffected and the additional removals will decrease risk of disease. In addition, while the change in deer density in these target areas would be noticeable, it would be similar to deer densities found in nearby, backcountry areas of the park.

What may be different is that density reductions may be done more frequently than lethal removals for detection or assessment, which would mean more disturbance of deer from human presence and use of firearms. The additional disturbance is not expected to have any more impacts on deer than those described for detection and assessment actions. Deer dispersal would be temporary, would be within natural variability, and movement would return to pre-disturbance levels once the actions are finished.

There may also be situations in which response actions would be implemented concurrently with detection and assessment actions across the park, depending on the location and number of positive CWD cases. In this situation, the number of lethal removals may increase because of the need to reduce deer density in one or more high-density areas plus collect a required number of samples for detection and assessment purposes in another area. For the purposes of this analysis, we assumed a worst-case scenario in which lethal removals were being done for detection, assessment, and density reductions all at once and at maximum levels. Under a worst-case scenario, the maximum number of deer that would be lethally removed is estimated at approximately 500 deer over a one- to three-year period in order to achieve target densities in the high-density areas. The more likely scenario, based on the park's experience to date, is that an estimated 200 to 300 deer would be removed over a one- to three-year period (due to feasibility and other limiting factors) to achieve the target densities in those areas. Once target densities are achieved, holding deer densities at target levels (similar to backcountry areas) will probably require yearly maintenance and a sustained removal effort. Under a worst case scenario, the estimated number of deer that would continue to be lethally removed for annual maintenance and testing is estimated at 200 deer or less. The more likely scenario for yearly maintenance and testing is 100 deer or less. Overall, even under a worst-case scenario, the lethal removal of the additional deer to reduce and maintain lower densities in the high-density areas would not substantially increase the adverse impacts on the deer population over the impacts of detection and assessment actions alone. Individual deer would be removed but there would be no noticeable effect on the survival rate at the population level.

The previous analysis of detection and assessment actions showed that beneficial impacts on the deer herd could be expected as a result of the potential for early detection and reduction in the risk factor for CWD amplification and spread associated with high-density deer herds (NPS 2012a). Adding response actions would be expected to increase this beneficial impact as a result of sustained lower

densities through targeted reductions. Decreasing deer density is believed to reduce the chances of deer transmitting the disease to one another because there would be less infectious contacts between animals and less prion contamination within the environment. Chronic wasting disease can be spread via CWD-infected carcasses, live animals with chronic wasting disease, or prions in the soil where infected animals live (NPS 2013a). Chronic wasting disease can also be transmitted through bodily secretions such as saliva, urine, or feces (Mathiason et al. 2006). According to Samuel et al. (2003) and Farnsworth et al. (2005), the CWD transmission rate appears to be greater when deer populations are more highly concentrated. Grear et al. (2006) suggest focusing on removing CWD-positive animals, along with density reduction, in situations where controlling chronic wasting disease is the goal. There is more recent evidence to suggest that culling is an effective means of limiting CWD prevalence within white-tailed deer populations (Mateus-Pinilla et al. 2013). Therefore, although deer survival rates would be affected, the sustained lower densities that would result from the addition of response actions to the current detection and assessment actions could have a large beneficial impact on the overall deer population by reducing the risk of CWD amplification, spread, and establishment. In addition, the increased opportunity for coordinating actions with the Virginia Department of Game and Inland Fisheries would reduce the potential for regional amplification or spread of the disease.

Cumulative impacts. Other actions that have impacts on deer in and around the park include hunting, poaching, VDGIF CWD surveillance, deer-vehicle collisions, and farming. Poaching, hunting, and deer-vehicle collisions inside and outside the park result in the removal of individual deer from the population. Nearby agricultural activities provide additional food and create increased edge habitat for deer, fostering deer overabundance.

The lethal removal of deer through detection, assessment, and response actions would contribute to cumulative impacts on the deer population by removing a larger number of individuals from the park populations. However, even in combination with these other actions, not enough individual deer would be removed to reduce the population appreciably, either in the park or in the region, or have an impact on deer habitat or food sources. There is a greater potential for cumulative beneficial impacts because of the combination of the larger number of deer removed from high-density areas inside the park with deer removals outside the park and the coordination of disease management between the National Park Service and the Virginia Department of Game and Inland Fisheries.

