Decomposition varies spatially and temporally by vegetation cover and elevation in a West Virginia watershed

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INTRODUCTION

Microclimate effects on decomposition, as a function of forest structure and/or elevation gradients within local scales, remain a relatively unexplored and potentially crucial area of research given the high uncertainties surrounding the spatial and temporal variation in decomposition rates from empirical studies. To assess the influence and interaction of forest structure and elevation on decomposition, we conducted a two-year litter bag study from 2011 to 2013 using a common leaf litter (*Betula alleghaniensis*) in the Weimer Run watershed (374 ha) near Davis, WV. We used a factorial design to discretize the watershed into three vegetation classes (OPEN – an open gap within the forest; CANOPY – beneath the forest canopy; SHRUB – beneath the shrub layer within in the forest) within three elevation classes (LOW - 975 m; MID - 1050 m; HIGH 1100 m) (Figure One).

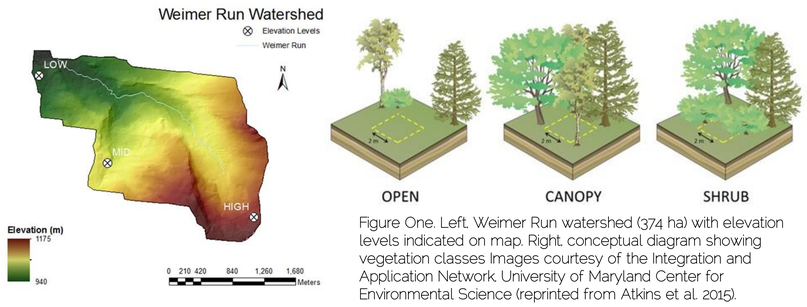


Figure One. Left. Weimer Run watershed (374 ha) with elevation levels indicated on map. Right, conceptual diagram showing vegetation classes Images courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (reprinted from Atkins et al. 2015).

RESEARCH QUESTIONS

1) What are the effects of forest structure (as represented by vegetation cover class) on decomposition across an elevation gradient within a cool, humid watershed in West Virginia?

2) Does decomposition differ seasonally among elevation and/or vegetation cover classes?

METHODS

- Five litterbags containing ~2 g of dried, recently senesced (< 7 days) *B. alleghaniensis* leaves were placed at each plot on October 1, 2011 (Figure Two).
- One litterbag, per plot was collected after 1, 8, 12, 20, and 24 months (this rotation was chosen so that bags were collected at the beginning and end of the growing season (June-October).

Figure Two. Example of litterbag deployment in the field at collection one (October, 2011) Silver tags are labels.

- Leaf C and N were determined using a Flash 2000 NC Soil Analyzer (ThermoFisher Scientfic).
- Acetyl bromide soluble lignin concentration (%ABSL) was determined using a modified method from Foster et al. (2010) and Fukushima & Kerley (2011) with a UV mini-1240 Photo-spectrometer (Shimadzu)
- Decomposition rates were compared among collections using Kruskal-Wallis tests in R.
- Further analysis will quantify lignin and cellulose concentrations in leaves and two common substrates.

Figure Three. Looking down the power line break near the top of the Weimer Run Watershed.

Figure Four. Dense shrub coverage. Note shrubs moving into open forest gap.

Figure Five. Canopy forest with shrub cover at the mid elevation level.

