

# **Counting Sheep: A Deterministic and Stochastic Model of Bighorn Sheep and Mountain Goats in Rocky Mountain National Park**

Becky Patrias

28 July 2009

There is an expanding population of mountain goats near Rocky Mountain National Park in Colorado that is threatening to invade the territory of native bighorn sheep. It is feared that competition for forage and terrain from the mountain goats will endanger the livelihood of the bighorn sheep population. In order to model this potential interaction, a two-species population model with a disease sub-model is created. First, a logistic growth model that includes competition between the two species is made. Then a SIR disease sub-model representing the effects of an outbreak of *Pasteurella* in the bighorn sheep is added to the competition model. This model is used to make a stochastic simulation of the population dynamics. The final model and simulation illustrates suppression of the bighorn sheep population caused by the mountain goats which brings the sheep to dangerously low numbers directly following a *Pasteurella* outbreak.