Conclusion. The addition of CWD response actions to the current detection and assessment plan would result in additional disturbance of deer because density reductions may occur more frequently than lethal removals for detection and assessment, and may result in a larger number of deer being lethally removed under a worst-case scenario in which density reductions are done concurrently with maximum removals for testing. The more likely scenario, based on the park's experience to date, is that the number of deer lethally removed through a combination of detection, assessment and response actions would be within a range of 100 to 300 individuals per year over a five-year period, which is similar to the maximum number of deer that could be removed under the approved detection and assessment actions alone. Under either scenario, the number of deer that would be lethally removed, whether density reductions are considered separately or in combination with detection and assessment actions, would have no noticeable negative effect on the long-term survival rate at the population level. Therefore, the addition of the proposed response actions would not noticeably change the impacts on the park's deer population from those previously analyzed for the approved CWD detection and assessment plan. The primary impacts of adding response actions would be beneficial, both individually and cumulatively. Lower deer densities are linked to decreased risk of CWD amplification and spread. Reducing the number of deer in high-density areas in combination with targeted removal of clinically ill deer would decrease the chances of deer transmitting chronic wasting disease to one another and decrease the risk of CWD amplification, spread, and establishment in and near the park, reducing the potential for CWD establishment and to the likelihood of population level effects. This would be a substantial benefit to the deer population when considered in the context of NPS policies for disease management, wildlife management, and resource protection.

Visitor Use and Experience

About the analysis. Qualitative information was used to assess the overall impact of CWD management on visitor use and experience. Past visitor use data were used to estimate the effects of the alternative actions on visitors, including visitor statistics, historic use patterns, and visitor use observations obtained from a visitor use study (NPS 2012b).

Impacts of plan with addition of proposed response actions. As previously analyzed (NPS 2012a), the current detection and assessment actions have some adverse impacts on visitor use and experience when visitors are unable to access certain areas of the park because area closures are required for safety reasons during lethal removals for sampling. In particular, the removal of healthy appearing deer for testing could involve large geographic areas and large numbers of deer removed. These impacts are considered minor because closures are temporary, silencers are used on firearms to minimize noise, and visitors are notified in advance about closures and the need for them, so that they have an opportunity to adjust their plans and help alleviate some of the adverse impacts during periods of higher visitor use. In addition to limiting access, the removal of deer in high-density areas for testing can decrease the potential for visitors to view deer in these locations which may have adverse impacts on visitors who wish to see or photograph deer. These adverse impacts are also considered minor because although the opportunity to see large numbers of deer is reduced, the deer population in those areas is being maintained at levels that approximate nearby areas of the park, which still affords visitors the opportunity to see deer. The current detection and assessment actions also have a small beneficial impact on visitors as a result of removing sick and dead deer for testing. Visitors may benefit from educational and interpretive activities as a result of increased understanding about the disease and knowing that the park is taking actions to protect the deer.

The addition of the proposed response actions may require additional area closures to conduct density reductions but these are not expected to noticeably change the level of impact on visitors beyond what was previously analyzed for detection and assessment actions, alone. There may be some difference in timing and frequency, where closures may be implemented at different times of the year and may be somewhat longer, if additional time is needed to reach density targets. While this would probably inconvenience some visitors, every effort would be made to provide advance notice of closures so that visitors can adjust their plans, and to conduct lethal removals for testing and density reductions as quickly and efficiently as possible to minimize the length of closures

What may be different is that reducing deer densities in the target areas would probably decrease opportunities for visitors to view deer in these locations. Big Meadows, for example, is a favorite location for visitors to view and photograph deer because deer are almost always present and have become habituated to human presence, making them easily viewed. Some visitors make frequent trips to view deer in these favored locations; others come to watch deer at certain times of the year, such as the early-summer fawning season when does give birth and gather in the area with their fawns, and the fall mating season, when antlered deer may be seen. Density reductions in Big Meadows and other target areas would reduce the number of deer to a density more similar to the backcountry areas of the park, which means that there may be fewer deer present at any given time, and there may be times when no deer are present. This may decrease visitor enjoyment to the extent that visitors come specifically to Big Meadows and other areas to see deer. And unlike lethal removals for detection and assessment actions, where the number of deer removed varies widely according to the number of samples needed, the reduced deer density in these locations would be maintained for as long as the testing data indicate that response actions are warranted, meaning the decrease in opportunities to see deer could last a long time.

