Risk-Weighted Surveillance for Chronic Wasting Disease in Georgia

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APRIL 2022

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Introduction

This risk assessment and surveillance plan provides information to guide decisions regarding chronic wasting disease (CWD) sampling in Georgia. Chronic wasting disease is in the family of diseases known as transmissible spongiform encephalopathies (TSE). It is caused by a prion, an infectious protein particle. Once CWD is established on the landscape, there is little chance of elimination, and management of CWD in some states has proven challenging and costly.

In Georgia, native white-tailed deer (*Odocoileus virginianus*) are at risk for contracting CWD. Surveillance for the disease in Georgia began in 2002 and, at this time, CWD has not been detected in the state. However, CWD has been found in wild white-tailed deer in the bordering states of Alabama (2022) and Tennessee (2018) and nearby states of North Carolina (2022), Louisiana (2022), Mississippi (2018), Arkansas (2015), Missouri (2010), Virginia (2009), and West Virginia (2005).

By finding CWD as soon after introduction as possible, when prevalence is low and spread in the wild population is limited, Georgia Department of Natural Resources (DNR) can mount a management response to eradicate the disease locally before it becomes established. Therefore, at this time, optimizing the sampling effort for early detection should be the primary goal of surveillance in Georgia. To detect the disease as early as possible, surveillance should be focused geographically where the greatest introduction risks are located and in demographic classes in which the disease is most likely to be detected.

This report is the outcome of a collaboration between Georgia Department of Natural Resources and the Cornell Wildlife Health Lab to assess potential risks of CWD introduction and spread and to develop a surveillance plan for the state.

This report

1) provides an overview of the disease and its natural history;
2) describes the potential consequences should the disease be introduced;
3) summarizes past surveillance efforts in Georgia;
4) assesses the risk of CWD introduction into the state; and
5) prescribes a risk-weighted surveillance approach to determine sampling effort.

The risk assessment was developed to determine the factual basis of threats associated with CWD introduction into Georgia through a systematic evaluation of potential hazards (activities or situations that could introduce or distribute CWD), including activities conducted by taxidermists, meat processors, captive cervid facility owners, and neighboring states. As part of the risk assessment, a risk perception survey of DNR biologists was completed. This survey was used to evaluate the relative risks for CWD introduction posed by activities conducted within Georgia and the conditions and activities in surrounding states.

Based on the outcome of the risk assessment, a surveillance plan that focuses on geographic areas with the highest perceived risks was developed. The surveillance plan also incorporates a weighted surveillance method (Walsh et al. 2012, Heisey et al. 2014, Jennelle et al. 2018) to further focus sampling efforts on sex and age classes of white-tailed deer in which CWD is most likely to be first detected, thereby increasing sampling efficiency and improving the chance of detecting the disease as early as

possible. By using a weighted method in which sampling is proportionately distributed based on risk, the plan maximizes sampling efficiency and optimizes resource allocation.

This report is accompanied by a fully populated CWD Surveillance Database in Microsoft Access. The database provides functionality for managing CWD surveillance-related data, executing the hazard model to generate county-level sampling quotas, and reporting progress towards these quotas. An overview of the data collected during the risk assessments and the processes required to generate the annual sampling quota appears in Figure 1.

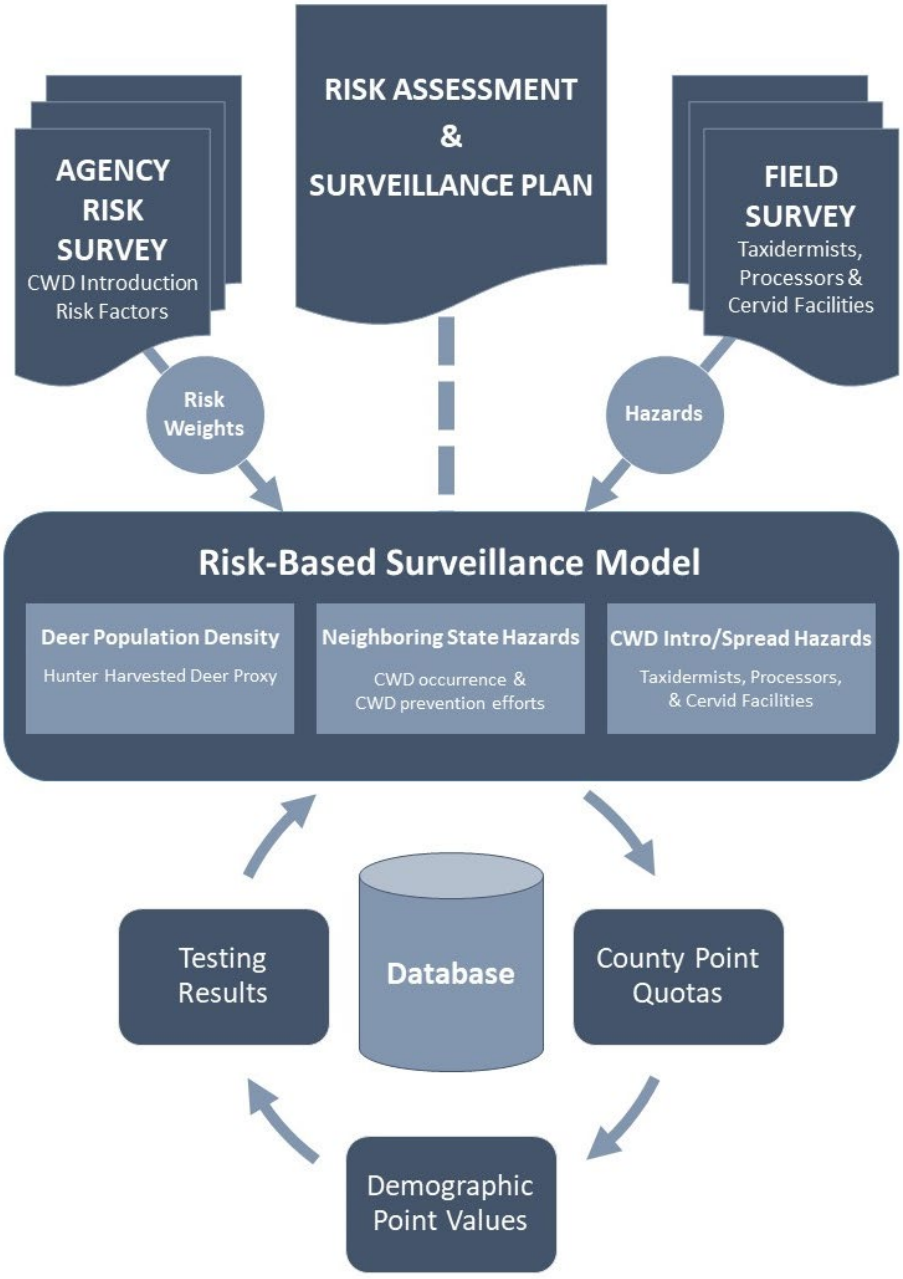

Figure 1. Workflow diagram for Georgia Department of Natural Resources' risk-based CWD surveillance system.

CWD Background

Chronic wasting disease is in the family of diseases known as transmissible spongiform encephalopathies (TSE). It is caused by a prion or infectious protein particle. Other TSEs include scrapie in sheep, bovine spongiform encephalopathy or "mad cow" disease in cows, and Creutzfeldt-Jakob syndrome in humans. Chronic wasting disease is the only known TSE of free-ranging species. First identified in a wildlife research facility at Colorado State University in 1967, CWD has subsequently spread to 30 states and four Canadian provinces in both free-ranging and captive cervids (Figure 2). Some of the more recent detections have come from the southeast United States region including in wild white-tailed deer in North Carolina, Louisiana, and Alabama in 2022; wild white-tailed deer in Tennessee and Mississippi in 2018; wild elk and white-tailed deer in Arkansas in 2015; captive white-tailed deer in Missouri in 2010 and wild white-tailed deer in 2012; and wild white-tailed deer in Maryland in 2010, Virginia in 2009, and West Virginia in 2005.

