# 5 year Strategic Plan for CHeRI

**Samantha M. Wisely, Director**
**Cervidae Health Research Initiative**
**UF Institute of Food and Agricultural Sciences**
**University of Florida**
**24 January 2024**

***Executive Summary***
Deer farming remains a growing industry in rural Florida which has approximately 400 deer farms that breed trophy deer and/or provide hunting opportunities to resident and non-resident hunters (Anderson et al. 2017). Nationwide the industry generates $8 billion for the US economy and employs >60,000 people. In addition to improving local economies, deer farms have the potential to improve habitat for other wildlife species.

In response to Florida stakeholders, the Florida Senate in FY 2014 provided a continuing academic appropriation to UF IFAS to form the Cervidae Health Research Initiative (CHeRI). CHeRI seeks to promote interdisciplinary science, education, and outreach that increases the health and production of captive cervids and bovids in a sustainable manner and promotes the health of native wildlife and the ecosystems in which they live. The goals of first strategic plan of CHeRI (2016-2023) were to:

- Engage the deer farm industry in Florida and create a network of cooperators
- Develop best management practices (BMP) for hemorrhagic disease (HD), including determination of disease drivers for acute HD, and development of efficacious vaccines
- Identify and develop BMP for other infectious diseases in fawn and adult deer
- Create an integrated pest management plan for *Culicoides spp.*, the vectors of HD
- Create useful decision-making tools for the deer farming industry

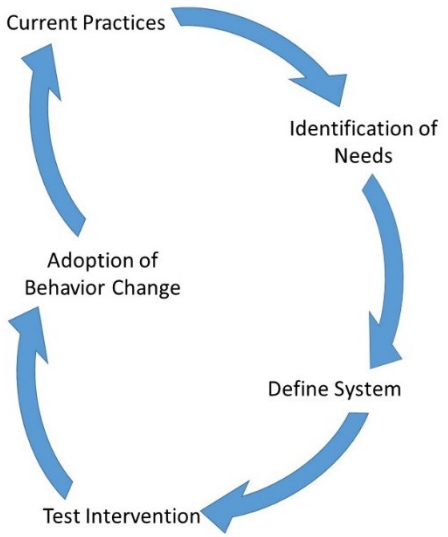
CHeRI faculty, technicians and students have worked hard to earn the trust and identify the needs of its stakeholders, Florida deer farmers. Since 2016, CHeRI has served 203 farms, and conducted diagnostic evaluation of 1955 deer. CHeRI has evaluated the efficacy of three vaccines for HD viruses and has identified multiple additional pathogens that cause significant mortality in Florida deer. Our entomology team has identified two previously unidentified insect vectors of HD viruses which sets the stage for developing an integrated pest management plan.

Using a science-based approach to tackle the needs of deer farmers, CHeRI scientists and students have published 42 scientific publications in the peer-reviewed scientific literature with 395 citations and trained 50 postgraduates or post-docs. In addition to gaining scholarly knowledge, these veterinary students, graduate students and post-docs interact regularly with deer farmers and develop an appreciation and working understanding of the industry.

In addition to conducting the science that is needed for the industry, in the past 5 years CHeRI has worked hard to translate that science into practical knowledge that deer farmers can use. CHeRI has held 10 workshops or field days that were attended by >500 people. CHeRI has

participated in every event hosted by the Southeast Trophy Deer Association (the regional industry group), and has multiple web or social media resources that have been accessed >48,000 times. Importantly, deer farmers who followed the best management practices outlined by CHeRI Extension saw a 25% decrease in animal mortality at a substantial financial savings to their farms.

Figure 1. Iterative process that defines the CHeRI research agenda




The next 5 years of CHeRI will build on the existing science and Extension (Figure 1). We will continue to focus on identifying HD viruses that kill deer so that vaccine manufacturers can make Florida-specific vaccines. We will also concentrate on other viruses such as mule deer poxvirus that is causing mortality in Florida deer. Now that we have identified which midges are carrying HD viruses, we can move forward with creating integrated pest management plans. And we will continue to work on decision making tools like our CHeRI HD dashboard, that will help deer farmers make informed decisions about management of their farms.

CHeRI by the numbers, 2017-2023:

- 42 peer reviewed scientific publications
- 395 citations
- 50 trainees
- 545 workshop participants
- 1955 deer diagnosed
- 25% reduction in mortality

## *Strategic Plan 2024-2029*

### *A focus on the pathogens that impact white-tailed deer*

The backbone of CHeRI's success has been its farm-based deer diagnostic program. When farmers have a deer die, they call the deer hotline. A necropsy crew is deployed to the farm where the team works remotely with our Wildlife Extension Veterinarian to conduct a gross examination and collect tissues. The tissues enter the diagnostic pipeline and once results are generated, a confidential veterinary diagnostic report is sent to the farmer. We will continue our necropsy and clinical support of deer farmers.