The National Park Service acknowledges that viewing and photographing deer, especially at Big Meadows, is a popular activity for many visitors and that decreasing the opportunity would diminish the experience of some visitors. However, the purpose of density reductions is not to eliminate deer from Big Meadows and the other high-density locations, but to reduce deer density to something approximating more natural conditions as they exist in surrounding backcountry areas in order to reduce the risk of CWD transmission. It is unlikely that density reductions would cause deer to stop using Big Meadows or the other target areas because these areas are highly attractive to deer. We expect deer to continue to use these areas and visitors would still have opportunities to see deer; however, the numbers are likely to be smaller and the opportunities would be less regular and predictable than at present. Density reductions are also likely to remove habituated deer, meaning that while deer would still be present in Big Meadows and other target areas, they may be less tolerant of human presence; therefore, less "viewable" compared to current conditions. Some of these adverse impacts may be alleviated by public outreach and education efforts that would help promote greater understanding of the risk and consequences of chronic wasting disease becoming established and spreading in the park's deer population and the need for the density reductions.

Cumulative impacts. Other actions that have impacts on visitor experience in and around the park include operational and administrative functions at the park that require area closures, such as intermittent maintenance, other management activities that require restricted access, and prescribed burns. For example, parts of Skyline Drive are closed after sunset during hunting season to reduce the likelihood of poaching. Prescribed burns, which are generally conducted in the spring months, may restrict visitor access and smoke may diminish visibility in the park. These management actions have a small amount of adverse impacts on visitor use and experience, such as restrictions to visitor access or interference with visitor enjoyment of the park. Some visitors may be required to change their plans if an area of the park they want to visit is temporarily closed. Visitors may not be able to access all areas of the park. However, such management actions are generally of short duration and these inconveniences are not likely to impact visitors to a large degree. The addition of the proposed response actions would contribute a small adverse increment but because CWD detection, assessment, and response actions do not generally overlap with closures for other reasons, the overall cumulative impact on visitor use and experience is considered minor.

Conclusion. The addition of the proposed response actions would have adverse impacts on visitor use and experience as a result of area closures that restrict visitor access, and decreased opportunities to view and photograph deer in favored viewing areas. The adverse impacts of area closures for density reductions would not be noticeably different than what visitors currently experience when areas are closed for lethal removals for detection and assessment. Closures for density reductions may be somewhat longer or at different times of the year but the overall adverse impacts would not change from existing, either individually or cumulatively. The main difference as a result of adding response actions is decreased opportunities for visitors to regularly view and photograph deer in favored locations such as Big Meadows. Deer would still be present but in smaller numbers, on a less regular basis, and may be less tolerant of human presence. This would probably reduce the enjoyment of visitors who come to the park specifically to see deer in Big Meadows and other favorite viewing areas. This would not reduce the overall visitor experience of the park because deer densities in these areas would be more similar to natural deer densities that occur throughout the park, which is in keeping with the natural conditions and experience that the park was established to conserve and promote. Public outreach and information may promote greater understanding of the need for the response actions, alleviating some of the adverse impacts.

Health and Safety

About the Analysis. Information about employee safety risks was taken from the *Chronic Wasting Disease Detection and Assessment Plan/Environmental Assessment* (NPS 2012a).

Impacts of Plan with Addition of Proposed Response Actions. As previously analyzed (NPS 2012b), the current detection and assessment actions pose some safety risks to NPS employees from the use of firearms and tranquilizer guns, contact with deceased deer, capturing and handling live deer, and exposure to tissues/fluids. To minimize safety risks, staff adhere to NPS safety guidelines (NPS 2008a, 2008b, 2010, 2012c) and, to date, no accidents or injuries have resulted from these activities. While it is impossible to eliminate all risk, it is expected that staff will continue to adhere to safety guidelines and that the risk of accidents and injuries will remain very low. The addition of the proposed response actions may increase the safety risks slightly, as lethal removals for density reduction may occur more frequently or for a longer period of time than would be the case for sampling, but the overall risk to employee safety would still be considered low because of continued adherence to safety guidelines and the use of trained, qualified authorized agents for lethal removals.