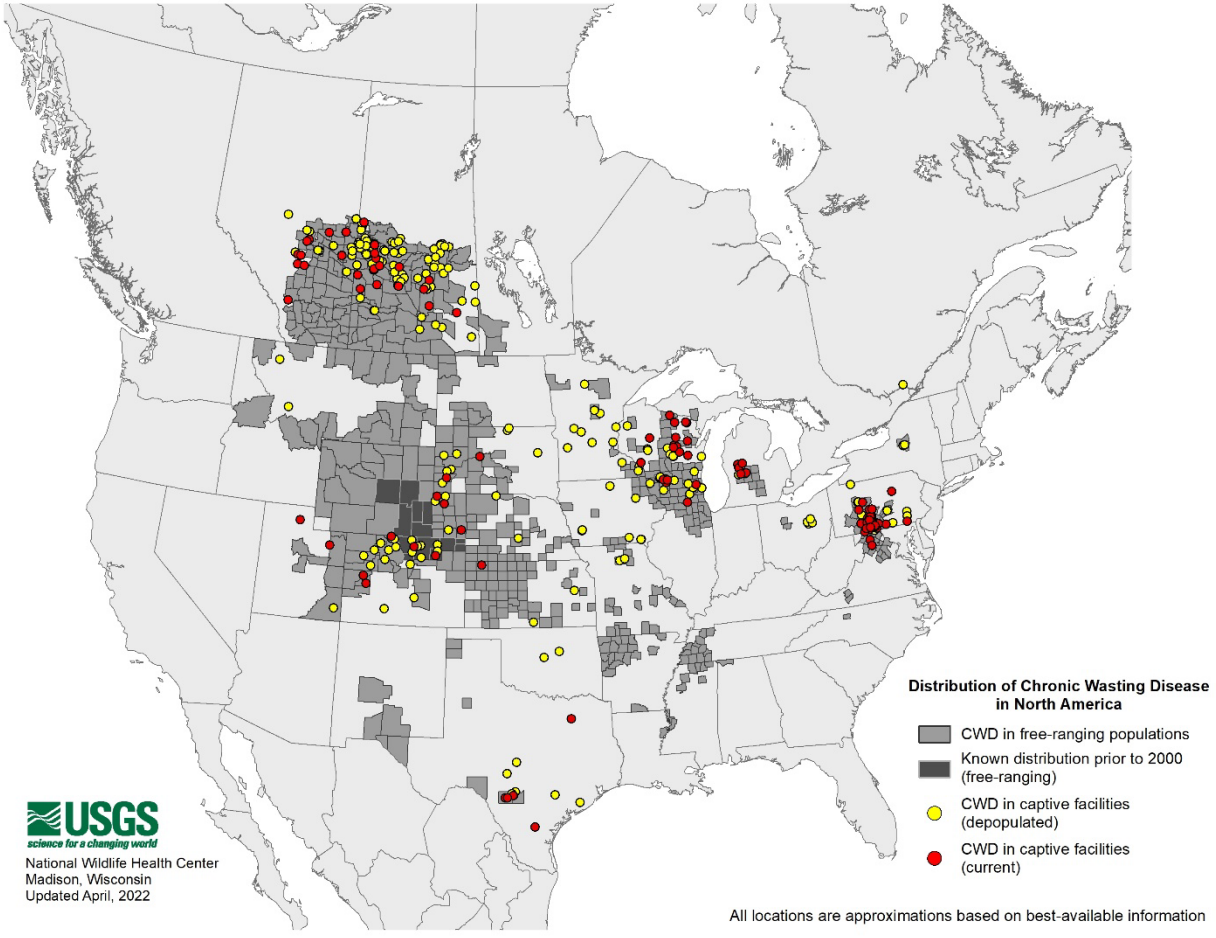

Figure 2. Current known distribution of chronic wasting disease in North America updated April 1, 2022. (Credit: Bryan Richards, USGS National Wildlife Health Center. Public domain. Acquired from USGS website on April 1, 2022. https://www.usgs.gov/media/images/distribution-chronic-wasting-disease-north-america-0.)

White-tailed deer, mule/black-tailed deer (*O. hemionus*), elk (*Cervus canadensis*), red deer (*Cervus elaphus*), moose (*Alces alces*), and reindeer/caribou (*Rangifer tarandus*) are the North American species that are naturally susceptible to CWD. Population-level impacts have been demonstrated in white-tailed deer, mule deer, and elk. In a Wyoming white-tailed deer study, Edmunds et al. (2016) estimated 42% prevalence in females and 28% prevalence in males. In this population, CWD-positive deer were 4.5 times more likely to die annually, and these deer were also overrepresented in the hunter harvest. This population was declining by 10% annually. Estimates indicate that population declines are likely to begin once the prevalence rate reaches 27%. A similar study of Wyoming mule deer showed that males had higher prevalence rates (50%) than females (30%), which is typical of most CWD-endemic areas (DeVivo et al. 2017). The population in this study is declining by 19% annually. Elk disease dynamics appear to be slower than those of white-tailed and mule deer. Monello et al. (2014) found an 8% prevalence in elk with a stable population, but the population was expected to decline if prevalence exceeded 13%.

Animals acquire infection through direct contact with other infected animals or indirectly through contact with prions in the environment (Almberg et al. 2011). Animals may begin to shed prions in fluids as soon as three months after becoming infected (Plummer et al. 2017). Prions have been detected in urine, feces, and saliva. Once in the environment, prions are able to bind to the soil and increase infectivity (Johnson et al. 2006). Limited studies have shown prion persistence in the soil for up to 16 years (Georgsson et al. 2006). Prions can also be taken up in plant tissues where they remain infectious (Pritzkow et al. 2015). There is currently no known method for environmental decontamination or animal treatment. Chronic wasting disease is always fatal. There has not been any demonstrated genetic resistance to disease; rather, there have been animals who have shown extended infection times. Similarly, vaccination trials have been largely unsuccessful (Wood et al. 2018).

Humans are not known to be susceptible to CWD. However, the similarity between CWD and other transmissible spongiform encephalopathies (e.g., “mad cow” disease) that have infected humans demands a level of caution. Recent unpublished animal studies suggest CWD can infect non-human primates from consumption of meat from CWD-infected animals. Therefore, the Centers for Disease Control and Prevention (CDC) recommends that no one consume a known CWD-positive animal.

CWD Impacts for Georgia

Management for wildlife health contributes in at least two ways to wildlife resource management as a public trust activity. First, it preserves the quality and quantity of trust assets (wildlife resources) for future generations. Secondly, to deliver benefits from trust management, agencies must include reduction of negative impacts associated with wildlife, whether these are perceived or real risks (Decker et al. 2016).

Chronic wasting disease has the potential to diminish the quality of the trust assets, because diseased animals are not as valuable as a trust resource. Hunters and the public are told not to consume sick animals, and decreased hunter participation has been documented in endemic areas. Hunters in several states have indicated they would not be as likely to participate in recreational activities if CWD had been found in the local deer herd (Needham et al. 2006).

A CWD outbreak would also put a severe financial strain on government agencies, not only from the lost revenue from license sales and associated federal funding, but also by redirecting financial and personnel resources (Bishop 2004). State agencies may face opposition to disease management

activities, which then hinders their abilities to operate effectively as trust managers (Needham and Vaske 2008). Mistrust of the agency and lack of cooperation from the public can bleed into other initiatives and activities. Hunting, as a tool for managing deer populations, could also be impacted, and revenue from license sales could be significantly diminished. Chronic wasting disease should be considered not only from a biological perspective, but also by the social, economic, and ecological impacts.

Economic Value of the Wild Deer Herd

Wildlife resources are often difficult to commodify. Expenditures by hunters include direct revenue gained from license sales and indirect economic input from retail sales, salaries and wages, and taxes. The white-tailed deer is an important wildlife resource and Georgia's most popular game species with over 200,000 deer hunters. Deer provide recreation for hunters and wildlife observers, and deer hunting contributes more than $890 million annually to Georgia's economy (Killmaster et al. 2014). Additional benefits from table fare and recreation represent tangible commodities for the hunting public. For instance, 4,391,604 deer hunt days (based on 21 mean number of days hunted for 209,124 hunters) at $40/day recreational value (Bishop 2004) equals $176M/year in recreational value. These commodities are likely to be impacted with detection of CWD.

Risk Assessment

The purpose of this CWD risk assessment for Georgia is to document and describe potential sources or causes of CWD introduction, referred to as hazards, into Georgia. The risk assessment is limited to hazards identified by past studies as potential avenues for CWD introduction. However, the risk assessment is also limited to hazards for which data already exist or could be collected through the risk assessment process. For instance, although illegal transport of cervid carcasses or parts from CWD-positive areas into Georgia may potentially occur, no data that quantify this hazard are available. Because Georgia currently has no known CWD occurrences in its wild or captive cervid population, the risk assessment includes potential hazards that exist due to activities and conditions in neighboring states, as well as hazards that exist within Georgia.

Outside Georgia

To understand potential CWD introduction risks from neighboring areas, we reviewed conditions and activities related to white-tailed deer and CWD in 16 southeast US states.

Georgia borders five states, two of which, Alabama and Tennessee, have found CWD in their wild cervid populations (Table 1). In addition, the nearby states of North Carolina and Mississippi are also CWD-positive. These outbreaks present obvious CWD introduction hazards due to natural deer movement near Georgia's northern and western borders. Chronic wasting disease has also been detected in Louisiana, Arkansas, Missouri, Maryland, Virginia, and West Virginia. Although such outbreaks may be more distant, the threat of natural spread through the wild cervid population or a long-distance introduction event still exists.

Surveillance Programs in Neighboring States

Undetected CWD outbreaks or undetected spread from known CWD-positive areas are potential sources for disease introduction to Georgia. Therefore, the effectiveness of surveillance programs administered in neighboring states is relevant to Georgia's early detection and response efforts. For Georgia, more

effective surveillance of the wild cervid population in neighboring states means a reduced risk of CWD introduction from undetected CWD occurrences.

Chronic wasting disease surveillance programs throughout the region vary in terms of why and how samples are collected, the sources of those samples, and where those samples are collected (Table 1). Programs that sample wild cervids in areas in which the disease has not yet been found, primarily in areas at greatest risk for introduction, and test a statistically justifiable number of samples annually are likely to be most effective at early detection.

Regionally, there are 13 states that sample more than 1,000 wild cervids annually. All states bordering Georgia have adopted or are in the process of adopting risk-weighted statewide active surveillance programs focused on early detection. Tennessee transitioned to this approach in 2018 and, following an outbreak of CWD in 2018, continues to sample large numbers of deer annually, particularly in southwestern Tennessee. Florida and Alabama have tested large numbers of deer annually statewide, and both are in the process of developing new surveillance approaches that distribute sampling efforts based on risk. South Carolina has had limited sampling in recent years due to funding restrictions. However, it is in the process of increasing sampling efforts for the 2022-2023 season and beyond. During the 2019-2020 sampling season, North Carolina tested over 2,700 samples submitted by hunters and clinically suspect deer.

Movement of Cervid Carcasses or Parts

Importation of carcasses or trophy heads from out-of-state represents a high risk for CWD introduction due to the potential for CWD-positive remains to be discarded on the landscape. Georgia has banned whole carcass importation from CWD-positive states because of the risk of CWD-positive parts being discarded in Georgia. Regionally, Alabama, Florida, North Carolina, and Tennessee prohibit whole carcass or parts importation from all states, regardless of CWD status (Table 2). Like Georgia, South Carolina bans whole carcass importation from CWD-positive states only and allows importation from CWD-negative states.

Feeding & Baiting

Concentrating animals around a food source is known to enhance disease transmission, and therefore, may facilitate transmission of CWD prior to detection by limited surveillance. Feeding and baiting are allowed, or allowed with some restrictions, in most states in the region (Table 2).

Captive Cervid Facilities

Long distance spread of CWD within and between states has been associated with the transfer of captive cervids between captive cervid facilities. Introduction of CWD to the wild cervid population has also been associated with CWD introductions at captive cervid facilities. Therefore, activities associated with captive cervid facilities, particularly transfers between facilities, may create CWD introduction hazards within Georgia or in neighboring states.

