

**Aquatic Insect Emergence from Headwater Streams:
Effects of thinning and riparian buffers**

Modification of assistance agreement with Dr. Andrew Moldenke (OSU)
(HAA003D00, task order HAF023F02)
9-5-03

Subject: Analysis of aquatic insect biomass produced under moderate thinning and clear-cutting with several different buffer widths along headwater streams.

Research sites: Continuation of studies at three Density Management Sites (Green Peak, Keel Mountain and Delph Creek). Green Peak and Keel Mountain were sampled for aquatic invertebrates pre-treatment; pre-treatment data for Delph Creek is from a nearby site (Lookout Mountain).

Status of currently funded research: The primary question is: “Does moderate thinning (with or without gaps) affect the total density, species richness, and biomass of ground-dwelling terrestrial arthropods adjacent to headwater streams?” We predict a short-term decrease in all 3 measures from disturbance, but a mid-term increase in these measures as deciduous shrubs and herbs increase in frequency and litterfall biomass (food pyramid cycles faster with deciduous litter so large predaceous insects and shredders increase proportionately). Current results are very preliminary: changes due to thinning are very minor, and are outweighed by differences in faunal assemblages naturally occurring along transects run perpendicular to streams. Varying widths of riparian buffers have little overall effect on fauna. Upland forest floor fauna *seems* not to be affected by thinning (analysis in progress).

The biggest effect of thinning on the arthropod fauna (if present) is likely to be due to the increased availability of soil moisture in the thinned stands, permitting microbial metabolism even during the driest seasons. This increased microbial metabolism is likely to be paralleled by an increased activity and density of soil microarthropods as the dry season progresses.

The clearest effect of my studies to date is the occurrence of early successional arthropod fauna in the 1-acre gaps. Such faunal elements may also be occurring in the thinned areas, but until the analysis is complete, I can not say for certain that they are there in any significant amount or richness. The basic experimental design involves 2 controls – unthinned forest *and* clearcut. The thinned areas are then compared along a scale stretching from the early successional species to the interior forest fauna. Not enough correlative natural history information is currently available to rank arthropod responses without such a localized scale. Casual observation reveals the only abundant early-successional faunal elements which are clearly present in the thinned stands are increased numbers and richness of pollinators (several groups); however, these arthropods were not sampled with pitfall trapping.

Proposed additional research: New data will be collected and analyzed to assess changes in aquatic invertebrate species richness and biomass due to thinning and alternative riparian buffers on the same three sites where the terrestrial invertebrate occurred. These data will tie in directly to the analyses of Olsen, Danehey and Chan concerning the effects of alternative riparian buffers at the same three sites. In the case of aquatic fauna the basic proposed mechanism of change (other than the disturbance itself) is the amount of additional energy fixed by deciduous shrubs overhanging the stream and the in situ photosynthesis by algae. If thinning significantly alters the input of sunlight to the stream, over some threshold relevant to photosynthesis, the basic structure of the aquatic faunal community should shift significantly from detritivores/fungivores to grazers. Such a shift would be expected to increase arthropod biomass and add species richness to the community since it should not adversely affect the detritivores.

An important correlated question is whether the thinning itself causes a fundamental change in the behavior of the emerged aquatic adults permitting, or forcing, them to fly much further from the stream. Since the stream produces the large majority of flying insects in this environment, such an alteration in flight behavior could change the availability of biomass for flycatching birds and bats.

Proposed methodology: Phenological patterns of aquatic emergence of insect biomass from headwater streams will be assessed with 0.5m² emergence tent-traps. The streams sampled will be the same as the pre-thin samples.

At Green Peak EPT flight patterns in thinned and control environments will be sampled with flight-intercept and malaise traps placed in perpendicular arrays to the stream. These trapping devices collect far more than just adult aquatic insects, permitting analysis of the distribution of all flying insects in these environments potentially available to flycatching vertebrate species.

Collaborators: I will continue to work directly with Chan, Danehey and Olsen to conduct analyses, and work closely with BLM personnel to ensure the work goes smoothly on the ground and that the analysis addresses questions important to the BLM. Potential collaboration with Rick Haefele of Oregon DEQ has been discussed relative to developing an automated computer-assisted identification system with joint specimen sets; Dave Lytle, OSU Dept of Zoology, will also collaborate on this topic. Rob Progar, US Forest Service-PNW (new appointment starting Oct 2003), has worked on the pre-thin analysis for the Density Management Study and is very interested in continuing to collaborate with BLM on this study. Rob may be able to further advance this work.

Products

1. Scientific publication on the effects of thinning & riparian buffer widths on aquatic emergence from headwater streams
2. Scientific publication on the seasonal & geographic distribution of flighted insect biomass in forests, and how it is affected by thinning.
3. Collaboration with Chan, Danehey, and Olson on a publication oriented to managers integrating the aquatic ecosystem responses to thinning and riparian buffers.

4. Advances toward producing an automated invertebrate identification system that will revolutionize the entire field of aquatic ecology. This is part of a National Science Foundation funded, 4-year study to produce a software package complete with hardware for automated 'handling'.

Schedule

1. Aquatic emergence and distribution of flighted insects under the forest canopy will be assessed throughout the warmer portion of the year (May to October, 2004).
2. Identification and biomass analysis will be made as soon as possible during the summer and progressing into the winter, complete by March 31, 2005.
3. Manuscripts produced by June 30, 2005.

Budget

Salaries (including OPE)

Moldenke @ 0.10 FTE8,200

Ver Linden @ 0.50 FTE26,400

Supplies

Malaise trap material300

Subtotal 34,900

Indirect costs @ 15%5,235

Total 40,135