Cumulative Impacts. Other wildlife management actions with potential to impact employee safety include aversive conditioning of bears and coyotes, and trapping of nuisance bears. The aversive conditioning of bears and coyotes poses inherent risks to employees, such as being attacked by bears or coyotes, or other general injuries that are inherent with working in the field, such as cuts or sprains. In combination with the safety risks posed by adding the CWD response actions, the overall cumulative impact is adverse but is still considered to be very low because the same safety guidelines are followed for any action that involves interacting with wildlife. Also, the results of aversive conditioning of bears and coyotes, and of trapping of nuisance bears, creates a safer work environment for park employees, which helps to offset some of the adverse cumulative impacts.

Conclusion. The addition of the proposed CWD response actions would result in some additional risk to employee safety over detection and assessment actions alone because of the increased use of firearms for density reductions. This additional risk would be minimized by the use of trained, qualified agents for all actions involving firearm use and adherence to NPS safety guidelines. The overall risk to employee safety is considered low, individually and cumulatively, because all staff would continue to adhere to NPS safety guidelines.

LIST OF AGENCIES AND PERSONS CONSULTED

Virginia Department of Game and Inland Fisheries

U.S. Forest Service

U.S. Fish and Wildlife Service

Virginia State Historic Preservation Office

Attendees at three public meetings held in March 2013

Science Team Members

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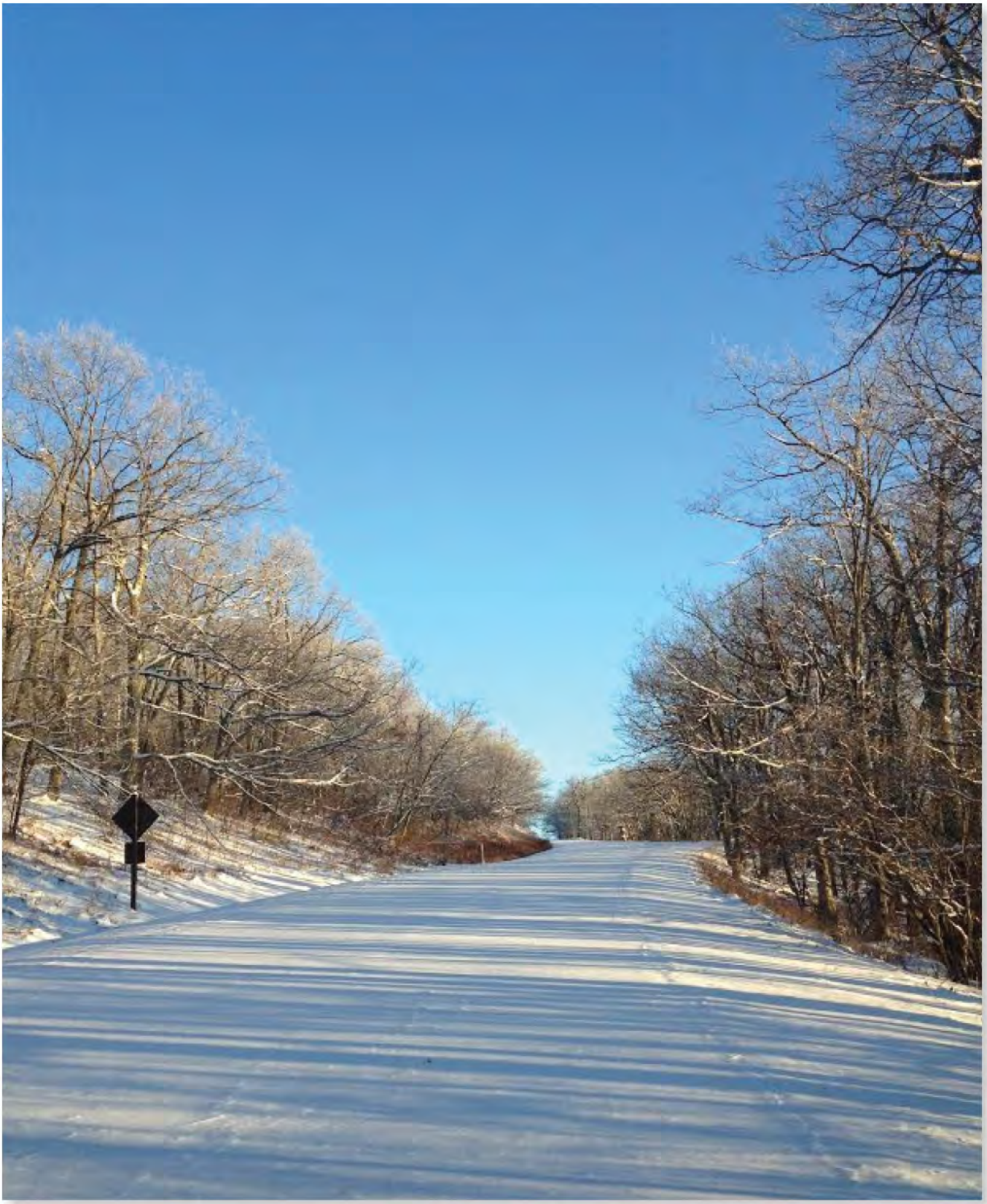
Dan Walsh, Ph.D.	Quantitative Ecologist	USGS National Wildlife Heatlh Center
Jeb Wofford	Biologist	NPS Shenandoah National Park



