"WHAT, THEN, SHALL WE DO?"

THE BOONE AND CROCKETT QUANTITATIVE WILDLIFE CENTER IS FINDING SOLUTIONS

BOONE & CROCKETT
Quantitative Wildlife Center

Ask most wildlife agency staff what wildlife divisions do, and it's likely you'll get a long list, including timber harvest and prescribed fire, game species management, non-game management, threatened and endangered species work, permitting, wildlife-human conflict resolution, boundary posting, and (last but not least) hunting and trapping regulations.

Nevertheless, while the to-do list is long, nearly all of the tasks arguably fall into two broad categories (habitat work, species regulations), with decision-making and priority-setting guided by two over-arching decision rules (cost/benefit analysis and consideration of relative risk).

HABITAT WORK

This is any action having to do with the art and practice of designing and implementing treatments that affect food and cover. Because most plants don't move around on the landscape quickly, habitat manipulations are relatively easy to evaluate. The physical impacts of treatments are out in the open and there for anyone to see.

SPECIES REGULATIONS

These are rules that define hunter behavior with the explicit goal of managing species populations and demographics. Unlike habitat work, regulations are relatively difficult to evaluate. For one thing, in many places, regulations change on a regular, and often annual, basis. This shape shifting virtually guarantees that the rules rarely persist long enough to be systematically evaluated. For another, regulations are constructs not things. By definition, success almost always is evaluated indirectly from surveys of hunter behavior and harvest. Only rarely are field evaluations conducted to assess regulatory impacts on wildlife population sizes or demographic characteristics. Other complexities include that it's surprisingly difficult to know how many animals actually exist in a population, the demographics of said populations, or the true prevalence of (mostly) unseen diseases. Not surprisingly, differences in opinion, personal observations, and culturally popular anecdotes can be (and often are) persuasive to both decision makers and the affected public.

COST BENEFIT ANALYSES AND ASSESSMENTS OF RELATIVE RISK

Whether it's children complaining ("I'll do it later" never comes), lawn care choices (mulch or rake?), or the consequences of ignoring spousal "suggestions," cost-benefit analyses and considerations of relative risk are baked into most decision making. While this should hold true for wildlife disease management as well, the data on which to systematically base these considerations mostly doesn't exist.

"WHAT THEN SHALL WE DO?"

— Billy Kwan, Linda Hunt, in *The Year of Living Dangerously*

When it comes to more fact-based surveillance, something that might help is interactive and geospatially explicit models that efficiently transform the unseen into the visible. Michigan State University wildlife and fisheries scientists are developing such tools, usually in close cooperation with agency biologists and stakeholder groups.

Researchers Dr. William Porter and Dr. David Williams have been leading the Boone and Crockett Quantitative Wildlife Center's efforts to address those needs. The Center has recently developed several methods that (a) provide accurate numerical estimates of deer, (b) direct the focus of CWD surveillance efforts, and (c) predict the impacts of various harvest strategies on the prevalence of disease.

To create accurate numerical estimates of deer, Dr. Sonja Christensen used distance estimation techniques to systematically transform observations of deer into predictions of the number of deer present on defined landscapes. While her product was specifically developed in response to requests from hunters and DNR biologists to better understand trajectories of deer recoveries following epizootic hemorrhagic disease (EHD), the method is applicable to landowners as they seek better understanding of deer numbers on their private properties.

To direct CWD surveillance, Jonathan Cook developed a method based on expert opinions about CWD risk factors (e.g., captive cervid premises, out-of-state hunting in CWD endemic areas, carcass disposal practices, etc.) mathematically combined to create heat maps displaying gradients of risk. The model accurately predicted CWD risk in Michigan, and now

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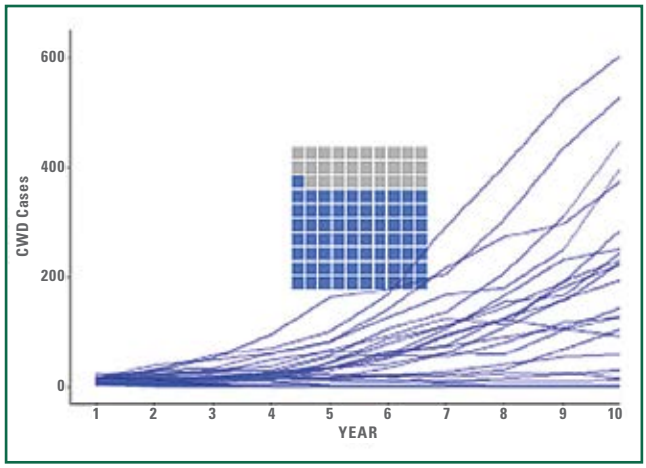
Indiana and Ohio (two states without known 'free-ranging' CWD) are considering how to implement Jonathan's model in their jurisdictions to direct surveillance efforts.

