ADDRESSING THE ROLE OF CATTLE-ELK INTERACTIONS IN THE EPIDEMIOLOGY OF INFECTIOUS DISEASES IN SOUTHWESTERN ALBERTA

Background:

In southwestern Alberta, pastures are commonly grazed by both free-ranging elk and beef cattle. This provides an opportunity for transmission of pathogens between these species. Disease transmission at the domestic animal-wildlife interface may result in maintenance or amplification of production limiting diseases in livestock, and threaten public health and endangered wildlife species. For example, brucellosis circulation in wildlife of Yellowstone National Park, Wyoming affects the cattle industry, bison herds, and human health. The rate, success, and dynamics of transmission for pathogens are influenced by the route of transmission and the temporal and spatial structure of interactions between hosts.

Objective:

The overarching goals of this study are to investigate the structure of cattle-elk interactions, to look at the effect of the level of these interactions on the risk of pathogen presence in these hosts, and ultimately to better understand the dynamics and impacts of disease circulation in a southwestern Alberta grazing ecosystem.

Methods:

i. Collaborators:
This is a collaboration between the departments of Production Animal Health and Ecosystem and Public Health, Faculty of Veterinary Medicine, and the Department of Environmental Science, Faculty of Environmental Design. The project is integrated within the ongoing Montane Elk Research Program, and new collaborations are being established with National Parks and laboratories in Alberta.

ii. Study site:
SW Alberta is the core of our study area with a high level of cattle-elk interactions. YaHaTinda Ranch and Jasper National Park are control sites where there is a low level of cattle-elk interaction.

iii. Diseases:
We have selected diseases with 3 distinct types of transmission routes. These can then serve as models for pathogen transmission in other systems. These include:

1. Fecal-oral transmission: Johnes disease, (MAP: Mycobacterium avium subsp. paratuberculosis)
2. “Nose-to-nose” direct contact: Bovine Viral Diarrhea and Infectious Bovine Rhinotracheitis
3. Indirect transmission through another host: Neospora caninum

These diseases are important in Albertan beef cattle and have a tremendous cost for the livestock industry. They are also present in wild cervids, but little is known about their importance and epidemiology in these wild hosts. Furthermore, MAP may be a public health issue as it has been linked to Crohn’s disease in humans.

iv. Animal location data and sample collection:
Through the Montane Elk Project, GPS telemetry radio collars have been deployed on 119 elk from 7 herds and 60 cattle in southwest Alberta. Using these GPS collar data we will determine cattle and elk distribution on the landscape, and model the contact structure between these two species (territory overlap). Archived elk samples from 7 herds in southwest Alberta (2006-2008) are available: 119 serum and 58 fecal samples. Thirty more elk will be collared and sampled by March 2010. An
additional 30 and 200 serum samples are also available from Jasper National Park and YahaTinda elk herds, respectively. More fecal samples will be collected from each of the 9 elk herds during winter 2010. Cow-calf ranches will be stratified with respect to the levels of interaction with elk. Serum and fecal samples will be taken from cattle in selected ranches to estimate disease prevalences (fall 2010-winter 2011). Ranchers will be surveyed about farm management, cattle vaccination and herd health history (to control for confounding factors), and potential factors influencing cattle-elk interactions.

v. Disease testing:
Serum samples will be tested for presence of antibodies against Neospora caninum, BVD virus and IBR virus (from February 2010). Fecal samples will be cultured to assess presence of MAP. Subsequently, molecular epidemiology techniques will be used to determine the relationship between strains.

vi. Analyses:
Regression analyses will be performed to look for correlations between disease presence and the level of cattle-elk interaction. A qualitative risk assessment on disease transmission between elk and cattle will be performed. Advanced spatial analysis will then be used to generate models of pathogen transmission between cattle and elk, and validate them with our prevalence data. Our results will indicate whether further research on inter-species pathogen transmission is warranted. A more intensive sampling might be necessary to improve the accuracy of our prevalence estimates.

Significance:

Production limiting infectious diseases have a tremendous impact on livestock industry in Alberta by the cost and the constant effort required for their monitoring and prevention. The Albertan grazing ecosystem is an interface between cattle and wildlife where infectious diseases may be circulating. This could result in maintaining the endemicity of these diseases, in a threat for various wild ungulates, and in jeopardizing the equilibrium of this ecosystem. Therefore, this project will generate valuable knowledge for both the Albertan cattle industry and the wildlife management agencies by informing them on the respective role of elk and cattle in this epidemiological system, the possible measures and interventions, and the risks for other endangered ungulates (e.g. Bison, Caribou, Moose). Occasions of wildlife-livestock interactions are various, therefore this work will be applicable to diverse areas in Canada and around the world, and other wildlife species. Extrapolation to other diseases with similar transmission routes will help to anticipating consequences of a disease introduction (e.g. Foot and mouth disease, brucellosis, tuberculosis). This work will promote health and welfare of food animals as well as wildlife, and will provide us with essential insight into processes driving this ecosystem.

In the case of Mycobacterium avium subsp. paratuberculosis, the understanding the pathogen ecology is essential to identify potential source of contamination for human populations if the link with Crohn disease was to be confirmed. These issues would be paramount for cattle industry and wildlife management. Indeed, humans are directly branched on this ecosystem whose health is to be considered as « One Health ».

Besides these aspects, this project provides a unique opportunity for the trainee to work on a multidisciplinary project including field and laboratory work, GIS technologies, epidemiology and ecology. This project will include different departments of the UCVM (University of Calgary-Faculty of Veterinary Medicine) into a rich network of academic institutions, research programs (SW Alberta Montane Research Program), and collaborators from National Parks, Ranchers Association, Animal Health agencies and laboratories in Alberta.

In conclusion, this work will be of great interest for the Albertan livestock industry and wildlife management and conservation, for the promotion of animal and public health in Canada and internationally.