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2013c Personal Communication via email between Jeff Gutierrez (The Louis Berger Group) and Rolf Gubler (Shenandoah National Park), regarding the 2013 fiscal year budget. May 22, 2013

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APPENDIX A: SAMPLING SIZE REQUIREMENTS / SAMPLING PERIOD / TISSUE SAMPLING AND CARCASS HANDLING REQUIREMENTS

DETECTION

The number of samples needed to determine presence or absence of the disease, with relative certainty is based on the size of a population. In defining a "population," it makes sense to consider deer that congregate together as a biological population. Meaningful biological populations of free-ranging white-tailed deer are difficult if not impossible to define. For purposes of this plan, we have chosen to include deer within counties adjacent to the park as part of the park's biological population, acknowledging that those closest to the park are more likely to be mixing/assimilating with the resident park deer most frequently. Since there is known movement of deer across park boundaries in addition to deer that reside solely in the park, it is reasonable to assume that some of the deer tested by the state outside of the park represent samples taken from the park's biological population of deer.

We have chosen to begin intensive CWD detection actions within the deer population when a known CWD case is within 30 miles of the park based on estimated maximum deer movement (Scanlon and Vaughan 1981). The disease is most likely to be detected in park district(s) closest to the CWD case. Therefore, sampling efforts will be concentrated in park district(s) within 30 miles of the case. CWD samples collected by the Virginia Department of Game and Inland Fisheries from deer residing in counties bordering these districts will be combined with park samples to meet sample size requirements. Our goal is to meet statistically valid sampling requirements with a 95% probability of detecting the disease if it is present within the population at or above a 1% prevalence (i.e., 1 in 100 deer have the disease) over a three-year sampling period. To be conservative in our ability to detect the disease if it is present, we have assumed an infinite deer population, which will lend more certainty to our findings if we fail to detect chronic wasting disease. This sampling effort gives the option of testing a "weighted total" (Walsh and Miller 2010) of 300 deer (Samuel et al. 2003) from park district(s) and adjacent counties. Because the samples may be weighted, fewer than 300 individual deer may actually have to be sampled to meet the above sampling requirements – see below and appendix B for more detail.

It is assumed that samples will be equally distributed across the landscape. While this is not always possible, an effort must be made to sample throughout the sampling area. If no samples are taken outside of the park, which is unlikely, the entire sample size may be collected from within the park. These samples could be collected in a variety of ways including targeted, opportunistic, live, and lethal surveillance as outlined in the alternatives below. Each method of sample collection is weighted, with targeted and opportunistic samples adding more to the total sample size than those collected from apparently healthy deer (Walsh and Miller 2010). For example, road-killed animals (Krumm et al. 2005) and those demonstrating clinical signs of chronic wasting disease (Miller et al. 2000) are more likely to test positive for the disease and represent a more valuable diagnostic sample to detect new foci of disease. Sampling animals with a higher likelihood of having the disease will reduce the number of samples needed from the park. The only available CWD sample weighting system was created by Walsh and Miller (2010). While this system was modeled on data derived from mule deer within the CWD endemic region of Colorado and the weighting may not be entirely accurate for eastern white-tailed deer, it represents the best available science to optimize CWD surveillance efforts. If similar sample weighting schemes are created using white-tailed deer specific data they will be adopted during the lifetime of this plan.

