LAB 7. HIERARCHICAL MODELS IN JAGS

The purpose of this exercise is to give you practice in designing and implementing multi-level models to represent hierarchical processes in ecology. In the problems below, please prepare a directed acyclic graph (DAG) representing the knowns and the unknowns. Use your graph to help you write out mathematical expressions for the posterior and joint conditional distributions. Code the models in JAGS. Please keep track of the difficulties you encountered and how you overcame them.

Exercise 1. Hierarchical controls on plant invasions

Fridley et al. (2007) offered an interesting synthesis of studies of factors that control the susceptibility of plant communities to invasion. One of their fundamental conclusions was that invasibility depends on processes that operate at different spatial scales—large scale processes create a context that influences the invasion process at finer scales. In this exercise you will use simulated data to model controls on invasion at two scales:

(a) At the fine scale, your model represents the number of exotic species in a 0.1 ha plot as a linear function of the proportion of the plot that contains disturbed (i.e., bare) soil.

(b) At the large scale, you will represent the intercept of your fine scale model as an asymptotically increasing function of road density. Roads facilitate invasive dispersal.

The data are provided two files (*"Invasive Road Data.csv"* and "*Invasive Count Data.csv*"). So, the idea is that there is some maximum number of invasive species that would be found in undisturbed plots that is set by the regional species pool. This maximum is approached at a decelerating rate as proximity to roads increases. Think about the form of the scientific model here.

Prepare a plot of the fit of the lower level model vs. observations (i.e., number of invasive plants as a function of soil disturbance at the average road density). Think about the nature of the data and be careful to choose the appropriate likelihood. Write 2-3 paragraphs describing your results with appropriate statistics and figures. Discuss the insights gained from your model.

Literature Cited
Fridley, J. D. *et al.* (2007). The invasion paradox: Reconciling pattern and process in species invasions. Ecology 88:3–17.