Of the southeast states reviewed, only Texas allows importation of all live captive cervids (Table 2). Kentucky allows importation only from Indiana (no known CWD occurrences), and three other states allow importation of exotic or non-native species. Illegal activities, such as unapproved movement or release of live cervids (Tidd 2018), has occurred from CWD-positive herds (Fitzgerald 2017). However, it was not feasible to assess this factor within the scope of this risk assessment.

High-fence shooting operations are permitted in 12 states in the region (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, South Carolina, Tennessee, Texas, West Virginia), and permitted release of captive-raised cervids is only allowed in one state (Texas).

While we recognize the coarse scale of these metrics, they can be helpful for directing surveillance efforts in the absence of other information. This assessment is not a comment on other states' practices or situations, but rather a suggestion for DNR on where to focus surveillance efforts.

Table 1. CWD status and surveillance activities in the Southeast (* = state neighbors Georgia).

State	CWD status	Wild cervid annual testing volume	Surveillance method	Sample source		
				Clinical suspects	Roadkill or other opportunistic sources	Hunter-harvested animals
Alabama*	Detected	1,000-4,999	Statewide	Statewide	Statewide	Statewide
Arkansas	Detected	5,000-10,000	Risk-based weighted sampling	Statewide	Statewide	Statewide
Delaware	Not detected	<1,000	Statewide			Statewide
Florida*	Not detected	1,000-4,999	Statewide	Statewide	Statewide	Statewide
Georgia	Not detected	1,000-4,999	Risk-based weighted sampling	Statewide	Statewide	Statewide
Kentucky	Not detected	1,000-4,999	Statewide	Statewide		Statewide
Louisiana	Detected	1,000-4,999	Risk-based weighted sampling	Statewide	Statewide	Statewide
Maryland	Detected	<1,000	Statewide	Statewide		CWD zone
Mississippi	Detected	5,000-10,000	Statewide county goals	Statewide	Statewide	Statewide
Missouri	Detected	>10,000	Statewide goals	Statewide		CWD area and bucks statewide
N. Carolina*	Detected	1,000-4,999	Statewide county goals	Statewide		Statewide
S. Carolina*	Not detected	<1,000	Statewide	Statewide	Statewide	
Tennessee*	Detected	5,000-10,000	Risk-based weighted sampling	Statewide	Statewide	Statewide
Texas	Detected	>10,000	Risk-based deer management unit goals	Statewide	Statewide	Statewide
Virginia	Detected	1,000-4,999	Statewide focused on older bucks		CWD zone	CWD zone
W. Virginia	Detected	1,000-4,999	Statewide goals		Statewide	CWD zone

Table 2. Activities associated with CWD introduction risk in southeast states, including if feeding or baiting is permitted anywhere in the state, if whole carcasses are permitted to be imported from non-CWD-positive states, and if the state allows importation of live captive cervids. Conditional indicates the activity is allowed only under specific guidelines.

State	Baiting	Feeding	Whole carcass importation	Live captive cervid importation	Intrastate live cervid movement	Cervid facilities	Hunting enclosures
Alabama*	Conditional	Allowed	Prohibited	Prohibited	Allowed	Allowed	Allowed
Arkansas	Conditional	Conditional	Prohibited	Prohibited	Prohibited	Allowed	Allowed
Delaware	Conditional	Allowed	Allowed from CWD-negative states only	Prohibited	Allowed	Prohibited (with the exception of grandfathered facilities)	Prohibited
Florida*	Allowed	Allowed	Prohibited	Prohibited	Allowed	Allowed	Allowed
Georgia	Conditional	Conditional	Allowed from CWD-negative states only	Prohibited	Conditional based on testing	Allowed	Allowed
Kentucky	Conditional	Conditional	Prohibited	Allowed from CWD certified herds	Prohibited	Allowed	Allowed
Louisiana	Allowed	Allowed	Prohibited	Prohibited	Prohibited	Allowed	Allowed
Maryland	Conditional	Conditional	Allowed from CWD-negative states only	Prohibited	Prohibited	Prohibited	Prohibited
Mississippi	Conditional	Conditional	Prohibited	Prohibited	Allowed from CWD-negative areas only	Allowed	Allowed
Missouri	Prohibited	Conditional	Prohibited	Prohibited	Prohibited	Allowed	Allowed
N. Carolina*	Allowed	Allowed	Prohibited	Prohibited	Allowed from CWD-negative areas only	Allowed	Allowed
S. Carolina*	Allowed	Conditional	Allowed from CWD-negative states only	Prohibited	Allowed	Prohibited	Allowed
Tennessee*	Prohibited	Conditional	Prohibited	Allowed from CWD certified herds. WTD prohibited.	Allowed from CWD-negative areas only	Allowed	Allowed
Texas	Allowed	Conditional	Allowed from CWD-negative states only	Allowed	Allowed	Allowed	Allowed
Virginia	Prohibited	Conditional	Prohibited	Prohibited	Prohibited	Prohibited (with the exception of grandfathered facilities)	Prohibited
W. Virginia	Conditional	Conditional	Allowed from CWD-negative states only	Allowed from CWD certified herds	Allowed from CWD-negative areas only	Allowed	Allowed

Inside Georgia

Meat Processors and Taxidermists

To assess risks of CWD introduction and spread within the state, we developed a risk survey for taxidermists and meat processors to identify locations and quantify potential hazards. The survey was administered by Responsive Management (responsivemanagement.com, Harrisonburg, VA) in September 2020. Responsive Management attempted to contact (by phone or email) and interview all taxidermists permitted by DNR and meat processors permitted by the Georgia Department of Agriculture (Figure 3). The telephone survey was administered by Responsive Management employees using a computer-assisted process to allow for immediate data entry. A multiple-callback design was used to maintain the representativeness of the sample, to avoid bias toward people easy to reach by telephone, and to provide an equal opportunity for all to participate. Responsive Management

contacted everyone who could be contacted (that is, not counting disconnected or invalid numbers) up to six times. Emails were sent to taxidermists who had not answered the phone by the sixth call, who had refused to take the survey over the phone, or who had invalid or disconnected numbers. Email addresses were not available for meat processors.

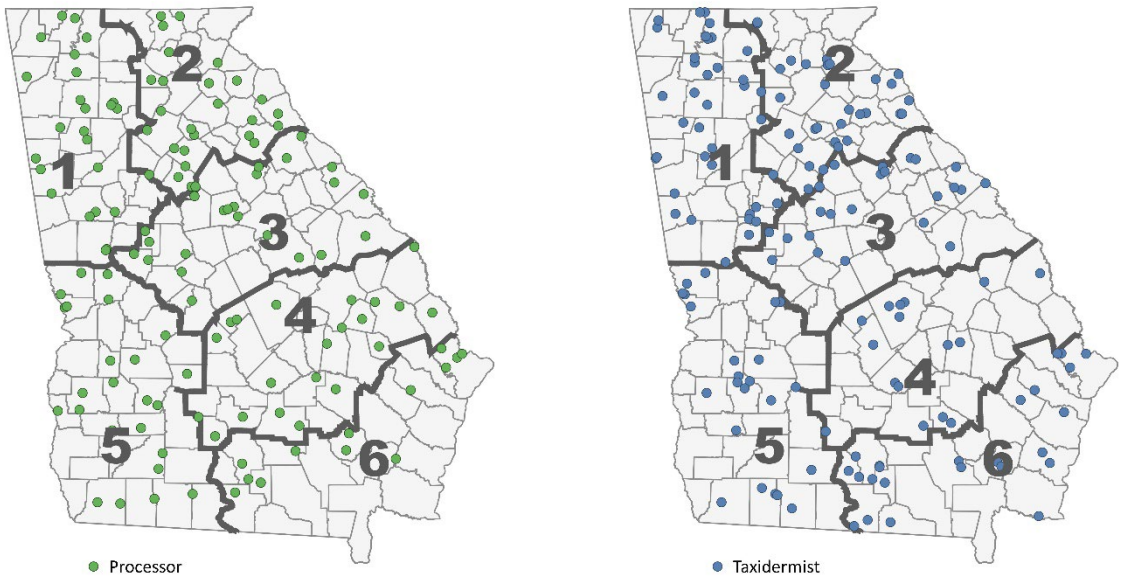

Figure 3. Locations of meat processors and taxidermists in Georgia with counties and regions outlined in black. Businesses that identified as both taxidermist and meat processor are shown in both maps. Numbers indicate Georgia DNR regions.

We used survey data from taxidermists and meat processors to gauge hazards from imported carcasses and parts, but this information does not include individual hunters who may process their animals at home. Of the 646 taxidermy/meat processing businesses identified (Table 3), 129 taxidermists, 112 meat processors, and 28 taxidermists/processors were successfully contacted for interviews. Businesses that did not respond to contact attempts were included in the risk assessment, because they may still be active and present a risk. If additional information becomes available in the future, it can be added to the CWD database and used in the hazard model to refine calculation of sampling quotas.

Table 3. Response by business type to surveys to determine CWD risks associated with activities. Licensed taxidermists and meat processors were contacted by Responsive Management.

Business Type	Total number of businesses	Number of completed surveys	Survey completion rate
Taxidermist	204	129	63%
Processor	414	112	27%
Taxidermist/Processor	28	28	100%
Total	**646**	**269**	**42%**

The number of taxidermists and processors varied across the regions with the highest densities in Regions 1 and 2 (Table 4). There were 11% (30/269) of businesses that also had live captive cervids on the premises, which may need further investigation as CWD detections in New York and Minnesota involved business proprietors mixing taxidermy and live cervids. The potential for CWD introduction from deer remains due to direct exposure or environmental contamination and presents a considerable risk to captive cervids at these businesses.

More than half (57%; 152/269) of taxidermists and meat processors received deer carcasses or parts from outside of Georgia (Table 5). Distribution of deer parts on the landscape is a potential route of CWD introduction. From the risk assessment, it appears that 24% (64/269) of respondents use high risk disposal methods, such as open pits, composting, discarding on the ground, or feeding to animals, that could leave prions on the landscape (Table 5). Further education and/or regulation to these businesses on preferred disposal methods (e.g., sanitary landfill, incineration) may be necessary to reduce risk of prion introduction.

Table 4. Distribution of taxidermists and meat processors across DNR regions.