ASSESSMENT

To assess disease intensity once it has been detected within 5 miles of the park, we will estimate the prevalence (±2% with a 95% confidence interval) in deer residing within a 5-mile radius of the index case (working cooperatively with the Virginia Department of Game and Inland Fisheries on lands outside Shenandoah National Park). Samples from inside the park will be collected based on areal extent and estimated deer density within and outside of the park. The maximum number of samples the National Park Service would contribute to the 5-mile radius (79-mi^2 area) established by the Virginia Department of Game and Inland Fisheries around each positive case would be 69 deer for the first positive CWD case and 97 deer for the second positive case (based on likely scenario estimates). As the number of cases detected increases, additional samples are needed to accurately estimate prevalence and sample size would increase accordingly (appendix B). Assessment samples will not be weighted because it could bias estimates of prevalence (i.e., percent of deer with the disease).

SAMPLING PERIOD

Sampling periods have been defined for both detection and assessment activities. Detection sampling will occur on a three-year cycle. If sample size is achieved in year 1, no additional samples will be taken in years 2 or 3. Assessment sampling will occur on a two-year cycle. If sample size is achieved in year 1, no additional samples will be taken in year 2. Calendar years will be used for data analysis consistency with state agencies.

Lethal removals for response would continue over a five-year period. At the end of that five-year period, the National Park Service would evaluate current conditions to determine if it would be appropriate to continue to maintain the reduced deer densities, even if no additional positive cases are found. If additional positive cases were found in the park or within five miles of the park during the five-year period, the National Park Service would continue to lethally remove deer to maintain lower deer densities and would expand lethal removals to the next closest high density areas as appropriate.

TISSUE SAMPLING AND CARCASS HANDLING REQUIREMENTS

Deer killed as part of targeted surveillance (i.e., deer with clinical signs of chronic wasting disease) would be placed in a plastic bag and taken to a designated holding area with an impervious surface where they will be kept until test results are received. Carcasses that are CWD negative would be disposed of using traditional methods (i.e., decompose on the landscape for small numbers of carcasses or landfill for large numbers). The National Park Service will adopt the state's preference to landfill any diseased carcasses. However, if landfill is not possible, other options would be considered, including incineration or alkaline digestion. Virginia Department of Agriculture Regional Animal Health Laboratories operate incinerators and are located in nearby Harrisonburg and Warrenton, Virginia. Deer recovered from opportunistic sampling will be left onsite (in forest settings) to decompose naturally and their location will be noted using a global positioning system (GPS). If an opportunistically collected sample tests positive for chronic wasting disease, the carcass remains will be collected and disposed of as described above. If chronic wasting disease is found within the park, all carcasses found within 60 miles of the positive case will be handled as targeted surveillance.

The National Park Service will regularly coordinate and cooperate with appropriate state and federal agencies on test results. The NPS Biological Resource Management Division tracks samples and maintains a CWD testing database. All positive detections would be reported to the park, NPS regional staff and the regional director. Due to the proximity of Northeast Region and National Capital Region park units, a positive CWD test result would be reported to both regions. All test results would also be reported to the state. Shenandoah National Park currently coordinates their CWD surveillance efforts with the state primarily through communications with the state CWD coordinator to share test results. The park also maintains a deer mortality database and tracks the results of CWD testing.

APPENDIX B: DEER SAMPLING LIMITS

11/16/2008 *by Mark Graham, NPS-BRMD*

11/26/2010 *revised by Jenny Powers, NPS-BRMD*

1. Chronic Wasting Disease (CWD) surveillance efforts can be divided between sampling for detection and sampling for prevalence estimation (assessment of disease intensity) after chronic wasting disease has been detected. Because the National Park Service does not have control of sampling outside of the park and yet has a goal of sampling a statistically valid proportion of the population for CWD detection, we will assume two scenarios, the first where the park must supply all of the samples and the second, and much more likely, that the park supplies a proportion of samples that can be calculated based on the total sampling area (SA), the total sample level, the proportion of the area that includes the park, the park deer density, and the deer density in the sampling area outside the park. All other potential scenarios will fall between these two.

   L = Total samples needed from sampling area (#, see table B.1)

   S = sampling area (mi^2)

   a = area of park inside the surveillance area (mi^2)

   d = deer density inside park (#/mi^2)

   o = deer density outside of park (#/mi^2)

   n = number of deer to be sampled in the park (#)

   ad = estimated number of park deer in the surveillance area (#)

   (S-a)o = estimated number of deer in the sampling area outside the park (#)

   number of deer to be sampled in the park $$n = (L)\frac{d}{(S-a)o+d} \quad \{1.1\}$$

Table B.1. Number of samples to be taken to detect the presence of chronic wasting disease with a given confidence if it occurs at a given prevalence. A sampling area of 79 mi² is assumed and includes 55 mi² of SHEN. If no samples are available within surrounding counties then 299 samples are needed from SHEN at the 95/1 sampling level (Samuel et al. 2003).

