The Effect of Storm Water Retention Ponds on Leaf Decomposition

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NSF Research Experience for Undergraduates

The College of William and Mary

Outline

- The Basics
- Measuring Leaf Breakdown
- Statistics and Thoughts

The Background: Why Decomposition?

- Decomposition is a functional measure of ecological integrity (Gessner and Chauvet 2002).
- Lightly impacted streams had leaf processing rates of a hard-leaf species more than 50% slower than in "intact" streams, fauna diversity was not lowered (Moulton and Magalhães 2003).
- Physical abrasion and microbial activity govern mass loss in developed streams, whereas processing was governed mainly by microbial and invertebrate activity in forested streams (Bird and Kaushik 1992).

Background: Decomposition

- Two possible sources of energy in freshwater streams:
  - Instream: photosynthesis by algae, moss, and higher aquatic plants
  - Imported (allochthonous): Autumn leaf fall
- Leaves are broken down by microbial activity, shredders, and physical fragmentation.

Questions

- Do storm water retention ponds affect leaf decomposition?
- If yes, what accounts for that change?
- What does decomposition tell us about ecosystem integrity?

Research Sites

Mulberry Place

- Diverse riparian zone (trees, low vegetation)
- Lightly Developed
- Narrow Floodplain
- “Soft” substrate

Research Sites

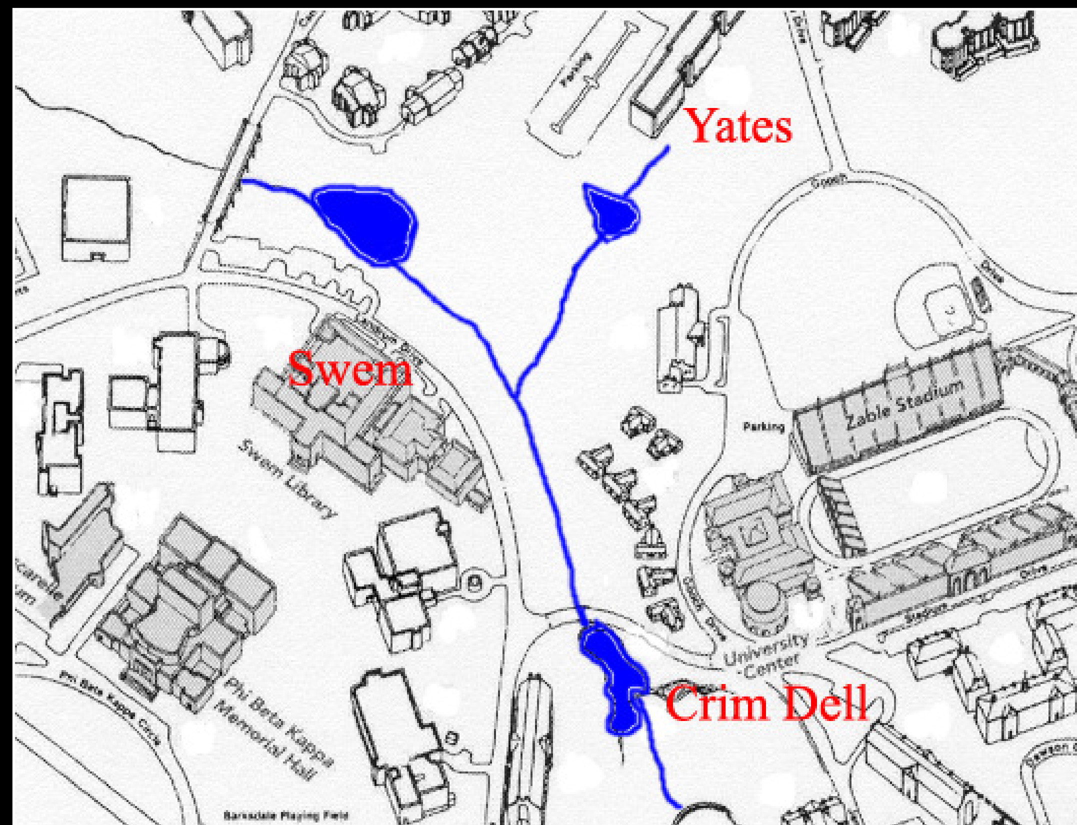
Ironbound Village

- Diverse riparian zone (trees, low vegetation)
- Urbanized
- Wide floodplain
- “Course” substrate