Key to the success of any farm is the production and maintenance of healthy deer. CHeRI research has shown that 40% of all mortalities are caused by orbiviruses, which are the viruses responsible for HD. Now that efficacious vaccines have been developed for the two most common HD causing viruses (EHDV-2 and EHDV-6), CHeRI will turn its attention to bluetongue virus (BTV) which is the third leading cause of mortality in Florida farmed deer. Bluetongue virus is a diverse complex of virus strains (serotypes) and thus we will spend several years identifying the most common strains in Florida so that vaccines can be developed for them.

CHeRI first identified mule deerpox virus in 2016 and has since found it to be a significant source of mortality for suckling fawns in Florida. More than 50 fawns have died from the virus or complications resulting from the virus. CHeRI will work to provide best management practices to producers to contain this highly contagious virus. In addition, we will characterize the virus such that vaccine manufacturers can produce vaccines against it.

Viruses are not the only pathogens of deer. Bacteria play a significant role in the mortality of deer. Antibiotics are the main tool that farmers have to fight infections, but antibiotic resistance can reduce the effectiveness of those treatments. CHeRI will investigate the prevalence of the main bacterial pathogens and conduct antibiotic resistance testing on field collected samples. Based on findings, CHeRI will be able to recommend best practices for antibiotic use to achieve the best results for sick deer.

Parasites can also have a devastating impact on farms. Haemonchus worms cause morbidity and mortality in farmed white-tailed deer in Florida and can have locally devastating impacts. CHeRI will take a two-pronged approach to helping farmers mitigate those impacts. First, we will better understand helminthicide resistance to the most popular treatments for parasites and help farmers choose effective treatments. We will also work with forage specialists to provide food plots that reduce interaction with haemonchus worms. These food plot studies will have the knock-on benefit of gaining a better understanding of which forages best support the nutritional needs of trophy quality white-tailed deer.

### *Create an integrated pest management plan for Culicoides spp., the vectors of HD*

Hemorrhagic disease viruses are vectored from one deer to another by biting midges (no-see-ums, *Culicoides* spp.). While effective vaccines will help decrease mortality, an integrated pest

management plan that reduces midges is essential to reducing the burden of disease on farms. The first years of CHeRI were devoted to finding which of the 52 species of midge in Florida were responsible for vectoring the viruses. Now that we understand that the majority of pathogen transmission is caused by just three midge species, we can begin to study their ecology so that we can develop integrated pest management plans. To that end, CHeRI scientists will study the three Culicoides vector species to determine what time of day they are most active, where do the larvae live, and which habitats do they prefer. Once we better understand where and when they are active, we can make recommendations about how to control them. Additionally, we will determine the best methods for control. It is unclear if Culicoides are becoming resistant to the most commonly used pesticide, permethrin and if alternatives are more effective or  and is prevalent throughout Florida.

In summary, over the next 5 years, CheRI will:

- Characterize bluetongue virus serotypes for vaccine development
- Identify poxvirus outbreaks and develop best management practices for containment
- Determine antibiotic resistance for commonly used antibiotics
- Describe helminth resistance for haemonchus worms, identify effective antihelminths
- Design food plots that increase trophy deer production value and decreases parasite load
- Design integrated pest management plans that use the most effective pesticides in the most effective way possible.

### *Working Toward Decision-Making Tools for EHD Management*

Commodity production increasingly relies on decision-making tools for best management practices.  Pesticide application, nutrient application, harvest timing and breeding can all be made more efficient and therefore cost effective if decisions are made based on the best available information about the production system. The best tools are those that are based on industry needs. Our first application the CHeRI HD Dashboard provides real-time information on HD outbreaks in Florida. Farmers who wish to vaccine animals or transport animals within Florida have found this dashboard to be extremely useful. We will use our iterative process of research design and stakeholder participation to develop decision-making tools that aid Florida deer farmers to increase production and quality of animals. Potential tools include:

- Pesticide application and deer vaccination calendar based on vector and/or virus emergence
- Risk calculator that shows locations of high risk of EHD emergence
- Encyclopedia of common deer farm diseases
- Stocking calculator that allows users to input the cervid species they want to farm and the acreage of their pens/preserves.
- Wildlife Conservation Certification program that deems farms wildlife friendly if they meet certain environmental milestones.

