LYME DISEASE, WILDLIFE MANAGEMENT AND PUBLIC HEALTH

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Summary

http://drfoxvet.com/info/LYME-DISEASE-WILDLIFE-MANAGEMENT

Do some state and federal wildlife management practices create public health problems? The One Health concept is helpful in answering this question, since it recognizes that human, animal and ecosystem health are interconnected. It has been adopted by the American Medical Association, American Veterinary Medical Association and other health organizations (1). Embracing this unifying principle has generated a significant movement since its adoption was published as a resolution by the National League of Cities (2). An illustrative review presented below applies the One Health concept to a public health issue in Minnesota that is relevant to all states and countries where Borreliosis (Lyme disease) and other tick-transmitted and animal-harboring diseases are an increasing public health concern (3). It will show how this health issue is connected to human activities variously condoned and legally protected by local and state authorities by the Department of Natural Resources in particular. Some evidence-based public health proscriptions and initiatives are considered.

INTRODUCTION

My concern over Minnesota’s Grey wolf being de-listed from protection under the Federal Endangered Species Act and becoming a legitimized fur-bearer for trappers and a trophy animal for hunters to harvest once again, lead me to research these questions: 1. How well does the state Department of Natural Resources (DNR), which would be managing the wolf ‘harvest,’ accord with the One Health paradigm, wherein public health is dependent upon environmental/ecological health and animal health and well-being? 2. Would a more science and ethics based (rather than traditional, cultural and profit-driven approach,) be called for to bring public policy into compliance? When wildlife management is eco-centric, monitoring and managing indigenous wildlife species to facilitate much needed ecosystem conservation, preservation and restoration (CPR) of natural biological diversity (including indigenous plant varieties) --- the essential elements of proper stewardship and a healthier natural environment are put in place. A healthier, balanced environment means healthier human and domestic as well as wild animal populations and communities.

One vivid example comes to mind that occurred while I was working in East Africa and India. There, I saw a dramatic seasonal increase in tick-born diseases affecting livestock and people associated with the pesticide-induced virtual extinction of the oxpecker and other tick-eating birds, aggravated by the confinement of poultry that once helped control ticks when raised free-range. The profit-driven multinational drug company response of more vaccines and stronger pesticides which predictably followed is the antithesis of a One Health approach to disease prevention.
As is the case in other regions across the U.S., the ‘wilderness’ and wild lands of Minnesota are in various stages of recovery following two centuries of unregulated human exploitation, from logging and mining, to farming, hunting and trapping. Now under the banner of the nascent One Health movement, the dots are being connected between public health and healthy ecosystems and wildlife (4,5). This calls for a re-assesment of current State and Federal management and protection of natural resources beyond current laws and policies, advocating “sustainable” natural resource use. In particular, the encouragement (but not necessarily enforcement) of ‘best’ farming and ranching practices, monitoring of recreational activities such as hunting and commercial trapping by setting seasonal quotas, calls for a new approach from the One Health perspective.

LYME DISEASE EPIDEMIOLOGY

The Minnesota Department of Natural Resources and Pollution Control Agency have sufficient data (see below) to be able to connect the dots leading to correction in public policy, awakened as it should be by the Minnesota Department of Public Health’s alarm bell report citing an escalating incidence of Lyme disease in the human population. My colleagues in the veterinary profession will attest to its increase in the canine population as well. According to the Minnesota Department of Health Disease (6)

“Record numbers of Lyme disease cases were reported to the Minnesota Department of Health (MDH) in 2004, including substantial numbers of case-patients exposed to infected Ixodes scapularis ticks (deer ticks or black legged ticks) in some western and central Minnesota counties not previously considered high risk areas. Other diseases transmitted by I. scapularis namely human anaplasmosis, (HA, formerly known as human granulocytic ehrlichiosis or HGE) and babesiosis, were also reported at record or near-record levels.--- Since MDH began Lyme disease surveillance in 1983, 5,833 cases of Lyme disease (agent, Borrelia burgdorferi) have been reported among Minnesota residents. In 2004, a record 1,023 Lyme disease cases were reported; this represents a 116% increase from the 473 cases reported in 2003, and an 18% increase from the prior high of 867 cases in 2002. As recently as 1999, Lyme disease incidence was 6.0 per 100,000 Minnesota residents, versus the 20.0 per 100,000 observed in 2004.” It is notable that veterinarians in Minnesota are also treating more cases of Lyme disease in dogs (7).