Research Sites

William and Mary Campus

- Riparian zone rich in trees
- Highly developed area
- Diverse substrate

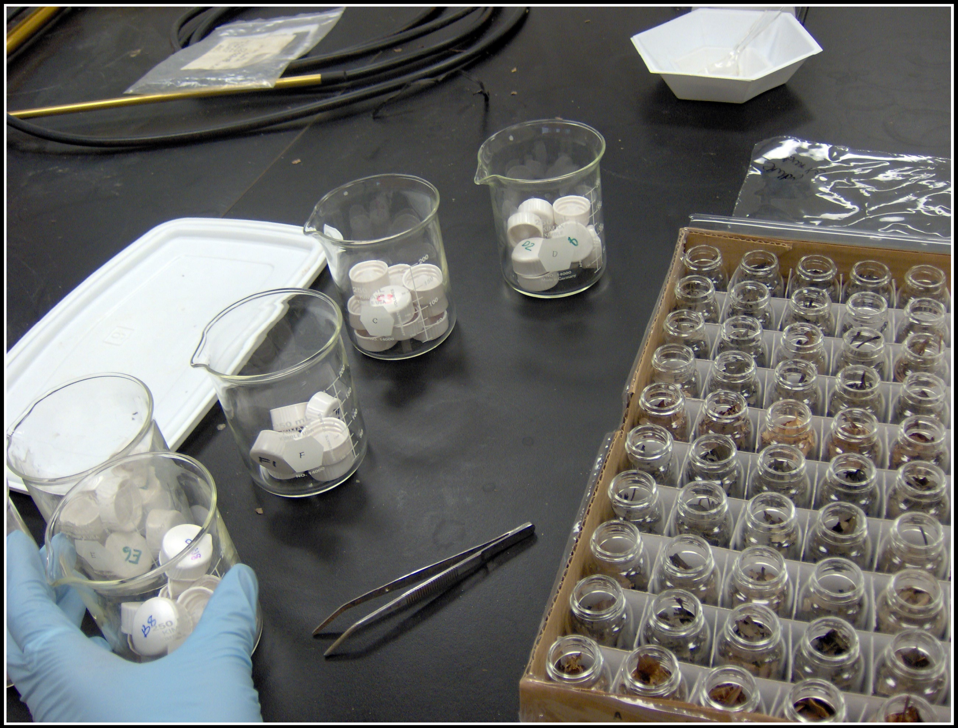


Experimental Design

- 50 gram mixed leaf litter bags
- Sets of five <u>upstream</u> and <u>downstream</u> of retention ponds
- Collect after 2 and 5 weeks.