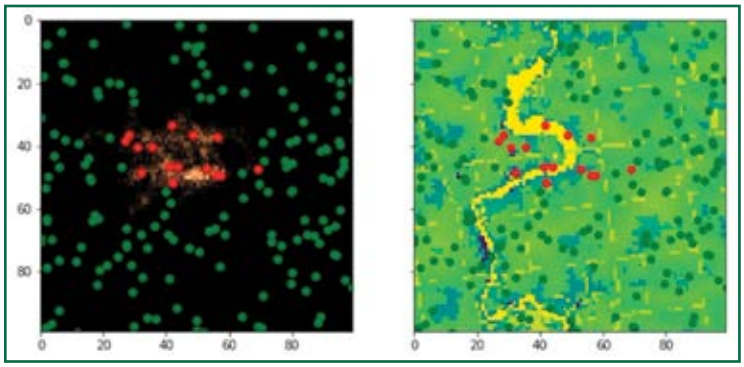
To predict CWD spread from known infections, a third tool, also developed by Cook, combines information about deer behavior with geography to predict the directionality of disease spread. Michigan (and sooner or later, Indiana and Ohio) may implement the tool to allocate surveillance resources and implement regulations designed to enhance biosecurity.

A fourth agent-based model, developed by Dr. Aniruddha Belsare (in collaboration with Dr. Josh Millspaugh), addresses questions raised initially by Missouri DNR. Now loaded with Michigan data, the product gives DNR biologists, the Natural Resources Commission, and eventually, perhaps even hunters themselves an opportunity to "test drive" various regulation packages before implementation and quantify the likelihood that those packages help or hinder disease. Under development is a "shiny app"—in our terms, a simplified version of the model with certain set variables that will run on any smart phone, making the tool potentially accessible to anyone (very cool).

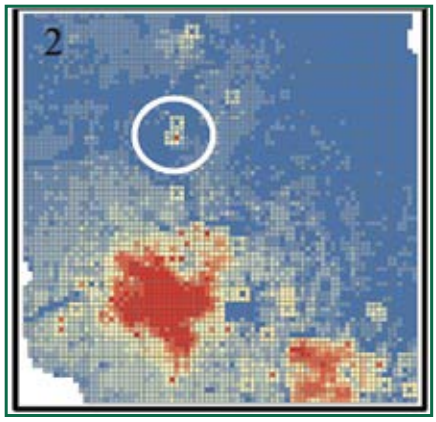
Finally, a model under development by doctoral candidate Noelle Thompson will allow managers to evaluate the relative risk of various practices (e.g., baiting versus food plots) and the relative benefit of various deer removal strategies (e.g., sharp-shooting under different densities of disease, more or less access to infected and exposed deer).



ABOVE: Dr. Belsare's model is being used by Michigan DNR to evaluate the risk of CWD outbreak under different deer regulation packages.
BELOW: Noelle Thompson's model simulates local-scale CWD spread with individual deer on real landscapes to allow testing of management interventions, like culling, complicated by limited access to land.



BELOW: Dr. Sonja Christensen working at the Quantitative Wildlife Center. Dr. Christensen used distance estimation techniques to systematically transform observations of deer into predictions of the number of deer present on defined landscapes.



LEFT: Jon Cook's model incorporates deer movement and landscape and spoil characteristics to predict spread of CWD, including improving our ability to anticipate long-distance sparks.

MICHIGAN STATE CWD MODELING TEAM

DR. SONJA CHRISTENSEN
RESEARCH SPECIALIST IN THE DEPARTMENT OF FISHERIES AND WILDLIFE
Evaluating the interaction of emerging diseases on white-tailed deer populations

JON COOK
B&C FELLOW - PHD CANDIDATE
Risk integration and decision making: surveillance approaches for CWD

DR. ANIRUDHHA BELSARE
B&C FELLOW - POST-DOCTORAL RESEARCH ASSOCIATE
An agent-based approach for surveillance and management of CWD

NOELLE THOMPSON
B&C FELLOW - PHD CANDIDATE
Modeling white-tailed deer disease risk to determine cost-effective management techniques

Aiming for release in late 2020, this agent-based "consequences" product will be focused on investigating the effectiveness of five commonly considered management approaches, individually and in combination:

1—Selective removal of different age and sex classes within management areas of various sizes (i.e., 5, 10, or 15 km circles around a diseased individual or an infected location;

2—Nonselective removal within management areas of different sizes with the aim of population reduction;

3—Intensive but nonselective removal in "high-use zones" like river corridors or forest fragments in agricultural landscapes;

4—Removals under various hunter-harvest regimes, including "earn a buck," antler point restrictions, and hunting under a two-buck limit;

5—Removals with and without various hunting practices in place, like baiting and the use of lures.

We often hear (and have heard for 40 years) that researchers and their outputs don't relate to "real world" concerns. In fact, just the opposite is true. This misperception needs to change if for no other reason than doing more of what we've always done isn't going to help. New science and better predictive technologies are essential to respond to the (literally) existential concerns on the conservation horizon. Perhaps more than anything else, new strategies are key to providing a set of common facts for the public and agencies to use as they deliberate and chart courses of action in managing a disease that's now (and will be) part and parcel of most deer management discussions for the foreseeable future.

That's huge, because, after all:

"EVERYONE IS ENTITLED TO HIS OWN OPINION, BUT NOT TO HIS OWN FACTS"
— Daniel Patrick Moynihan

Dr. William Porter (head of table) leading a meeting with fellows at the Boone and Crockett Quantitative Wildlife Center.