Probability of Detecting One Positive	Prevalence	Total Samples from Sampling Area	Based on a 79 mi² surveillance area*, the Max park contribution if the VDGIF is sampling outside of the park
75%	1%	138	100
80%	1%	160	116
85%	1%	189	137
90%	5%	46	33
	2%	114	83
	1%	230	167
95%	5%	59	43
	2%	149	108
	1%	299	217
99%	5%	91	66
	2%	229	166
	1%	458	333

Yellow highlighting equals suggested sampling level

*Size of surveillance area is highly variable and will be determined cooperatively with the Virginia Department of Game and Inland Fisheries, therefore numbers given here are only for example purposes. In all likelihood, our surveillance area will be much larger than 79 square miles and will include park districts (within 30 miles) and adjacent counties.

2. The size of sampling area is key because it defines the limits of the biological population. Because meaningful biological populations of free-ranging white-tailed deer are difficult if not impossible to define, for purposes of this plan we have chosen to include deer within counties adjacent to the park as part of the park population, acknowledging that those closest to the park are more likely to have interchange with the park population most frequently. For the purposes of the following example we have used a 79-square-mile area (5 mile radius) as the sampling area; however, it is quite likely that the sampling area will be much larger than this given that sampling will include districts of the park within 30 miles of a known index case as well as adjacent counties. Thus, strictly defining the land mass for a sampling area will be approached on a case-by-case basis and the following detection example is only for the purposes of demonstration. The results presented here are conservative; in reality, the sampling area and number of deer collected by the state may be higher and reduce the need for park sampling.

3. In estimating the proportion of deer that should be sampled from the park, the density of deer outside the park was assumed to be 25 deer/mi². The density of backcountry deer inside the park was also assumed to be 25 deer/mi². Deer density in developed areas of the park was assumed to be 100 deer/mi². Developed areas were estimated to be 5% of the park area. The total area of the park was estimated to be 311 mi². Thus the average park deer density was calculated to be 29 deer/mi² when a surveillance area includes developed areas or Skyline Drive within the park.

4. Accounting for the Big Meadows area at 150 deer/mi² as part of a sampling area of 79 mi², the average deer density within the sampling area containing it would be 29.4 deer/mi², which is not different enough from 29 deer/mi² to warrant special consideration. Hence, when calculating the maximum deer samples that Shenandoah National Park would need to contribute, 29 deer/mi² was used as the inside of park density, while 25 deer/mi² was used as the outside of park density.

5. Deer samples should be taken from within districts of the park that are within 30 miles of a known CWD case. It is probable that a larger proportion of deer will be sampled from developed areas compared to backcountry areas due to the greater density of deer in these areas, the increased habituation of deer in developed areas, and easier access. Because higher deer densities increase the risk factor of CWD amplification in the population, any decrease in developed area densities due to sampling would be beneficial. Proportional sampling would dictate that more deer be sampled from developed areas as well.

DETECTION SURVEILLANCE

6. Because the exact sampling area cannot be determined at this time, to calculate the number of samples required for detection surveillance efforts, a 5-mile radius circle was assumed, thereby representing a 79-mi^2 area. Using ArcGIS, 5-mile radius circles were plotted on maps of the park to determine the maximum area of the park that could occur within the surveillance area. It was assumed that the park would combine data with the state for detection and prevalence estimation activities if it is available. In the second scenario where data from the state are not available, the numerical demand on the park is greater. The maximum area of the park that would be included in the 79-mi^2 area is about 55 mi^2. To calculate sample contributions, the deer density outside the park was assumed to be 25 deer/mi^2, and inside the park an average of 29 deer/mi^2 was used. Confidence levels at given prevalence rates assumed infinite-sized populations.

7. Because the purpose of detection surveillance is to detect the presence of chronic wasting disease as early as possible, it is recommended that sampling levels in table B.1 are chosen based on assumed prevalence levels of 1% rather than higher levels. A commonly used level, and the one recommended here is to use the 95/1 confidence level. In other words, a 95% probability of detecting one positive case if chronic wasting disease occurs at 1% prevalence. This would require 217 samples from the park given a 79-mi^2 sampling area that included 55 mi^2 of the park.

