

# Disease Ecology: Can Plant Disease Affect Human Health?

by

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## Instructions

After you have been introduced to Sin Nombre virus (SNV) and sudden aspen decline (SAD), discuss the following questions in your group and be prepared to share with the class.

### *Question Set A*

What abiotic variables do you think would be affected by the amount of canopy cover in an aspen stand?

How would these abiotic variables be affected by a loss of canopy cover?

### *Question Set B*

Could sudden aspen decline (SAD) and recent increased prevalence of Sin Nombre virus (SNV) in humans be related?

If so, how? If not, why not?

## Data Sheet 1

*Experimental design:* Lehmer et al. (2012) studied stands of aspen trees that varied in how affected they were by sudden aspen decline (SAD), a disease that kills more than 90% of aspen trees in a stand within 3–6 years. As the trees die, their aboveground biomass (crown) begins to die (fade); the authors measure this dieback as “crown fade.” The authors measured the density of the overhead tree canopy (canopy cover) using a densiometer.

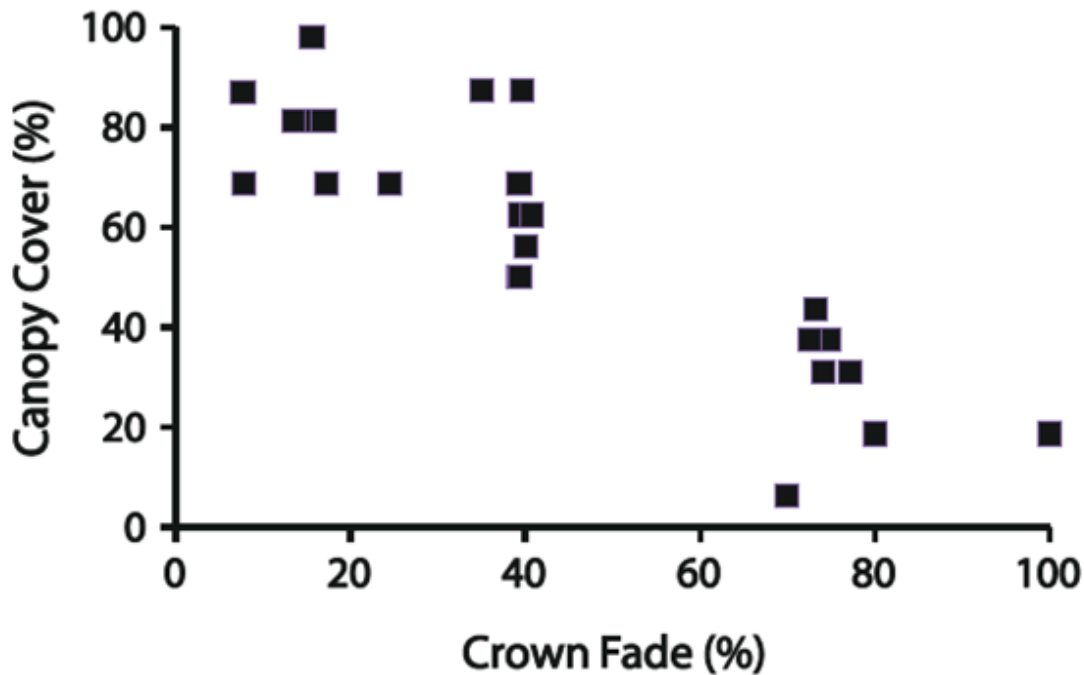


Figure 1. Crown fade vs. canopy cover. Lehmer et al., 2012.

### Question

1. Based on Figure 1, what is the relationship between crown fade and canopy cover?

## Data Sheet 2

*Experimental design:* Lehmer et al. (2012) sampled each aspen stand at 100 sampling locations and recorded what type of vegetation was present at each location. Using these 100 sampling locations, they were able to calculate the relative percent cover of rock and bare ground, in addition to forbs, graminoids (grasses), shrubs, and vegetative litter for each aspen stand. All of the plant species considered together are considered “Understory Plant Cover.”