	REGION						
	1	**2**	**3**	**4**	**5**	**6**	**Statewide**
Counties	**28**	**26**	**28**	**27**	**31**	**19**	**159**
Square miles	**9,350**	**7,131**	**9,801**	**10,663**	**11,643**	**9,327**	**57,915**
Taxidermists	50	47	26	27	22	32	204
Processors	80	54	82	86	73	39	414
Taxidermists/Processors	0	6	6	2	10	4	28
Total	**130**	**107**	**114**	**115**	**105**	**75**	**646**

Table 5. Practices of taxidermists and meat processors by region and statewide that have live captive cervids on their premises and/or handle deer carcasses harvested from outside Georgia. High-risk disposal methods include on premises deposition in open pits, composting, left on property in a manner potentially exposing other animals to remains, or fed to other animals. Low-risk disposal methods include disposal in a landfill, rendering or incineration, or returning remains to the hunter.

Business type	**Region**	**Interviewed open businesses**	**Live captive cervids**	**Deer from out-of-state**	**High-risk disposal**	**Low-risk disposal**
Taxidermist	1	37	4	22	5	2
	2	27	3	16	12	3
	3	16	4	9	4	1
	4	15	3	8	4	0
	5	13	1	4	4	0
	6	21	2	13	10	1
	Statewide	**129**	**17**	**72**	**39**	**7**
Meat Processor	1	23	2	15	0	1

	2	20	2	14	1	2
	3	18	2	4	5	2
	4	20	2	5	7	1
	5	19	2	11	4	1
	6	12	1	8	4	2
	Statewide	**112**	**11**	**57**	**21**	**9**
Taxidermist / Meat Processor	1	0	0	0	0	0
	2	6	0	5	0	2
	3	6	0	6	2	1
	4	2	0	2	0	0
	5	10	2	7	0	0
	6	4	0	3	2	0
	Statewide	**28**	**2**	**23**	**4**	**3**
All	**Statewide**	**269**	**30**	**152**	**64**	**19**

This assessment did not include individual hunters who process their own animals. Although the practices and activities of these individuals could not be assessed, some activities may pose potential hazards. For instance, disposal would be a concern if carcass parts are discarded on the landscape, allowing other animals to be exposed to potentially CWD-positive tissues or contaminated soils or plants (Pritzkow et al. 2015).

Captive Cervid Facilities

We also evaluated captive cervid facilities in the state. In Georgia, there are 83 licensed captive cervid facilities (Figure 4). The cervid species present was known for 76 of the facilities, of which 72 have CWD-susceptible species (76% have white-tailed deer and 25% have elk, red deer, or mule deer). No facilities have reindeer, which have just recently been shown to be naturally susceptible, but are not being included in the USDA CWD Herd Certification Program Standards at this time (Benestad et al. 2016).

Similar to the survey used to collect data on risks associated with taxidermy and meat processing businesses, we designed a survey to identify risks associated with cervid facilities, including fence quality, operation concerns, disposal methods, and other activities. While information about potential hazards was incomplete for most facilities, it appears that a small fraction (n=9) have inadequate fencing, and over half (n=49) of the captive cervid facilities have shooting operations. Due to the known CWD introductions at captive cervid facilities that have occurred in other states, additional information related to potential risks for CWD introduction and spread to the wild cervid herd should be collected. These data can be used to refine the estimation of risks associated with these businesses. If survey results become available in the future, they can be added to the Access database and used in the hazard model to refine calculation of sampling quotas.

As mentioned previously, 30 taxidermists and meat processors also have live captive cervids on site, which may represent a higher CWD introduction risk due to the potential for transfer of prions between wild cervid carcasses brought in and live cervids.

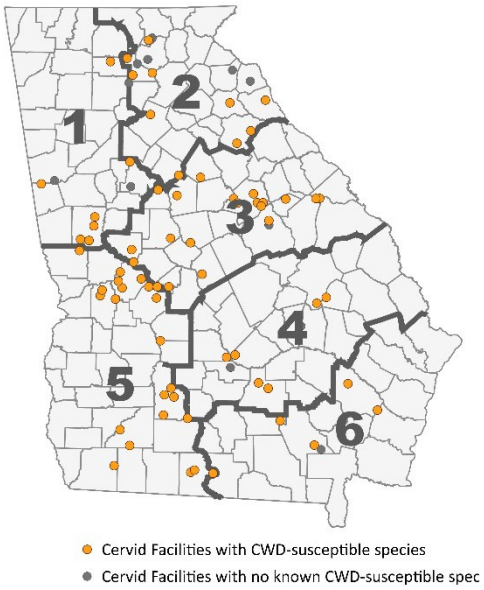

Figure 4. Locations of captive cervid facilities in Georgia with counties and regions outlined in black. Numbers indicate Georgia DNR regions.

DNR Risk Perception Survey

DNR biologists and wildlife management staff were surveyed to assess perceived risk of CWD introduction to Georgia due to potential hazards. These hazards were characterized as negligible, low, medium, or high risk in an online survey administered with Qualtrics survey software (Qualtrics, Provo, UT, USA. https://www.qualtrics.com). The risk factors included in the survey corresponded with variables collected for potential hazards within Georgia, as well as extrinsic factors, such as the occurrence of CWD in a neighboring state. The risk factors were converted to numeric values [negligible=0, low=1, medium=2, and high=3] (Table 6).

Table 6. Results of risk perception survey of CWD introduction hazards associated with business practices of taxidermists, meat processors, and captive cervid facilities. Risks were assessed and quantified by DNR biologists through the Qualtrics survey. Risk factors were converted to numeric values with negligible risk=0, low risk=1, medium risk=2, and high risk=3.

Hazard by business type	Average risk score	Standard deviation
Taxidermists and meat processors		
Number of deer handled annually		
0-10 deer	0.57	0.65
10-100 deer	1.57	0.65
>100 deer	2.43	0.94
Disposal method leaving carcasses/parts available to wild deer or elk	1.86	0.95
Hunter-harvest cervid parts coming in from out of state	2.21	0.97
Additional activities on premises		
Wild deer rehabilitation	1.36	1.08

Captive cervid facilities		
Possession of CWD-susceptible species	2.29	0.73
Importation of live captive cervids from other states	2.58	0.76
Disposal method of carcasses/parts that is available to wild deer or elk	2.21	0.80
Owner is not in compliance with regulations	2.57	0.65
Fence quality		
High - 8' and no breaches	1.86	0.95
Medium - Mostly 8' and questionable escapability	2.50	0.76
Low - not maintained to an acceptable standard	2.71	0.73
Additional activities on premises		
Deer processing	1.79	0.80
Taxidermy	1.86	0.77
Wild deer rehabilitation	2.14	0.86
High fence shooting operation	2.07	0.73
Neighboring states		
Detection of CWD (CWD-positive)	2.64	0.63
Presence of captive cervid facilities	2.43	0.76
Permitted import of live captive cervids	2.71	0.73
Permitted high-fence shooting operations	2.14	0.77
Low level CWD surveillance (<1,000 samples/year)	2.07	0.47

Surveillance Plan

Past surveillance efforts

Georgia has been conducting routine CWD surveillance since 2002 and has tested more than 11,000 non-detected samples (Table 7). Georgia DNR surveillance strategy includes two methods of sampling: targeted and active surveillance (Killmaster and Johannsen 2018). Targeted surveillance focuses on collecting samples from cervids displaying clinical signs characteristic of CWD and from captive or wild deer found/harvested in or near captive facilities. Active surveillance focuses on collecting samples from hunter-harvested deer according to risk categories and road-killed deer.

Table 7. Previous CWD surveillance of white-tailed deer (WTD) in Georgia. (The total for 2021-2022 include samples collected up to January 28, 2022.)

Season	WTD
2002-2003	326
2003-2004	655
2004-2005	610
2005-2006	597
2006-2007	681
2007-2008	593
2008-2009	649
2009-2010	612
2010-2011	589
2011-2012	590
2012-2013	94
2013-2014	215

2014-2015	132
2015-2016	230
2016-2017	264
2017-2018	302
2018-2019	300
2019-2020	943
2020-2021	1,364
2021-2022	1,380
Total	**11,126**

Weighted Surveillance

The probability of CWD detection in the free-ranging deer population can vary due to a number of factors including the age and sex of the deer population segments sampled, as well as the sample source (hunter-harvested, roadkill, clinical suspect, etc.). Research in CWD-positive states has identified older males as being more likely to have CWD than females or younger males. In addition, males are considered a better surveillance sample in most systems because of their large home ranges and behaviors including co-mingling with other males during the non-breeding season close contact with females during the rut and geophagy (dirt-eating). By assigning sample weights or "points" to an animal based on its value for detecting disease, we improve the information gathered per sample over a randomized collection process (Heisey et al. 2014, Jennelle et al. 2018). Therefore, this approach can improve the statistical assurance of freedom from disease with fewer tests.

Sample weights have not been calculated for Georgia or any other state in the eastern US. Georgia DNR may choose to develop state-specific surveillance weights and can adjust sampling efforts accordingly in the future. For this plan, we adapt surveillance weights developed for Wisconsin wild white-tailed deer (Jennelle et al. 2018) (Table 8).

For ease of implementation, assigned point values for each age/sex segment are rounded to the nearest half-point. This small adjustment has a negligible effect on actual quotas, but significantly eases interpretation. A buck that is 2.5 years or older at time of harvest is worth 3 points, while a yearling buck is worth 1 point; thus, an adult buck is three times more valuable a sample as a yearling buck. A doe that is 2.5 years or older at time of harvest is worth 1.5 points, while a yearling doe is only 1 point. Therefore, the surveillance program objective is to actively seek older bucks and does for sampling to increase the probability of early disease detection. Fawns are excluded from the point tally because of the low probability of disease detection in this age class. Unknown sex and age samples are not counted toward point quotas as their value cannot be accurately assessed.

For this plan, in contrast to the point scheme proposed by Jennelle et al. (2018), point values will not vary by sample source (hunter harvest, vehicle collision, found dead, sharpshooting, or reported abnormal). There is anecdotal evidence from eastern states (e.g., Pennsylvania, Virginia, and West Virginia) that vehicle collisions are a more valuable surveillance sample than Wisconsin data may indicate. However, because sample weights have not been determined for any states in the eastern US, sample weights will be the same within an age-sex population segment for all potential sample sources.