DEER CONNECTIONS

The MN DNR’s management of the White tailed deer population is challenging because high-density populations in some hunting zones can mean high tick numbers, (8) especially when wolf predation on sick and debilitated deer is disrupted or negated by killing these natural deer-herd managers. Some 250,000 licensed deer hunters in 2011 were permitted to kill up to 5 deer to depopulate some areas. This widely quoted figure refers to the estimated seasonal number of actual deer hunters, but may be a low figure considering that in 2011 there were 192,331 registered deer hunts, with a combined total of licenses sold for regular firearms, archery and muzzle loaders reported to be almost 760,000. (The MN DNR manages a reported 110 game species on 1.1 million acres, generating over $25 million from the sale of hunting and trapping licenses in 2008).
Several studies have shown that abundance and distribution of deer ticks are correlated with deer densities (9). When the deer population was reduced by 74% at a 248-acre (100 ha) study site in Connecticut the number of nymphal ticks collected at the site decreased by 92%. The relationship between deer and tick abundance, and human cases of Lyme disease was documented in the Mumford Cove Community in Groton, CT, from 1996 to 2004. The deer population in Mumford Cove was reduced from about 77 deer per square mile to about 10 deer per square mile (4 deer per square kilometer) after 2 years of controlled hunting. After the initial reduction the deer population was maintained at low levels. Reducing deer densities to 10 deer per square mile (4 deer per square kilometer) reduced the risk of humans contracting Lyme disease in by more than 90% (10).

But a 2006 study by the Center for Infectious Disease Dynamics at Penn State found that reducing the deer population in small areas may lead to higher tick densities, resulting in more tick-borne infections in rodent hosts leading to a high prevalence of tick-borne encephalitis and creating a tick “hot-spot” (11). This finding confirms the importance of DNR management practices encouraging thriving populations of smaller carnivore species (e.g. wolves) to help control rodent numbers, especially as a ‘buffer’ when there is over-harvesting of deer in some hunting zones and seasons.

RODENT AND CARNIVORE CONNECTIONS

The probability of more people and their ‘litmus’ dogs becoming infected increases with the more there are of tick infested rodent species that harbor this, and other diseases in the environment that these people inhabit or visit. In one field study it was reported that “the strongest predictors of a current year’s risk of Lyme disease were the prior year’s abundance of mice and chipmunks and abundance of acorns 2 y previously. In no case did inclusion of deer or climate variables improve the predictive power of models based on rodents, acorns, or both” (12).

When the carnivorous avian and mammalian predators that keep rodent numbers in check are being killed by trappers and hunters, and in some states dying from diseases transmitted by free roaming cats and dogs we should anticipate higher Lyme burdens. These rodent species are not on the DNR’s radar for ecosystem management, otherwise we would most likely not have this escalating public health problem, the environmental effects of climate change/global warming (13) not withstanding.

The above probability of escalating tick-born diseases in Minnesota, and most likely therefore in other states where Lyme disease and other tick born diseases are prevalent, is supported by the carnivore mortalities from trapping recorded by the MN DNR. 1,012 Bobcats, 903 Fisher cats, and 1,842 Martens, whose main diet is small rodents, were killed by licensed trappers in 2010-2011. The DNR also states:

“The gray fox is classed as a furbearer, and is managed with a regulated hunting and trapping season each year. Only a few thousand are taken for fur annually. Information not posted by DNR---The red fox is the most common predator in the state. Hunters and trappers harvest up to 100,000 each year, but the fox population remains strong. ---Coyotes can be harvested by hunting and trapping. In Minnesota, roughly 4,000 are shot or trapped each year.”
But in another set of figures for 2010-2011 the DNR reports the killing of 44,051 coyotes by small game hunting license holders. In addition, government predator control agents exterminate ‘troublesome’ coyotes, on which there are now bounties in some counties, and trap and kill an average 200 problem wolves annually. These hunted predator species are the main rodent population control agents in healthy, well-managed ecosystems, along with Mink and the Long and Short tailed weasels who are also prey to trappers. Significantly, the number of licenses given out to trappers has risen from 925 in 1982-83 to 7,027 for the 2008-2009 season which parallels the rise in Lyme disease diagnosed in-state.

What will be the long-term ecological impact of the DNR’s annual kill quota of a provisional 400 wolves following a permit lottery for 6,000 wolf hunters and trappers who are likely to catch non-target endangered species such as the Lynx as well as other smaller carnivores? Couple this with over 7,000 licensed trappers already having permits for other species, the small rodent population and attendant ticks are likely to flourish for decades to come. Lyme and other tick born diseases will predictably escalate in the human population.

AVIAN CONNECTIONS

Smaller birds of prey also help regulate the population of rodent carriers of Lyme and other diseases, but many succumb to poisoning from ingesting lead shot in downed prey and from the remains of hunter-killed deer. According to a 1999 report by the Minnesota Pollution Control Agency, some 1,300 tons of highly toxic lead shot is put into the environment by hunters every year. This accumulating poison gets into the food chain, paralleling the accumulation of mercury from the state’s coal-fired power plants which contaminate fish in the great lakes, children and other consumers. Lead has been found in Woodcock, and may be an issue in other ground-feeding, insect-consuming birds that play a significant role in controlling ticks, notably pheasants, grouse, turkeys, partridge and crows. Permitting hundreds of thousands of these birds to be killed annually by state licensed small game hunters may be imprudent from a public health perspective.