8. Because CWD detection sampling is a resource-intensive process, the National Park Service often seeks to maximize detection surveillance by applying appropriate weights to samples collected from different classes of animals. For example, samples collected from animals hit by cars or displaying clinical signs of chronic wasting disease are more likely to test positive than those taken from the general population of healthy appearing deer. A weighting system was recently published for mule deer taken from the CWD endemic area of Colorado (Walsh and Miller 2010). While weights for white-tailed deer are likely to be slightly different the relative value of each sample is likely to be similar given that the clinical and pathological aspects of the disease are similar in both species (Miller and Wild 2004).

9. If appropriate, we may use the weighting system put forward by Walsh and Miller (2010) to maximize our CWD detection efforts. Once total sample size has been determined the number can be met by collecting a variety of types of samples. Targeted surveillance samples are weighted heaviest and fawns least. Sample size can be met by multiplying the weight by number of samples taken of a given type and adding to reach total sample size. See table B.2.

PREVALENCE ESTIMATION

10. For prevalence estimation sampling in response to chronic wasting disease being detected, a 5-mile radius circle would be mapped around the case, samples taken to estimate prevalence with an error of +/-2% at 95% confidence.

11. As the number of cases detected increases, the error bars on the prevalence estimate increase unless more samples are obtained. Table B.2 contains sample numbers needed for one to three positive CWD cases with varying-sized confidence intervals.

Table B.2. Sampling weights for CWD samples referenced to a healthy appearing male = 1.0. This table reflects the relative "weight" of a sample taken for CWD detection. This table does not apply to assessment or response actions. (Note: weighted sampling is only appropriate for detection activities not prevalence estimation because we do not want a biased sample when estimating disease intensity.)

Deer Status	Prevalence in test population	Sample Weights	Standard Error of Weights
Suspect—female (targeted surveillance)	0.36	11.57	1.6
Suspect—male (targeted surveillance)	0.32	10.27	1.46
Mostly road-killed, either sex) (Opportunistic surveillance)	0.06	1.90	0.24
Lethally Removed **Healthy appearing** deer – **Adult Male**	0.03*	1.00*	NA
Lethally Removed **Healthy appearing** deer – **Adult Female**	0.02*	0.58*	0.06
Lethally Removed **Healthy appearing** - **Yearling Female**	0.01*	0.4*	0.15
Lethally Removed **Healthy appearing – Yearling Male**	0.01*	0.25*	0.08

Example: If over the period of three years SHEN collects 20 deer killed by cars or predators, 1 CWD suspect male, 1 CWD suspect female, 40 lethally removed adult females, and 50 lethally removed adult males the park would reach a detection sample size of 133. When pooled with an additional 166 adult male samples collected from surrounding counties and tested by the state, sample size for the population will be achieved.

1.9 x 20 = 38

10.27 x 1 = 10.27

11.57 x 1 = 11.57

0.58 x 40 = 23.2

50 x 1 = 50

TOTAL = 133.04

Note: If weighted sampling increases the number of animals which must be removed, we will instead use an unweighted sampling strategy where each adult deer accounts for a single sample.

Table B.3. Estimating Prevalence: Samples required to attain given confidence intervals and error sizes over varying number of detected CWD positive cases. A sampling area of 79 mi² is assumed to include 55 mi² of SHEN. This represents the worst case scenario that requires the largest number of samples to be taken from SHEN.

		1+ CWD Case		2+ CWD Cases		3+ CWD Cases	
Confidence (%)	Error (+/- %)	SA Total Samples	SHEN Samples	SA Total Samples	SHEN Samples	SA Total Samples	SHEN Samples
90	5	32	23	45	33	55	40
	2	80	58	112	81	136	99
	1	158	115	219	159	265	193
95	5	38	28	54	39	65	47
	2	95	69	133	97	162	118
	1	187	136	259	188	313	227
99	5	50	36	70	51	86	62
	2	124	90	174	126	210	153
	1	242	175	334	243	402	292

Green highlighting equals suggested sampling levels.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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Shenandoah National Park
Amend Chronic Wasting Disease Detection and Assessment Plan to Include Response Actions
Environmental Assessment

Virginia