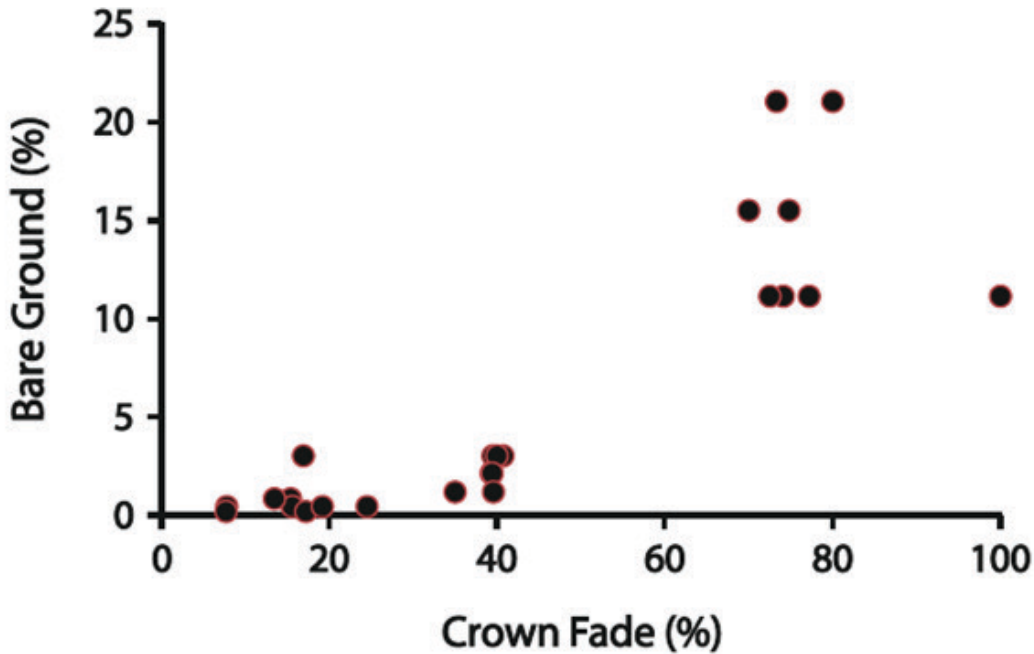
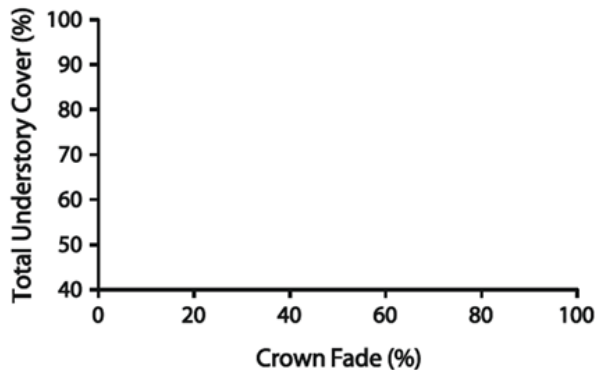


Figure 2. Crown fade vs. bare ground cover. Lehmer et al., 2012.

### Questions

- Based on Figure 2, what is the relationship between crown fade and percent cover of bare ground?
- Given the relationship between crown fade and percent cover of bare ground presented in Figure 2, what is your prediction for the relationship between crown fade and percent cover of understory plants (total understory cover)? Draw your prediction on the axes below, and then explain your reasoning for your predicted relationship.



## Data Sheet 3

*Experimental design:* The biomass of all of the plant species in the understory (forbs, graminoids (grasses), shrubs, and vegetative litter) considered together are called “Total Understory Biomass” in Figure 3 below. Although Lehmer et al. (2012) found a decrease in percent cover of understory plants with an increase in crown fade, they found an increase in the total understory biomass (kg/ha) with an increase in crown fade. Hence, the authors found that as crown fade increased, less of the ground was covered in plants, but those plants had more biomass.

