

CLASS PROJECT: LAND-USE CHANGE AND LEAF BREAKDOWN RATE

ORGANIC MATTER CYCLING

One important ecological process is the breakdown of organic matter. In stream ecosystems, one important source of organic matter is leaves that fall in from riparian trees. These *allochthonous* inputs are an important source of nutrients and energy for stream food webs. Coarse particulate matter (e.g., leaves) is broken down into small particulate matter. A diverse set of benthic invertebrates help break down large organic matter such as leaves, called shredders (e.g., many species of caddisflies or Trichopteran).

THE QUESTION

Various sources of anthropogenic degradation (e.g., toxic run-off) can decrease the biodiversity of stream invertebrates, including shredders. Some insect groups, such as caddisflies, are extremely sensitive to pollution. Given that different aquatic invertebrates contribute to leaf breakdown rates, and that human land-use degradation can drive extinctions in aquatic invertebrates, then human watershed degradation could decrease the rate of processing of organic matter. These leads to the question: *how does human land-use influence leaf breakdown rates?*

QUANTIFYING LEAF BREAKDOWN RATE

Leaf breakdown rate can be quantified using leaf-litter bags. Mesh bags are filled with dried and pre-weighed leaves. These bags are placed out in streams. Invertebrates quickly colonize the leaf bags and start “shredding” or breaking down the leaves. The bags are then collected, dried, and weighed. Leaves lose mass at an exponential rate, thus:

$$Mass_t = Mass_{initial} * e^{-K*t} \quad \text{(Equation 1)}$$

With K as the exponential breakdown rate (proportion/day) and t is the number of days incubated in the stream. This equation can be rearranged to estimate K :

$$K = - \ln (Mass_t / Mass_{initial})/t \quad \text{(Equation 2)}$$

THE ASSIGNMENT

Part 1. A. Put out litter bags.—Take careful notes on the habitat type. Place in the slow-moving section of a stream. Make sure you can find it again (Note: Depth, dominant riparian vegetation, stream, location).

B. Use GoogleEarth to collect information on human land-use around your leaf-litter site.—Fill out the provided datasheet. Find the study location on GoogleEarth. Record the latitude and longitude. Record specified land-use information. Do this while the leaf litter bag is incubating.

C. Pick up litter bags at roughly 7 and 14 days later.—Turn in the litter bag and the data sheet. The TA will dry and weigh the leaf bags. We will post the data on the class website. **DUE March 14**

Part 2. Use the class data to investigate how human land-use influence leaf litter breakdown rate. Use equation 2 to estimate K for all of the data. How does land-use influence leaf litter breakdown rate? Plot the data. More details on this component to come. **DUE April 4**