Risk Assessment as a Tool to Evaluate Health Status of a Salvaged Herd of Captive Wood Bison

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Extended Abstract: The diseased bison issue is one of the most controversial wildlife management issues in northern Canada. In 1990, a federal environmental assessment review panel recommended that all existing free-ranging diseased bison *(Bison bison)* in and around Wood Buffalo National Park be eradicated and replaced with healthy wood bison (Connelly et al. 1990). This proposed action was met with conflicting mandates and perceptions and opposing fundamental values of the stakeholders involved, and with strong public opposition, mostly from the First Nations communities and environmental organizations (Gates 1993). Two major concerns expressed during this process were the loss of genetic diversity represented by infected herds and the possible impairment of ecosystem integrity (Gates 1993).

The Hook Lake Wood Bison Recovery Project is a community-based wildlife conservation project that was initiated in 1996 and is run cooperatively between the Government of the Northwest Territories (N.W.T.) and the community of Fort Resolution, N.W.T., through the direct involvement of the Aboriginal Wildlife Harvesters' Committee and Deninu Kue' First Nation. A principal objective of the project is to salvage genetic diversity from the Hook Lake herd, a wild, free-ranging herd of wood bison in the Slave River Lowlands that is infected with bovine tuberculosis *(Mycobacterium bovis)* and brucellosis *(Brucella abortus)*. The long-term goal is to use the captive, disease-free herd as source stock to reestablish a healthy herd of free-ranging bison in the Hook Lake area (Gates et al. 1998; Nishi et al. 2001, 2002).

The Hook Lake Wood Bison Recovery Project uses a combination of techniques to salvage and propagate a healthy captive herd of wood bison that includes (1) orphaning of newborn wild-caught calves that may have been exposed to *B. abortus* and *M. bovis*, (2) field-testing of calves for maternal antibodies to brucellosis prior to entry in the isolation facility, (3) isolating calves in pairs to prevent potential spread of disease, (4) hand-rearing and prophylactic treatment of captive calves using a combination of antimycobacterial and anti-*Brucella* drugs, (5) serological testing

[1]NatureServe Explorer (version 4.0, July 2004) lists the wood bison as *Bos bison athabascae*.

of first-time heifers and their captive-born calves at three days and four weeks post-calving, and (6) intensive whole-herd testing for both diseases and removal of any suspicious reactors (Nishi et al. 2001, 2002). From 1996 to 1998, we captured a total of 62 calves. Presently, 57 individuals comprise the founder herd along with an additional 65 captive-born animals ranging in age from yearlings to five-year olds.

To date, there have been no confirmed cases of tuberculosis or brucellosis, although in winter 1997, one isolated calf pair was removed from the 1996 cohort (before the calves were combined into one herd) because of a tuberculin reaction in one female calf (Y33). Because a comparative cervical test could not be conducted by a Canadian Food Inspection Agency-accredited veterinarian within 10 days of the caudal fold test, the reactor calf and its pen mate (male Y43) were euthanized as a precautionary measure. A postmortem conducted on both calves did not reveal any gross visible lesions although histopathological observations determined that acid fast bacteria were present in a single minute granulomatous lesion in a single mediastinal lymph node of the reactor calf. Laboratory culture for the isolation of *Mycobacterium* spp. was negative (Gates et al. 1998).

All founder animals have been repeatedly tested using a combination of serological tests for brucellosis and tuberculosis. We defined an overall risk model for each disease that was a product of three risk probabilities—(1) prevalence of true infection at time of capture, (2) efficacy of the prophylactic treatment regime, and (3) sensitivity of the disease testing regime—summed across the three founder cohorts (APFRAN 2003). We used recent data from Wood Buffalo National Park bison (Joly and Messier 2004) to estimate initial values for prevalence of true infection in captured bison calves at time of capture; however, we did not include an assessment of the prophylactic treatment regime in the risk model because of a paucity of data on drug efficacy in bison. Our assessment of the disease-testing regime was based on one type of diagnostic test for each disease—the caudal fold test for tuberculosis and the buffered plate antigen test (BPAT) for brucellosis. We used a first-order Markov model to estimate sensitivity of the testing regime with the criteria that all 57 founders had tested negative on a minimum of eight BPAT and caudal fold tests, respectively. Based on this risk model, the 95^{th} percentile of the probability of at least one infected bison being present given that all bison have tested negative according to the testing regime was < 0.0003 for tuberculosis and < 0.0002 for brucellosis (APFRAN 2003). We suggest that the risk estimates for the animal health hazards *B. abortus* and *M. bovis* are very low and negligible, respectively, and lie within Canada's appropriate level of protection based on past and recent importation of livestock into Canada.

The probability of a latent infection, i.e., an animal that is infected but tests negative on diagnostic tests, in a founder bison is one potential complicating factor that is not well addressed by this model. However, it is also important to note that the risk model was likely conservative for several reasons. Firstly, the risk model used only a single test for either disease, although we have employed a wide spectrum of diagnostic blood and serological tests for both diseases. Secondly, the model did not explicitly estimate the efficacy of the drug treatment protocol.

Thirdly, the overall model did not consider results of postmortem examinations on captive-born animals that showed the absence of disease infection in over 35 culled bison. Consequently, we suggest that the true risk of disease in the Hook Lake Wood Bison Recovery Project is actually lower than the model output. We suggest that the benefits of the recovery project should be considered, especially, the reproductive capacity of the founding bison and their offspring and the unique and variable lineage of genetics this herd represents for conservation of wood bison in Canada (Wilson 2001).

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