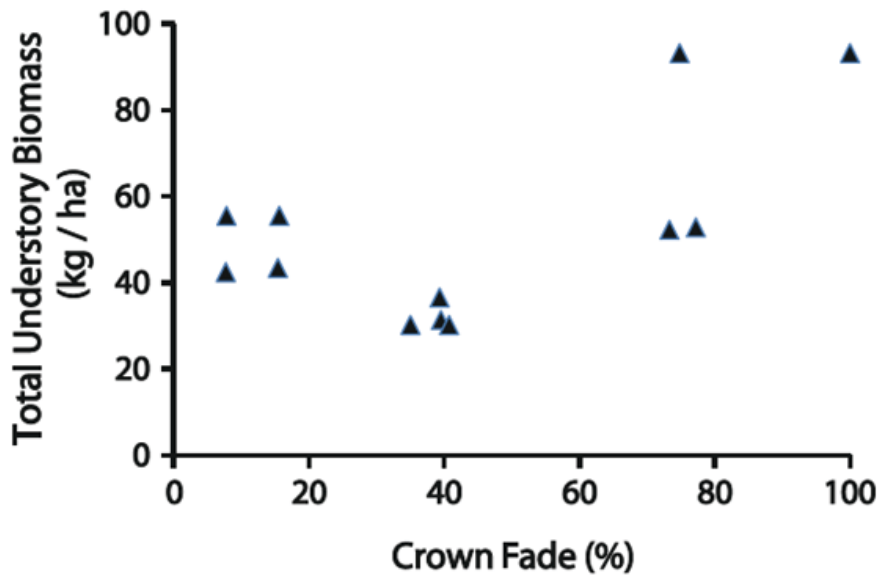
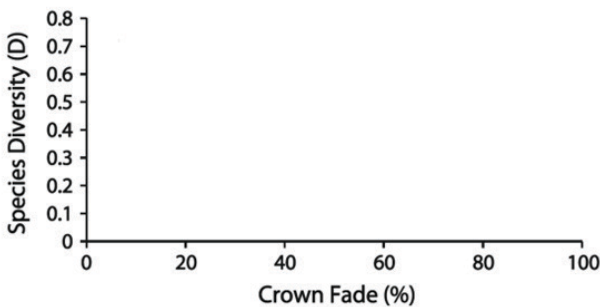


Figure 3. Crown fade vs. total understory biomass. Lehmer et al., 2012.

### Questions

- How does crown fade affect the dispersion of vegetative biomass in the understory of an aspen stand? Does the *dispersion* of understory plants become uniform, clumped, or random? Explain your reasoning. To answer this, consider the percent bare ground (Data Sheet 2) and total understory biomass (Data Sheet 3) results together, along with your corrected graph from Question 3.
- How do you think these changes in the plant community will affect the species diversity (the number or richness of species) of small mammals (e.g., mice, voles, shrews)? Draw your predicted relationship between crown fade and small mammal species diversity on the axes below, and then explain your reasoning for your predicted relationship.



## Data Sheet 4

*Experimental design:* Lehmer et al. (2012) used Sherman live traps to trap small nocturnal mammals that they checked each morning for captured mammals. At each site, they used 100 traps distributed across ten 100-m transects and thus they were able to calculate the density of small mammals (the number of rodents per hectare) in each aspen stand.

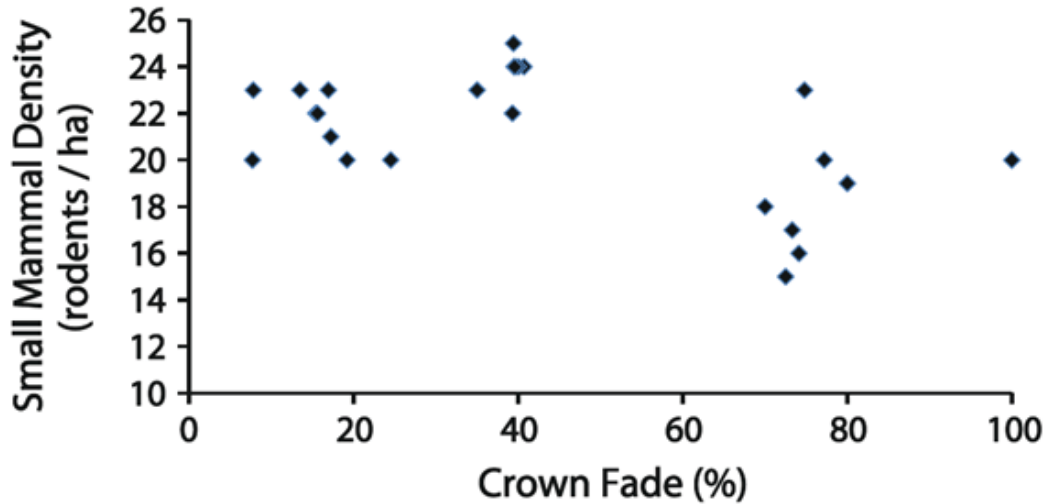
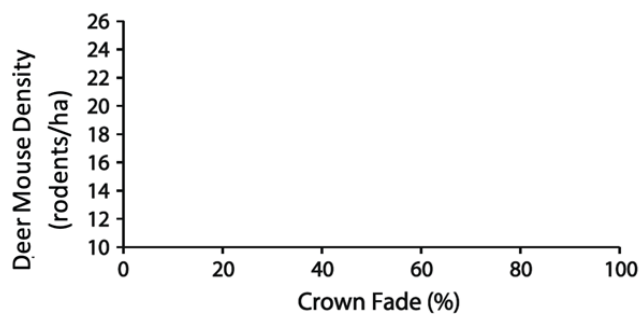