Table 8. Modeled weights for sex and age classes of hunter-harvested animals (Jennelle et al. 2018). Surveillance point values are simplified weights to meet county point quotas and may come from any source (hunter harvest, vehicle collision, found dead, or clinical suspects).

Sample	Hunter-harvested deer's weighted value	Surveillance points
Adult male (≥2.5 yrs)	3.237	3
Adult female (≥2.5 yrs)	1.328	1.5
Yearling male (1.5 to <2.5 yrs)	1.000	1
Yearling female (1.5 to <2.5 yrs)	0.877	1

Statewide Point Quota

An objective of this surveillance plan is to collect sufficient points statewide to allow detection of at least one case of CWD with 95% confidence if the prevalence in yearling males (the reference class for comparison) is 1%. To achieve this goal, the statewide sampling quota should be set at 2,994 points (https://popr.cfc.umt.edu/CWD/). For simplicity, the annual statewide point quota for Georgia will be rounded up to 3,000 points.

It is important to recognize that 100% confidence in the ability to detect CWD at any prevalence cannot be achieved due to the nature of sampling. Chronic wasting disease outbreaks in Arkansas and Tennessee have shown that CWD can exist undetected for a period of time allowing it to rise to a significant local prevalence level before being detected for the first time. Furthermore, Belsare et al. (2020) demonstrated that heterogeneities resulting from spatial clustering of disease or non-random sampling associated with hunter harvest could significantly increase the sampling required to detect disease at 1% prevalence.

During the 2019-2020 sampling period, 943 samples were collected by the DNR (Figure 5), which was equivalent to 2,006.5 points (Table 9). The average point value per sample collected was 2.13. DNR increased sampling efforts in the following two seasons. In 2021-2022, the DNR collected 1,380 samples as of January 28 (Figure 5), which was equivalent to 3,183 points (Table 9). The average point value per sample collected increased to 2.3. Thus, current sampling efforts can achieve the surveillance plan objective of 3,000 points.

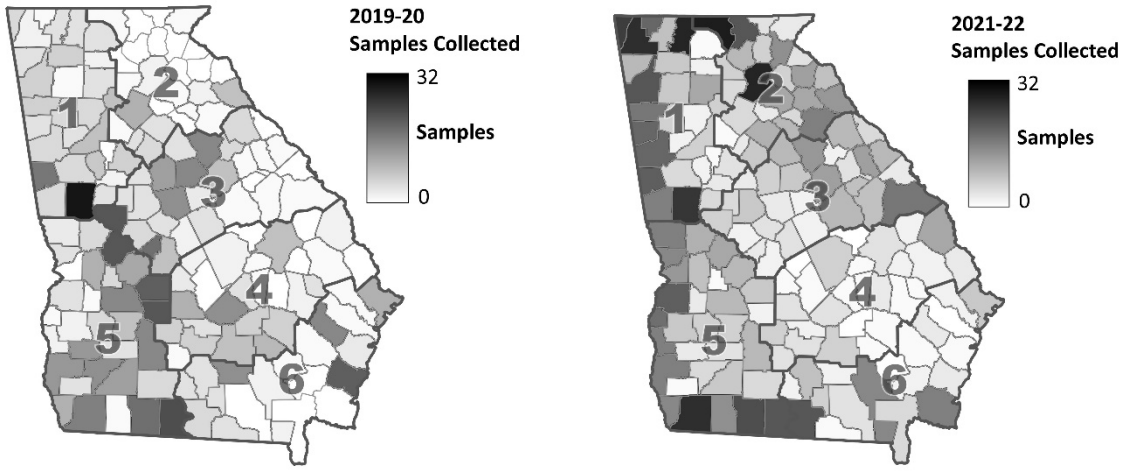

Figure 5. White-tailed deer samples collected per county in Georgia during the 2019-2020 and 2021-2022 seasons. Counties and regions are outlined in black. Numbers indicate Georgia DNR regions.

Table 9. Surveillance points from deer sampled in the 2019-2020 and 2021-2022 seasons in Georgia.

	Male		Female		Total	
2019-2020	Deer	Points	Deer	Points	Deer	Points
Adult	489	1,467	283	424.5	**772**	**1,891.5**
Yearling	64	64	51	51	**115**	**115**
Fawn	10	0	13	0	**23**	**0**
Unknown	21	0	12	0	**33**	**0**
Total	**584**	**1,531**	**359**	**475.5**	**943**	**2,006.5**

	Male		Female		Total	
2021-2022	Deer	Points	Deer	Points	Deer	Points
Adult	821	2,463	332	498	1,153	**2,961**
Yearling	153	153	69	69	222	**222**
Fawn	4	0	1	0	5	**0**
Unknown	0	0	0	0	0	**0**
Total	**978**	**2,616**	**402**	**567**	**1,380**	**3,183**

County Point Quotas

To maximize the chance of early detection, sampling effort should be distributed geographically based on the CWD introduction risk. Areas with higher risk of disease introduction should have more intensive surveillance. Therefore, the 3,000 sampling points are distributed proportionately based on risk by county, the smallest sampling unit for the state.

Each county is scored using two metrics: 1) a hazard risk score (risk of CWD introduction due to human activities) and 2) a demographic risk score (risk of introduction due to spread within the free-ranging deer population). The 3,000 point sample quota is divided 2:1 between these metrics, with 2,000

sampling points distributed based on hazards (the hazard risk score) and 1,000 sampling points based on a demographic metric (the demographic risk score).

Hazard Risk Score

The hazard risk score is calculated per county as the sum of all risk-weighted hazards for that county. Hazards accounted for in this metric include those found in the risk assessment process, which are the presence and activities of meat processors and taxidermists, the presence and activities of cervid facilities, and the detection of CWD and activities of states adjacent to border counties.

An individual risk score was determined for each taxidermist, meat processor, and captive cervid facility known to be in operation at the time of the risk assessment. Each entity was assigned a base score of 1 point; additional risk points were added for additional hazards according to the average risk score for that hazard from the risk perception survey described earlier. Risk scores for all entities were summed per county.

For counties bordering other states, if a hazard or risk condition existed in a neighboring state, an additional risk score was calculated (Table 10). For each condition, the associated risk from the risk perception survey was multiplied by the condition level to determine a condition risk score. The individual risk scores were summed for each county. Due to the perceived risk of CWD introduction resulting from intrinsic vs extrinsic factors and based on information gathered from risk surveys completed for Georgia, as well as other states, the condition risk scores were scaled up relative to the other hazard risk scores by a factor of 15. We are unable to assess the risk from factors not examined here, such as illegal importation or captive cervid escapes, so we recommend increased sampling in those areas to surpass the given county quotas. The condition risk scores per county are shown in Figure 6. Two thirds of the sampling point quota was distributed based on the total risk score (Figure 7).

Table 100. Risk factors, weights, and condition values for states neighboring Georgia counties.

Condition or activity in a neighboring state	Expert survey risk weight	Multiplier for condition level		
		0	0.5	1
Detection of CWD	2.64	Not detected	n/a	Detected
Presence of captive cervid facilities	2.43	Prohibited	Allowed only under limited conditions	Allowed
Permitted importation of live captive cervids	2.71	Prohibited	Allowed only under limited conditions	Allowed
Permitted high-fence shooting operations	2.14	Prohibited	n/a	Allowed
CWD-surveillance approach	2.07	Strategic statewide sampling including hunter-harvested animals	Opportunistic sampling of clinical suspects or roadkill samples	Limited or no surveillance

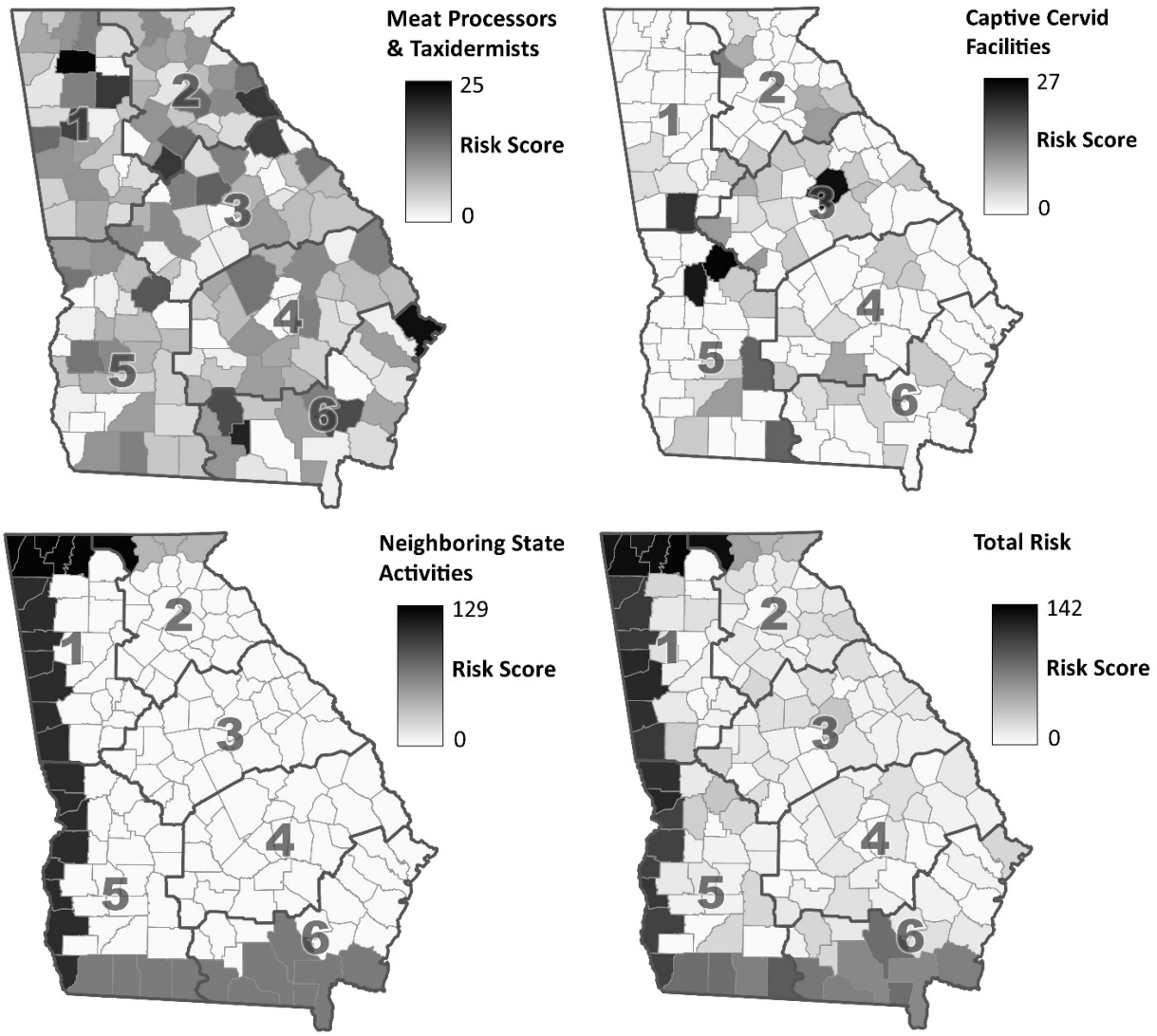

Figure 6. Hazard risk scoring by county. Hazards present within Georgia and in neighboring states were weighted according to the results of the DNR risk assessment survey and aggregated by county. Counties and regions are outlined in black. Numbers indicate Georgia DNR regions.