Experimental Design

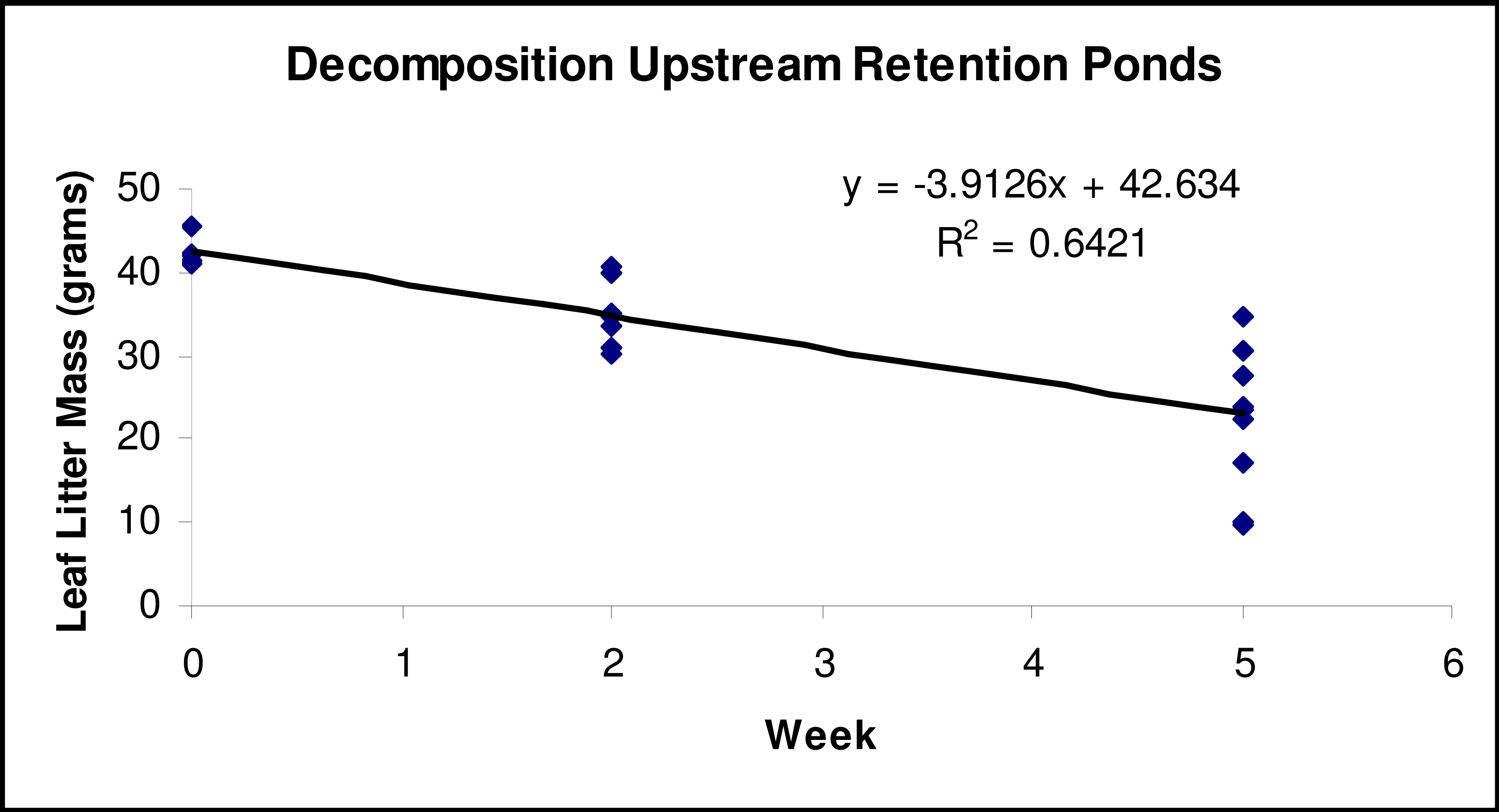
- Dry leaf litter for re-weighing
- Survey Invertebrates
- Ash leaf litter for AFDM