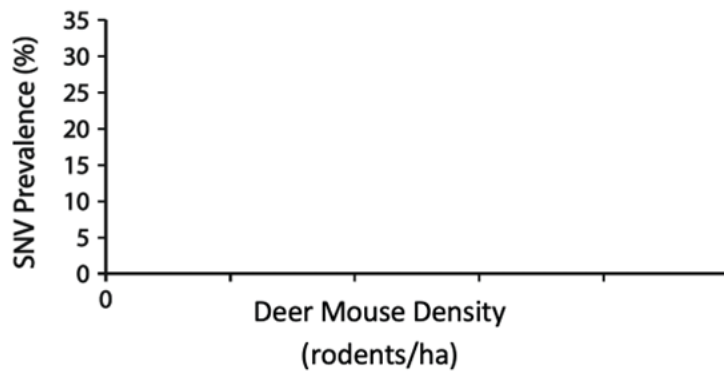
Figure 4. Crown fade vs. small mammal density. Lehmer et al., 2012.

### Questions

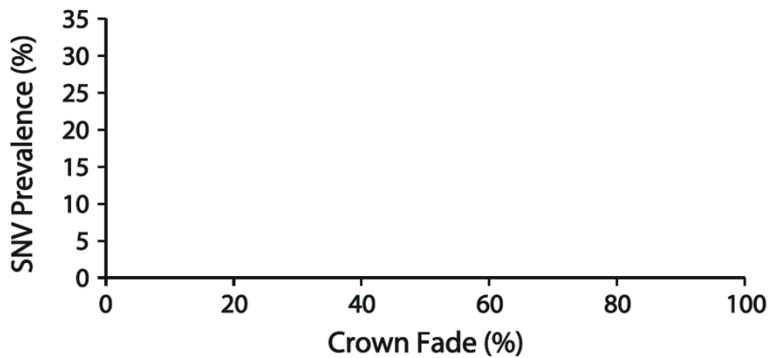
- Based on Figure 4, what is the relationship between crown fade and small mammal density?
- Figure 4 shows the overall relationship between crown fade and small mammal density. Not all small mammals, however, responded in the same way to crown fade. Deer mice were found in greater numbers in aspen stands that were heavily affected by sudden aspen decline (SAD). Draw your predicted relationship between deer mouse density and crown fade below. What is a possible explanation for why deer mouse density increases when overall mammal species diversity decreases in the community?



8. Deer mice are one of the best reservoir species for Sin Nombre virus (SNV). Lehmer et al. (2012) tested deer mouse blood samples for antibodies against SNV so that they could measure the prevalence of SNV in rodents from each aspen stand. Draw your predicted relationship between deer mouse density and SNV prevalence below, and then explain your reasoning for your predicted relationship.



9. Lehmer et al. (2012) found a significant correlation between the plant disease sudden aspen decline (SAD) and the prevalence of SNV. Draw your predicted relationship between crown fade and SNV prevalence on the axes below, and then explain your reasoning for your predicted relationship.



10. Now that you have worked through the data from Lehmer et al. (2012), do you think sudden aspen decline and the recent increased prevalence of Sin Nombre virus in humans could be related? Please explain why or why not. If you identified a relationship, would this relationship be causation or correlation? Explain your response.