Demographic Score

The purpose of the demographic information is two-fold. First, if the deer population or deer harvest is sufficiently low in certain areas to prevent adequate sampling, the effort needed to acquire desired samples may be logistically infeasible. Second, in higher density deer areas, there is a higher probability of transmission and spread so deer should be sampled more intensively in these areas to ensure that clusters of infection are not missed.

County-level deer population estimates were not available for Georgia. Therefore, the numbers of hunter-harvested bucks in 2019-2020 was used as an index for deer population per county. One third of the sampling point quota was distributed based on this demographic index (Figure 7).

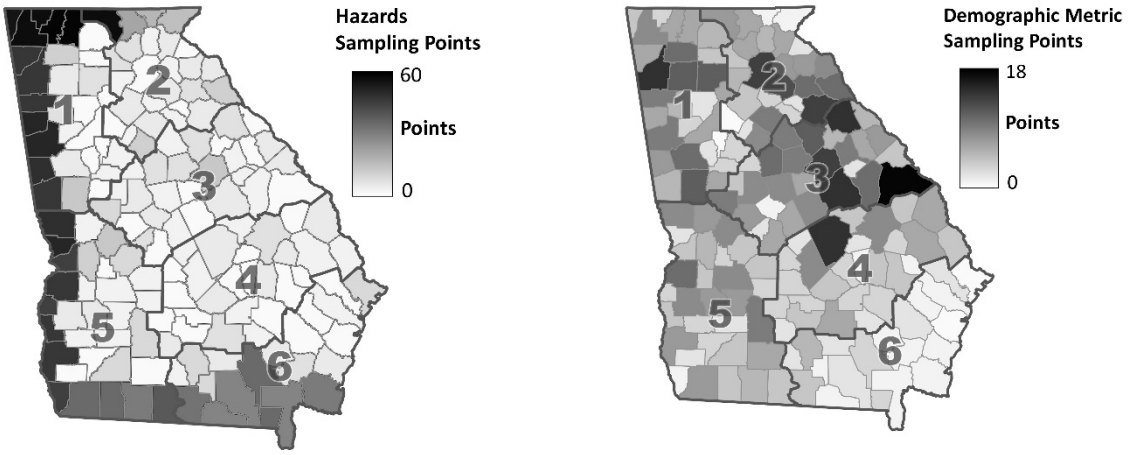

Figure 7. Sampling point quota allocation from hazard scoring and demographic index. Counties and regions are outlined in black. Numbers indicate Georgia DNR regions.

County Surveillance Category

The Access database used to calculate county surveillance quotas allows DNR to designate surveillance goals for specific counties. These surveillance categories are early detection, monitoring, and high-risk (Table 12).

Table 11. Surveillance categories that may be assigned to counties to calculate point quotas.

Surveillance category	CWD status	Goal	Point quota
Early detection	CWD has not been detected in county or neighboring counties.	Detection of new outbreaks of CWD from unknown or long-distance sources.	Proportional allocation based on the accumulation of hazards and deer harvest density
Monitoring	CWD is present.	Monitoring spread and change in prevalence of CWD.	Determined by agency
High risk	CWD has not been detected in county, but exists in neighboring county.	Detection of new outbreaks of CWD resulting from natural movement of infected deer from neighboring areas.	Determined by agency

For Georgia, which has not yet detected CWD, all counties are assigned to the early detection category, and sample quotas are calculated based on hazard and demographic scores. In the event that CWD is detected adjacent to border counties or within Georgia itself, counties can be assigned to the monitoring or high-risk surveillance categories. Counties assigned to these categories can be removed from the distribution of the 3,000 point statewide quota based on hazards and deer density. Point

quotas, beyond what are required for early detection of CWD, for these categories are determined by the agency.

County Sampling Point Quotas for 2022-2023

The suggested county-level sampling quotas, which are the sum of the hazard sampling points and the demographic metric sampling points, are shown in Figure 8 and summarized by region in Table 13. Compared to the 2019-2020 and 2021-2022 sampling seasons, geographically the sampling effort is shifted towards the Georgia state borders and to areas with higher known risks for CWD introduction and spread (Figure 9). The change in sampling effort represents a geographic redistribution of effort.

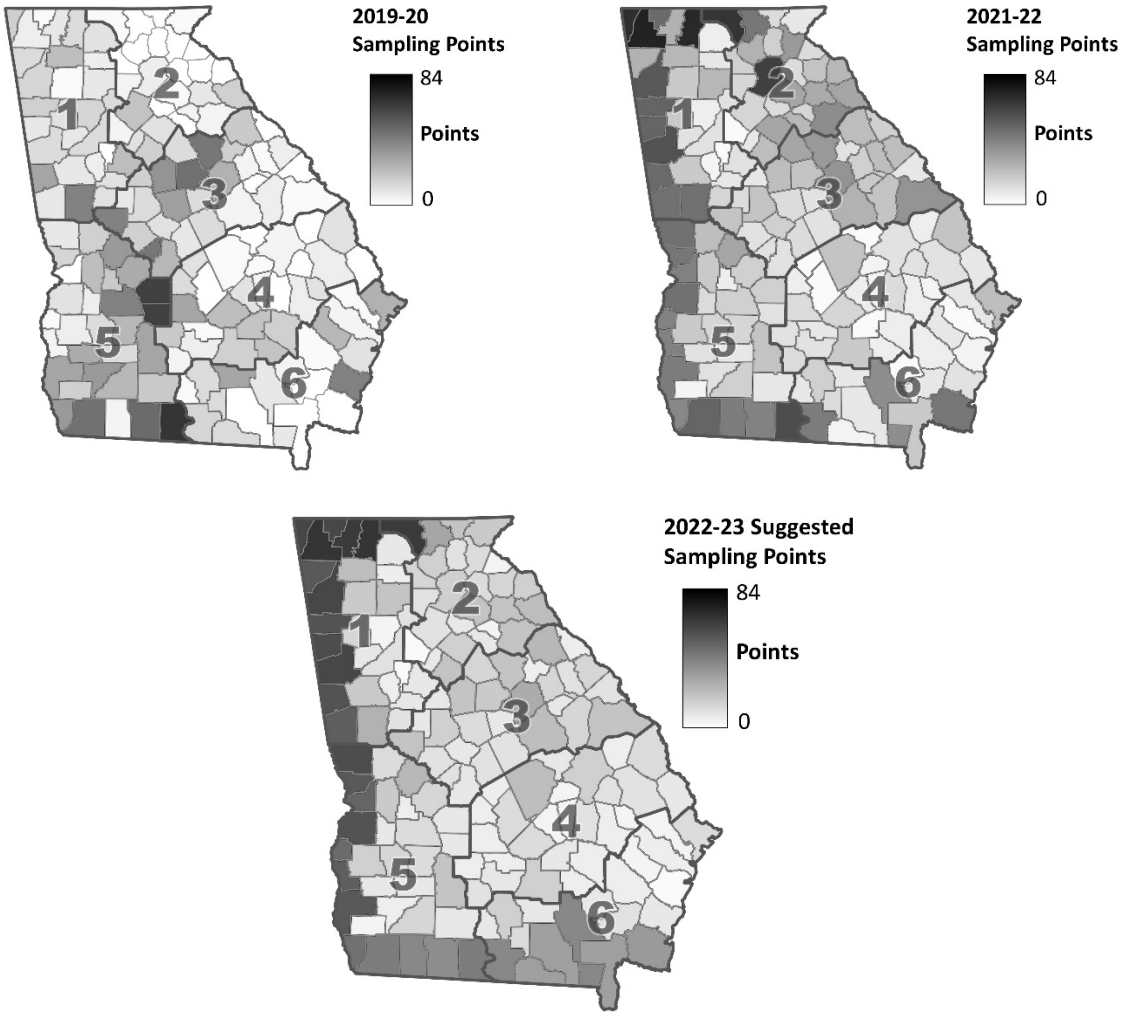

Figure 8. Comparison of 2019-2020 and 2021-2022 white-tailed deer surveillance point equivalents and suggested 3,000 sampling point quota for 2022-2023. Counties and regions are outlined in black. Numbers indicate Georgia DNR regions.