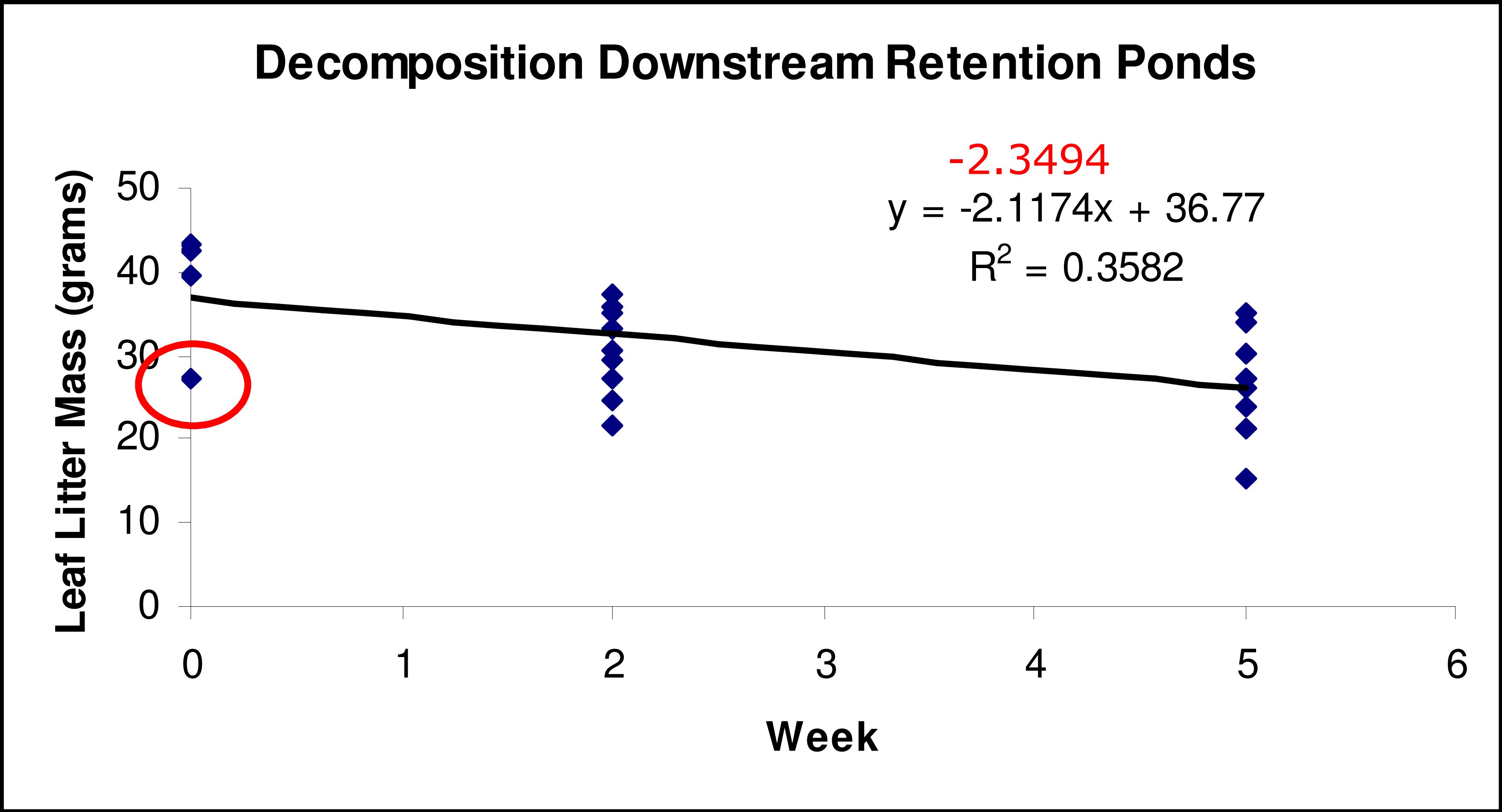
Results: Summary

- Decay Rates
  - Upstream: -3.91 g/week
  - Downstream: -2.12 g/week
  - Significant: NO
- Invertebrate Survey
  - Upstream: 10583
  - Downstream: 1380
  - Significant: NO
  - Invertebrates correlate with decay (overall)