RESULTS & DISCUSSION

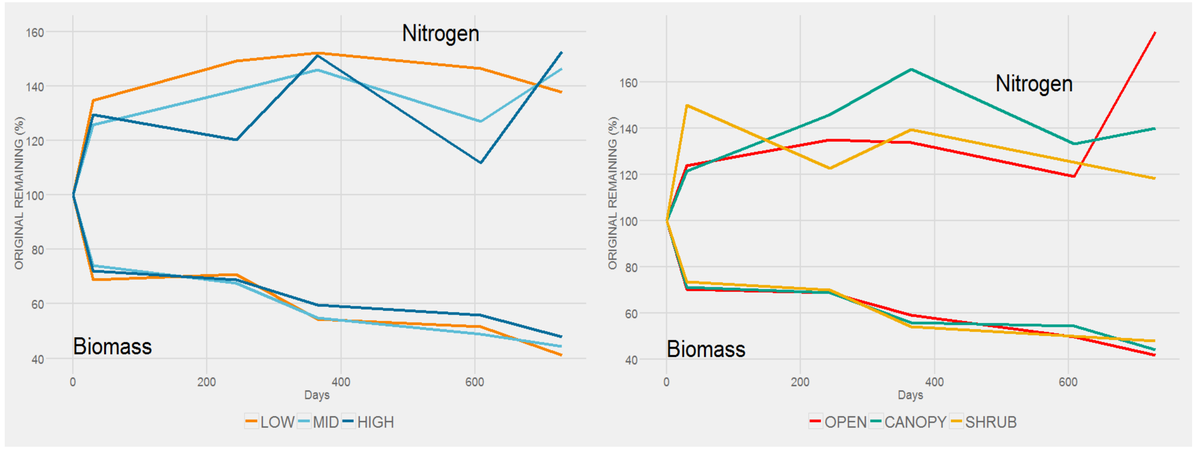


Figure Six. Original percentage (class means) of biomass and nitrogen remaining after each collection period, by ELEVATION on the left, and VEGETATION on the right.

- Total mass loss from litter bags differed with elevation after two years (LOW 41.1%, MID 44.4%, and HIGH 47.8%).
- Among vegetation classes, OPEN sites showed the highest total mass loss (41.7%), followed by CANOPY sites (44.2%), and SHRUB sites (47.7%).
- Relative decomposition rates (k) and total mass loss (%) among elevation classes were influenced strongly by season, with significant differences among classes after one month (p = 0.02) and 12 months (p = 0.02). Preliminary statistics are online (QR code and URL below).

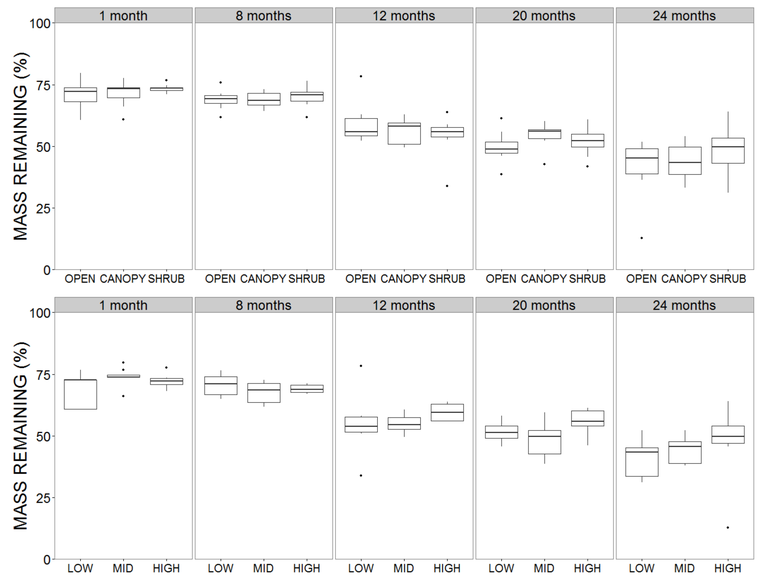
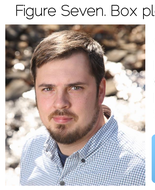


Figure Seven. Box plot of litter mass remaining, with VEGETATION at top, and ELEVATION at the bottom.

- During winter 2012, below-average snowfall and low temperatures resulted in retarded decomposition at higher elevations (Figure Seven at 20 months).
- N:Lignin ratio differed more by vegetation (OPEN = 8.24, CANOPY = 7.23, SHRUB = 9.42) than by elevation (LOW = 7.96, MID = 8.43, HIGH = 8.15).

FOR MORE . . .

tables, statistics, code, pictures, and figures can be accessed by the QR code to the right or at the URL: goo.gl/vkTYJC



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