HUMAN CONNECTIONS

Urbanization and other anthropogenic factors can be implicated in the spread of the Lyme disease organism (Borellia burgdorferi sensu lato) to humans. The Wikipedia entry on Lyme disease provides a useful synopsis, stating:

“ In many areas, expansion of suburban neighborhoods has led to gradual deforestation of surrounding wooded areas and increased border contact between humans and tick-dense areas. Human expansion has also resulted in reduction of predators that hunt deer as well as mice, chipmunks and other small rodents – the primary reservoirs for Lyme disease. As a consequence of increased human contact with host and vector (carrier), the likelihood of transmission of the disease has greatly increased. Researchers are investigating possible links between global warming and the spread of vector-borne diseases, including Lyme disease. The deer tick (Ixodes scapularis, the primary vector in the northeastern U.S.) has
a two-year life cycle, first progressing from larva to nymph, and then from nymph to adult. The tick feeds only once at each stage. In the fall, large acorn forests attract deer, as well as mice, chipmunks and other small rodents infected with B. burgdorferi. During the following spring, the ticks lay their eggs. The rodent population then "booms". Tick eggs hatch into larvae, which feed on the rodents; thus the larvae acquire infection from the rodents. At this stage, tick infestation may be controlled using acaricides. Adult ticks may also transmit disease to humans. After feeding, female adult ticks lay their eggs on the ground, and the cycle is complete. On the West Coast of the U.S., Lyme disease is spread by the western black-legged tick (Ixodes pacificus), which has a different life cycle.

Human interspecies interferences and practices that do not foster optimal biological diversity in ecosystems (14), notably the rattle snake roundups in the Southwest, cause rodent population imbalances. These maladaptive behaviors are associated with increased incidence of various zoonotic (animal-to-human) diseases such as documented outbreaks of Sylvatic plague and Hanta virus in the U.S. southwest. Rodent populations can also harbor leptospirosis and tularemia, carry other tick-born diseases such as Tick paralysis, Rocky mountain spotted fever, Colorado tick fever, and Ehrlichiosis, and be the reservoirs for mosquito transmitted St. Louis, LaCrosse and California encephalitis viruses, Eastern and Western equine encephalitis and West Nile fever. Municipal, agricultural and wildlife/natural resource management activities that disrupt terrestrial and aquatic ecosystems and consequentially reduce indigenous populations of insectivorous birds, bats and other vertebrates and invertebrate species that variously help control tick and mosquito numbers, give an anthropogenic edge to the emergence of zoonotic diseases.

CONCLUSIONS

The evident fostering of high deer densities as a form of wildlife farming by the Minnesota DNR, compounded by the deers’ access to agricultural land to feed on corn and other crops, coupled with decades of harvesting and near extermination of small and large carnivores, and lead from hunters’ shot poisoning raptors and ground-feeding birds who are also killed in large numbers by licensed small game hunters, has created a perfect ecological storm for the proliferation of Lyme and other disease-transmitting ticks. The same is probable in other states following the same cultural traditions and imperatives of hunting, trapping and predator control.

The science-based ecological and ethical management/stewardship of natural resources and wildlife is in accord with the One Health concept, and also with enlightened self interest, when concern for animals and nature takes priority over our own pecuniary interests: and when equal and fair consideration are given to all stake holders, human and non-human. The ecological anarchism of a minority of special interest groups, which make up their own laws and regulations while circumventing others concerning the extraction of natural resources and managed ‘harvesting’ of wildlife for primarily recreational and commercial purposes, has no place in civil society or a truly democratic nation state.
The control and prevention of endemic zoonotic diseases and new emerging diseases that threaten both the human and domestic animal populations call for an inter-agency and inter-disciplinary approach with public involvement (15), the effectiveness of which would be enhanced by a shared vision of the One Health concept (16). Such a vision shared by the veterinary and medical professions and allied specialists in epidemiology, conservation biology and other sciences calls for a diplomatic and ultimately collaborative engagement with other stakeholders and responsible parties including: State and Federal regulatory agencies, politicians, legislators, the business community, farmers and hunters, non-profit conservation and animal protection organizations. A civil society initiative to examine how natural resource and wildlife management practices can help play a critical role in the reduction and prevention of zoonotic diseases such as Borreliosis (Lyme disease), along with improved protection of predator species other than the human, is long overdue.

References

(1) (www.onehealthinitiative.com and www.onehealthcommission.org )

(2) www.nci.org/influence-federalpopicy/resources)


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