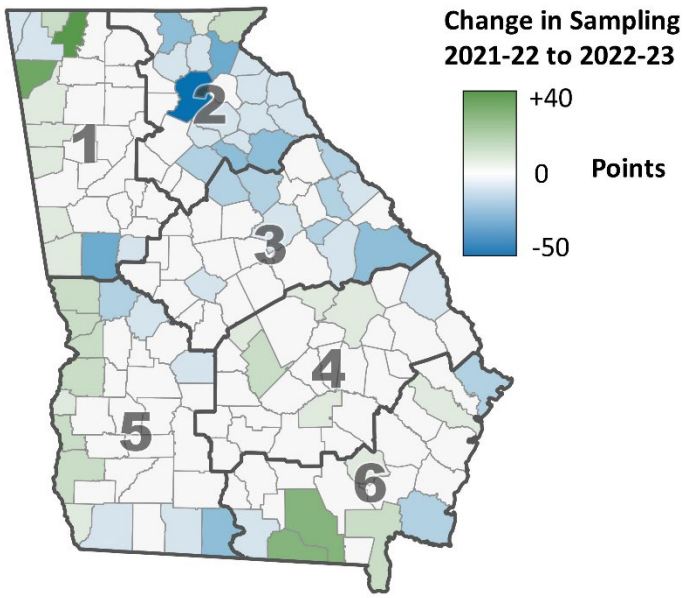

Figure 9. Change in sampling points from those collected in 2021-2022 to the suggested 3,000 point quota for 2022-2023, reflecting a statewide redistribution of effort. Counties and regions are outlined in black. Numbers indicate Georgia DNR regions.

Implications and Recommendations for DNR Biologists

Because this CWD surveillance strategy is more targeted and more spatially explicit than past efforts, it is important to note the implications and considerations for DNR biologists as they implement this strategy in their respective regions. The quotas for 2022-2023 are suggested efforts based on the accumulation of hazards and deer harvest density; however, staffing considerations and the ability to obtain samples may impact reaching these quotas each year.

These quotas can be filled by any source of wild white-tailed deer: hunter harvest, clinically ill, vehicle collisions, sharpshooting, and found dead. The point quotas do not factor in escaped captive cervids. However, these animals should be collected and tested in every instance possible. Field staff should receive regular updates on status of county quotas to ensure they can meet goals during the hunting season.

We suggest that point quotas are recalculated with updated information at least every three to five years.

Taxidermist Program

To assist with efforts to increase the volume of CWD samples, programs to incentivize partnerships with taxidermists and meat processors for collection and submission of samples have been successful in other states (Ableman et al. 2019). We recommend leveraging this program early and often, especially in counties that have historically not generated many samples and now have a substantial point quota. We also recommend regular communication with participating taxidermists and/or meat processors to ensure they are not collecting samples from counties where the quota has already been achieved.

Table 12. County CWD surveillance sampling quotas by region based on sampling 3,000 points. Risk points are proportionally allocated to counties from two sources: the demographic risk score based on the estimated buck harvest in 2019-2020 as a proxy for deer density (1,000 points statewide) and the hazard risk score based on identified hazards (2,000 points statewide). Processor/taxidermist risk score accounts for risks associated with size of operation, importation of cervids, disposal methods, and presence of live cervids. Cervid facility risk score incorporates risks associated with type of facility, fence quality, operation concerns, and other activities. Neighboring state conditions risk score incorporates risks associated with practices that may represent a higher risk for CWD introduction with minimal disease surveillance. Risk points are then tallied for each county to define a county sampling quota.

	Demographic Risk		Hazard Risk					
Region 1	Buck harvest	Demographic Risk Points	Processor/ Taxidermist Risk Score (number of businesses)	Cervid Facility Risk Score (number of facilities)	Neighboring State Conditions Risk Score	Total Hazard Risk Score	Hazard Risk Points	Point Sampling Quota
Bartow	1,001	12	12.7 (8)	0	0.0	12.7	5	**17**
Carroll	861	10	10.9 (8)	3.7 (1)	108.2	122.7	52	**62**
Catoosa	308	4	5.8 (3)	0	128.5	134.3	57	**61**
Chattooga	599	7	5.2 (2)	0	108.2	113.4	48	**55**
Cherokee	1,014	12	19.6 (9)	0	0.0	19.6	8	**20**
Clayton	56	1	0	0	0.0	0.0	0	**1**
Cobb	216	3	1.7 (3)	0	0.0	1.7	1	**4**
Coweta	890	11	10.6 (5)	2.3 (1)	0.0	12.9	6	**17**
Dade	434	5	1.7 (3)	0	128.5	130.2	56	**61**
Douglas	356	4	9.1 (5)	0	0.0	9.1	4	**8**
Fayette	272	3	3.6 (3)	0	0.0	3.6	2	**5**
Floyd	1,276	15	2.3 (4)	0	108.2	110.4	47	**62**
Fulton	609	7	5.1 (5)	0	0.0	5.1	2	**9**
Gilmer	516	6	3.4 (2)	0	0.0	3.4	1	**7**
Gordon	945	11	24.9 (8)	0	0.0	24.9	11	**22**
Haralson	554	7	14.6 (8)	0	108.2	122.7	52	**59**
Heard	638	8	4.5 (4)	3.3 (1)	108.2	115.9	49	**57**
Henry	372	4	3.4 (2)	6.6 (3)	0.0	9.9	4	**8**
Meriwether	962	12	8.2 (4)	21.4 (4)	0.0	29.7	13	**25**
Murray	619	7	12.9 (9)	0	128.5	141.4	60	**67**
Paulding	497	6	19 (8)	0	0.0	19.0	8	**14**
Pickens	427	5	0.6 (1)	0	0.0	0.6	0	**5**
Pike	552	7	3.9 (3)	0	0.0	3.9	2	**9**
Polk	816	10	3.4 (2)	0	108.2	111.5	48	**58**
Spalding	359	4	7.9 (6)	0	0.0	7.8	3	**7**
Troup	531	6	4.1 (4)	0	108.2	112.3	48	**54**
Walker	770	9	8.3 (8)	0	128.5	136.8	58	**67**
Whitfield	542	7	10.2 (3)	0	128.5	138.7	59	**66**
Total	**16,992**	**203**	**217.5 (130)**	**37.3 (10)**	**1,399.4**	**1,654.0**	**704**	**907**

Region 2	Demographic Risk		Hazard Risk					Point Sampling Quota
	Buck harvest	Demographic Risk Points	Processor/ Taxidermist Risk Score (number of businesses)	Cervid Facility Risk Score (number of facilities)	Neighboring State Conditions Risk Score	Total Hazard Risk Score	Hazard Risk Points	
Banks	657	8	6.4 (4)	0	0.0	6.4	3	**11**
Barrow	353	4	6 (5)	0	0.0	6.0	3	**7**
Clarke	242	3	2.4 (1)	0	0.0	2.4	1	**4**
Dawson	375	5	5.8 (3)	13.6 (4)	0.0	19.4	8	**13**
DeKalb	110	1	0	0	0.0	0.0	0	**1**
Elbert	928	11	19.4 (6)	5.4 (1)	0.0	24.7	11	**22**
Fannin	663	8	6.7 (4)	0	128.5	135.2	58	**66**
Forsyth	514	6	7.1 (2)	1 (1)	0.0	8.1	3	**9**
Franklin	698	8	11 (5)	1 (1)	0.0	12.0	5	**13**
Gwinnett	424	5	10.9 (3)	0	0.0	10.9	5	**10**
Habersham	581	7	11 (5)	0	0.0	11.0	5	**12**
Hall	1,160	14	2.3 (4)	0	0.0	2.3	1	**15**
Hart	751	9	13.1 (6)	1 (1)	0.0	14.1	6	**15**
Jackson	1,045	13	14.4 (11)	0	0.0	14.4	6	**19**
Lumpkin	573	7	9.9 (3)	8 (3)	0.0	17.9	8	**15**
Madison	925	11	11.1 (9)	8.1 (1)	0.0	19.1	8	**19**
Newton	713	9	19.6 (11)	5.4 (1)	0.0	24.9	11	**20**
Oconee	353	4	6.1 (3)	0	0.0	6.1	3	**7**
Oglethorpe	1,191	14	3.6 (3)	10.7 (2)	0.0	14.3	6	**20**
Rabun	144	2	1.7 (3)	0	36.5	38.2	16	**18**
Rockdale	220	3	9.3 (4)	0	0.0	9.3	4	**7**
Stephens	241	3	1.1 (2)	0	0.0	1.1	0	**3**
Towns	204	2	4.6 (1)	0	36.5	41.1	18	**20**
Union	600	7	11.7 (3)	3.3 (1)	36.5	51.5	22	**29**
Walton	807	10	14.4 (8)	0	0.0	14.3	6	**16**
White	478	6	8.2 (4)	0	0.0	8.2	4	**10**
Total	**14,950**	**180**	**217.6 (113)**	**57.4 (16)**	**237.8**	**512.7**	**221**	**401**

Region 3	Demographic Risk		Hazard Risk					Point Sampling Quota
	Buck harvest	Demographic Risk Points	Processor/ Taxidermist Risk Score (number of businesses)	Cervid Facility Risk Score (number of facilities)	Neighboring State Conditions Risk Score	Total Hazard Risk Score	Hazard Risk Points	
Baldwin	547	7	0.6 (1)	0	0.0	0.6	0	**7**
Bibb	202	2	11.4 (3)	0	0.0	11.4	5	**7**
Burke	1,494	18	5.9 (7)	0	0.0	5.9	2	**20**
Butts	342	4	0.6 (1)	8.1 (1)	0.0	8.6	4	**8**
Columbia	676	8	13.4 (7)	0	0.0	13.4	6	**14**
Crawford	626	8	1.7 (3)	0	0.0	1.7	1	**9**
Glascock	272	3	3 (2)	6 (1)	0.0	9.0	4	**7**
Greene	962	12	12.9 (7)	5.4 (1)	0.0	18.2	8	**20**
Hancock	1,175	14	7.9 (4)	25.9 (6)	0.0	33.8	14	**28**
Houston	592	7	1.7 (3)	0	0.0	1.7	1	**8**
Jasper	940	11	12.3 (4)	5.4 (1)	0.0	17.6	8	**19**
Jefferson	911	11	6.3 (6)	0	0.0	6.3	3	**14**
Jones	761	9	3.4 (6)	3.3 (1)	0.0	6.7	3	**12**
Lamar	380	5	7.6 (5)	0	0.0	7.6	3	**8**
Lincoln	508	6	0.6 (1)	0	0.0	0.6	0	**6**
McDuffie	543	7	5.9 (7)	0	0.0	5.9	2	**9**
Monroe	739	9	11.4 (5)	3.3 (1)	0.0	14.6	6	**15**
Morgan	861	10	3.4 (2)	5.4 (1)	0.0	8.7	4	**14**
Peach	288	3	5.8 (3)	10.7 (2)	0.0	16.5	7	**10**
Putnam	856	10	15.3 (7)	0	0.0	15.3	7	**17**
Richmond	383	5	6.4 (4)	5.4 (1)	0.0	11.7	5	**10**
Taliaferro	492	6	1.1 (2)	0	0.0	1.1	0	**6**
Twiggs	569	7	1.1 (2)	5.4 (1)	0.0	6.5	3	**10**
Upson	805	10	11.8 (8)	10.7 (2)	0.0	22.5	10	**20**
Warren	814	10	0.6 (1)	5.4 (1)	0.0	5.9	3	**13**
Washington	1,209	15	10 (11)	4.3 (2)	0.0	14.3	6	**21**
Wilkes	1,202	15	18.8 (6)	0	0.0	18.8	8	**23**
Wilkinson	770	9	1.1 (2)	0	0.0	1.1	0	**9**
Total	**19,919**	**241**	**181.5 (120)**	**104.5 (22)**	**0.0**	**286.0**	**123**	**364**