### *Chronic Wasting Disease and Florida Deer Farming*

In June 2023, the Florida Fish and Wildlife Commission (FWC) announced that it had found CWD in Florida for the first time. Immediately the regulatory landscape of Florida shifted to include CWD management zones. CHeRI will work with deer farmers to navigate the changing regulatory landscape, to advocate for the best scientific research that benefits deer farmers, and to translate that research into practical knowledge that will reduce the spread of CWD.

### *References*

Anderson, D.P., Frosch, B.J., Outlaw, J.L. 2017. Economic impact of the United States cervid farming industry. Agricultural and Food Policy Center, The Texas A&M University System. APFC Research Report 07-4.

Table 1. Deer Farm Practice and/or the Needs identified by CHeRI to combat EHDV. The third column identifies the research that CHeRI funds to address those needs and the fourth column identifies the benefit to deer farmers.

| Practice | Need | Research Needed | Outcome and Application |
|---|---|---|---|
| **EHDV and BTV Vaccination/Treatment** | Efficacy Studies of all available vaccines | Field trial Newport Vaccine (completed) | Reduce use of ineffective vaccine. Farm specific field trials likely needed to establish buy-in |
| | | Identification of and collaboration with other vaccine producers (ongoing) | Assess the state of knowledge for vaccine development and production |
| | | Challenge studies with naïve animals using novel subunit vaccines (ongoing collaboration with vaccine makers) | Test promising vaccines to hasten their production and marketing |
| | Understand HD epidemiology | Longitudinal studies of individual and population serology in white-tailed deer; longitudinal studies of EHDV genetics | Development of transmission and epidemiological models that will aid in predicting risk at the farm, regional, and national scale. Will aid in development of vaccine schedule and composition from year to year |
| **Permethrin spraying is used statewide without guidance on effective application** | Efficient, cost effective application of pesticide | Test efficacy of new pesticide products | Field trial of permethrin wrapped fences (completed) |
| | | Vector ecology studies (underway) | Essential to emergence modeling |
| | | Development of vector emergence model that allows farmers to focus timing and location of pesticide application | Essential to integrated pest management and recommendations for pesticide application |
| | | Development of attractants (ongoing) | Can aid in reducing host-vector interaction |
| | | Integrated pest management (additional funding needed) | Management of substrates, pesticide use, attractant use, health effects on deer |
| | | Vector competency studies (completed) | By defining which Culicoides are competent vectors we can focus our ecological studies |

| | | | |
|---|---|---|---|
| | | Development of biocontrol agents that do not involve chemical control (additional funding needed) | Species specific pest control that reduces bycatch and increases biodiversity |
| **Comingle exotics** | Identification of reservoir hosts | Identify which species are refractory and which are reservoirs. (ongoing) | Make recommendations about which cervids may increase the risk of EHDV to white-tailed deer |
| | | Develop SIR model of host species composition | |
| **High density penned animals** | Best stocking density | Prevalence of pathogen/exposure may be different in populations of different density | Recommendations of BMP on stocking density for farmed cervids |
| | | Develop SIR model of different host densities | |
| **Improper diagnosis of EHD** | Better, cheaper, faster diagnostics | Develop UF diagnostic pipeline to identify HD and non-HD causes of death and morbidity (ongoing) | Free, reliable diagnostic services for the deer farm industry are now available to Florida deer farmers |
| **Inconsistent vaccination year to year** | Understand regional risk of EHD each year | | Development of effective vaccines that are delivered to animals in a consistent and therapeutic way. |
| | Formulate regional vaccines based on predictive modeling of dominant strains | Risk models of EHD emergence | |

Table 2. Causes of mortality other than EHDV, the research need, and application to the deer farmer

| Pathogen or disease syndrome identified in Florida-farmed deer | Research Needed | Application to deer farmer |
|---|---|---|
| **Sepsis/enteritis** | Novel diagnostics that consider the entire microbiota and coinfections | Better diagnostics will help veterinarians and deer farmers treat deer with appropriate therapies |
| **Co-infections associated with EHDV** | Many animals are infected with EHDV but are asymptomatic. Need to understand what makes EHDV pathogenic at the host and pathogen level | Treating the co-infection may increase survival and reduce mortality |
| ***Trueperella pyrogenes*** | Surveillance to understand the true cost of this pathogen | Develop an appreciation for symptoms, treatment and BMP that reduce trueperella infection. |
| **Cervidpox virus** | Surveillance to understand the true cost of this pathogen | This pathogen was found in moribund fawns for the first time on a farm in Florida. Increased familiarity with symptoms and appropriate treatment regimes will reduce mortality |