Region 4	Demographic Risk		Hazard Risk					Point Sampling Quota
	Buck harvest	Demographic Risk Points	Processor/ Taxidermist Risk Score (number of businesses)	Cervid Facility Risk Score (number of facilities)	Neighboring State Conditions Risk Score	Total Hazard Risk Score	Hazard Risk Points	
Appling	372	4	4.7 (5)	0	0.0	4.7	2	**6**
Bacon	215	3	7.5 (6)	0	0.0	7.5	3	**6**
Ben Hill	311	4	1.7 (3)	1 (1)	0.0	2.7	1	**5**
Bleckley	280	3	8.1 (6)	0	0.0	8.1	3	**6**
Bulloch	548	7	6.4 (4)	0	0.0	6.4	3	**10**
Candler	331	4	6 (4)	5.4 (1)	0.0	11.4	5	**9**
Coffee	552	7	9.4 (7)	9.9 (3)	0.0	19.2	8	**15**
Dodge	731	9	6.6 (5)	0	0.0	6.6	3	**12**
Effingham	393	5	6.4 (4)	0	0.0	6.4	3	**8**
Emanuel	745	9	12 (8)	5.4 (1)	0.0	17.4	7	**16**
Evans	174	2	3 (2)	0	0.0	3.0	1	**3**
Irwin	454	5	5.2 (2)	0	0.0	5.2	2	**7**
Jeff Davis	327	4	9 (6)	0	0.0	9.0	4	**8**
Jenkins	405	5	1.1 (2)	0	0.0	1.1	0	**5**
Johnson	382	5	7.1 (6)	0	0.0	7.1	3	**8**
Laurens	1,234	15	13.9 (10)	0	0.0	13.8	6	**21**
Montgomery	202	2	1.1 (2)	1 (1)	0.0	2.1	1	**3**
Pulaski	300	4	4.1 (4)	0	0.0	4.1	2	**6**
Screven	601	7	12.5 (5)	0	0.0	12.5	5	**12**
Tattnall	437	5	3.4 (6)	0	0.0	3.4	1	**6**
Telfair	410	5	10.4 (5)	3.3 (1)	0.0	13.7	6	**11**
Tift	248	3	8 (3)	5.4 (1)	0.0	13.4	6	**9**
Toombs	390	5	12.5 (7)	0	0.0	12.5	5	**10**
Treutlen	231	3	0.6 (1)	0	0.0	0.6	0	**3**
Turner	317	4	3 (2)	0	0.0	3.0	1	**5**
Wheeler	319	4	0.6 (1)	0	0.0	0.6	0	**4**
Wilcox	354	4	0.6 (1)	3.3 (1)	0.0	3.9	2	**6**
Total	**11,263**	**137**	**164.9 (117)**	**34.5 (10)**	**0.0**	**199.3**	**83**	**220**

Region 5	Demographic Risk		Hazard Risk					Point Sampling Quota
	Buck harvest	Demographic Risk Points	Processor/ Taxidermist Risk Score (number of businesses)	Cervid Facility Risk Score (number of facilities)	Neighboring State Conditions Risk Score	Total Hazard Risk Score	Hazard Risk Points	
Baker	338	4	0.6 (1)	3.7 (1)	0.0	4.3	2	**6**
Brooks	402	5	5.8 (3)	16.1 (3)	68.6	90.4	39	**44**
Calhoun	365	4	7.1 (3)	0	0.0	7.1	3	**7**
Chattahoochee	387	5	0	0	108.2	108.2	46	**51**
Clay	390	5	5.2 (2)	0	108.2	113.4	48	**53**
Colquitt	615	7	3.4 (6)	0	0.0	3.4	1	**8**
Crisp	293	4	6.6 (5)	0	0.0	6.6	3	**7**
Decatur	683	8	10.4 (5)	5.4 (1)	68.6	84.3	36	**44**
Dooly	379	5	0.6 (1)	5.4 (1)	0.0	5.9	3	**8**
Dougherty	243	3	4.1 (4)	5.4 (1)	0.0	9.5	4	**7**
Early	627	8	1.1 (2)	0	108.2	109.3	47	**55**
Grady	395	5	12.7 (6)	0	68.6	81.3	35	**40**
Harris	756	9	9.6 (10)	0	108.2	117.7	50	**59**
Lee	659	8	7.3 (4)	0	0.0	7.3	3	**11**
Macon	418	5	16.6 (5)	5.4 (1)	0.0	21.9	9	**14**
Marion	538	6	1.1 (2)	24.1 (4)	0.0	25.3	11	**17**
Miller	250	3	0.6 (1)	0	0.0	0.6	0	**3**
Mitchell	399	5	9.9 (3)	10.7 (2)	0.0	20.6	9	**14**
Muscogee	267	3	13.9 (5)	0	108.2	122.1	52	**55**
Quitman	292	4	0.6 (1)	0	108.2	108.7	46	**50**
Randolph	759	9	13.6 (4)	0	0.0	13.6	6	**15**
Schley	335	4	2.3 (4)	0	0.0	2.3	1	**5**
Seminole	131	2	0.6 (1)	0	108.2	108.7	46	**48**
Stewart	929	11	1.1 (2)	0	108.2	109.3	47	**58**
Sumter	785	9	6.4 (5)	0	0.0	6.4	3	**12**
Talbot	688	8	10.4 (4)	0	0.0	10.4	4	**12**
Taylor	766	9	6.6 (5)	26.8 (5)	0.0	33.4	14	**23**
Terrell	645	8	11.8 (8)	0	0.0	11.8	5	**13**
Thomas	516	6	5.1 (5)	0	68.6	73.6	31	**37**
Webster	426	5	7.1 (3)	0	0.0	7.1	3	**8**
Worth	845	10	4.7 (5)	16 (2)	0.0	20.7	9	**19**
Total	**15,521**	**187**	**186.7 (115)**	**118.9 (21)**	**1139.4**	**1444.9**	**616**	**803**

Region 6	Demographic Risk		Hazard Risk					Point Sampling Quota
	Buck harvest	Demographic Risk Points	Processor/ Taxidermist Risk Score (number of businesses)	Cervid Facility Risk Score (number of facilities)	Neighboring State Conditions Risk Score	Total Hazard Risk Score	Hazard Risk Points	
Atkinson	236	3	5.4 (3)	5.4 (1)	0.0	10.8	5	**8**
Berrien	483	6	17.8 (8)	3.3 (1)	0.0	21.1	9	**15**
Brantley	148	2	17.1 (6)	0	0.0	17.1	7	**9**
Bryan	251	3	1.7 (3)	0	0.0	1.7	1	**4**
Camden	156	2	3.4 (2)	0	68.6	71.9	31	**33**
Charlton	173	2	1.1 (2)	0	68.6	69.7	30	**32**
Chatham	91	1	23.6 (11)	0	0.0	23.6	10	**11**
Clinch	262	3	0.6 (1)	0	68.6	69.1	29	**32**
Cook	236	3	9.1 (5)	0	0.0	9.1	4	**7**
Echols	161	2	2.4 (1)	0	68.6	71.0	30	**32**
Glynn	136	2	8.6 (4)	5.4 (1)	0.0	13.9	6	**8**
Lanier	126	2	21.2 (6)	0	0.0	21.2	9	**11**
Liberty	205	2	9.6 (5)	0	0.0	9.6	4	**6**
Long	171	2	2.4 (1)	0	0.0	2.4	1	**3**
Lowndes	455	5	10.4 (11)	0	68.6	78.9	34	**39**
McIntosh	103	1	2.4 (1)	0	0.0	2.4	1	**2**
Pierce	178	2	12.3 (4)	0	0.0	12.3	5	**7**
Ware	358	4	9.1 (5)	4.3 (2)	68.6	82.0	35	**39**
Wayne	267	3	0	5.4 (1)	0.0	5.4	2	**5**
Total	**4,196**		**158.4 (79)**	**23.6 (6)**	**411.3**	**593.3**	**253**	**303**

Acknowledgments

Funding for this project was cooperatively provided by the Georgia Department of Natural Resources and the Wildlife Restoration Program, which derives monies through an excise tax on sporting arms and ammunition paid by hunters and recreational shooters. We thank Charlie Killmaster and Dr. Tina Johannsen for administrative support and assistance with the development of this plan.

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Glossary

Captive cervid facility – general term for a location that holds cervids within a game-proof perimeter fence or confined area, such as a barn or pen, regardless of whether said cervid(s) may be claimed under private ownership and the purpose for which the cervids are being held.

Cervid – hooved mammal of the family Cervidae that typically grows and sheds antlers yearly, includes deer, elk, and moose.

Environmental contamination – prions shed in carcasses, urine, feces, and saliva bind to the soil and plants and remain infectious to deer.

Hazard – A condition or physical situation with a potential for an undesirable consequence or to cause harm, e.g., may introduce or spread CWD prions.

Prevalence – Number of animals positive for CWD divided by number of animals in the population.

Prion – misfolded protein that is the infectious agent of CWD.

Risk – Possibility that something unpleasant will happen or situation involving exposure to danger.

Risk assessment – a systematic process of evaluating the potential risks that may be involved in a specified activity or practice.

Wildlife health – the vitality and integrity of wildlife species at population levels that support their functional roles in sustaining ecological systems that benefit society and the natural world.