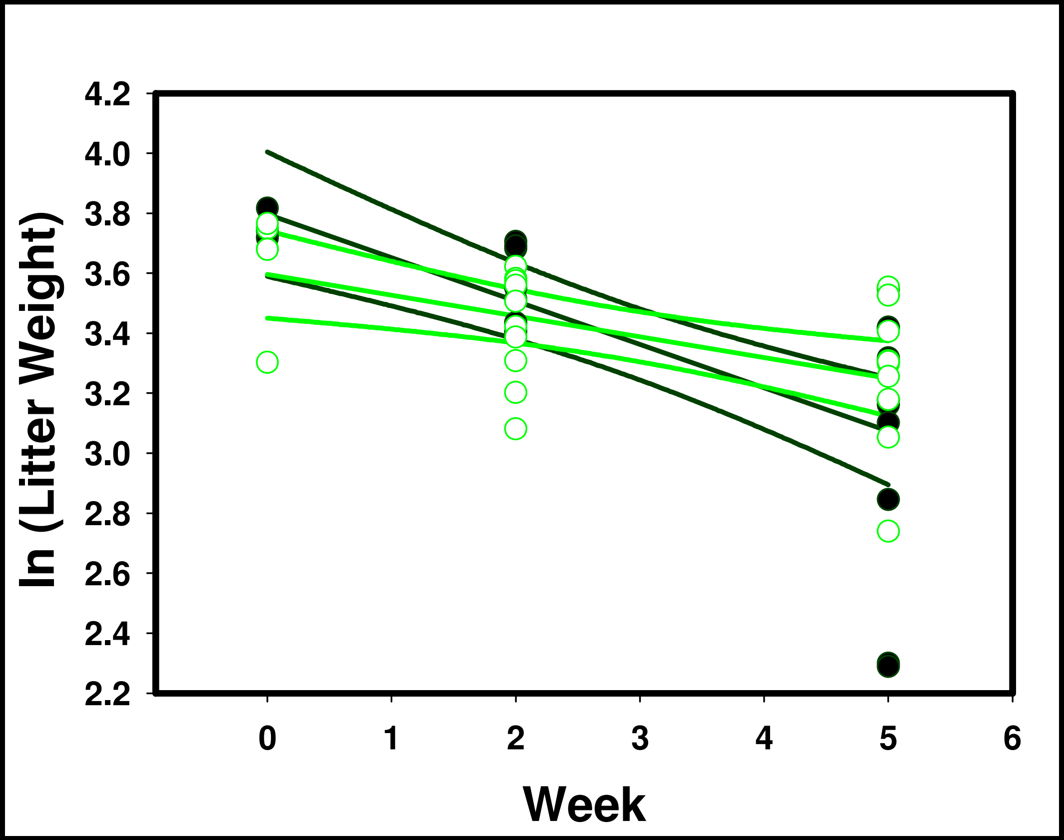
Results: All Ponds



Results: All Ponds



Results: Decay Significance



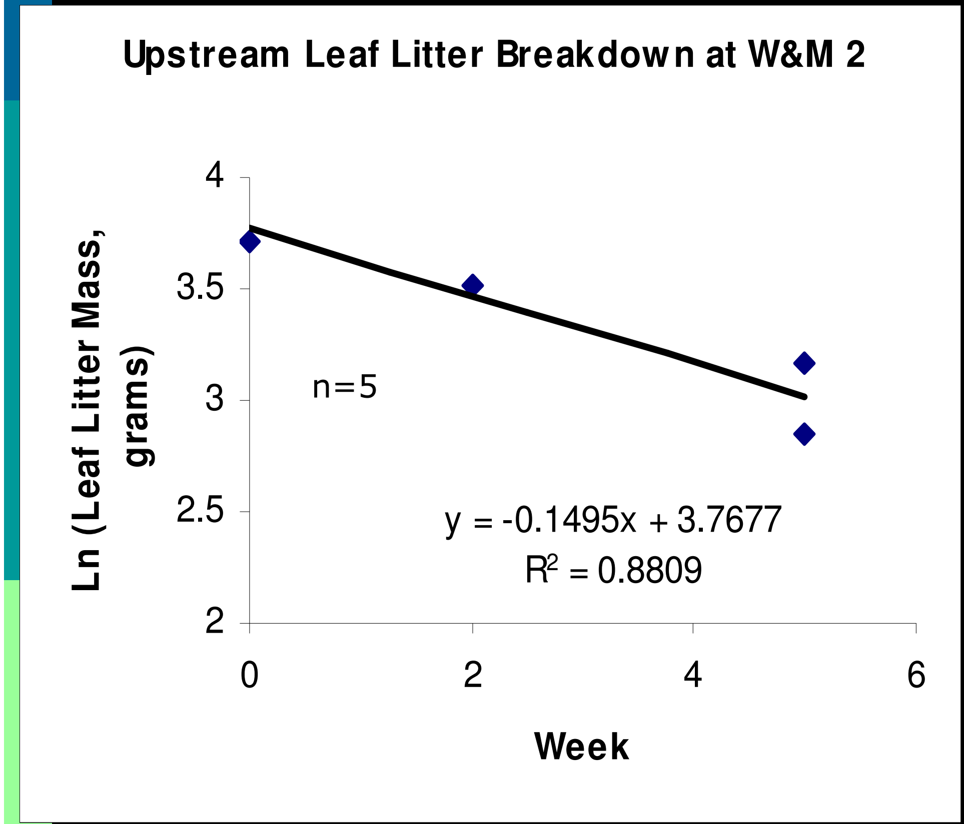
*Paired two sample t-test comparing leaf masses after 5 weeks, p = 0.1085

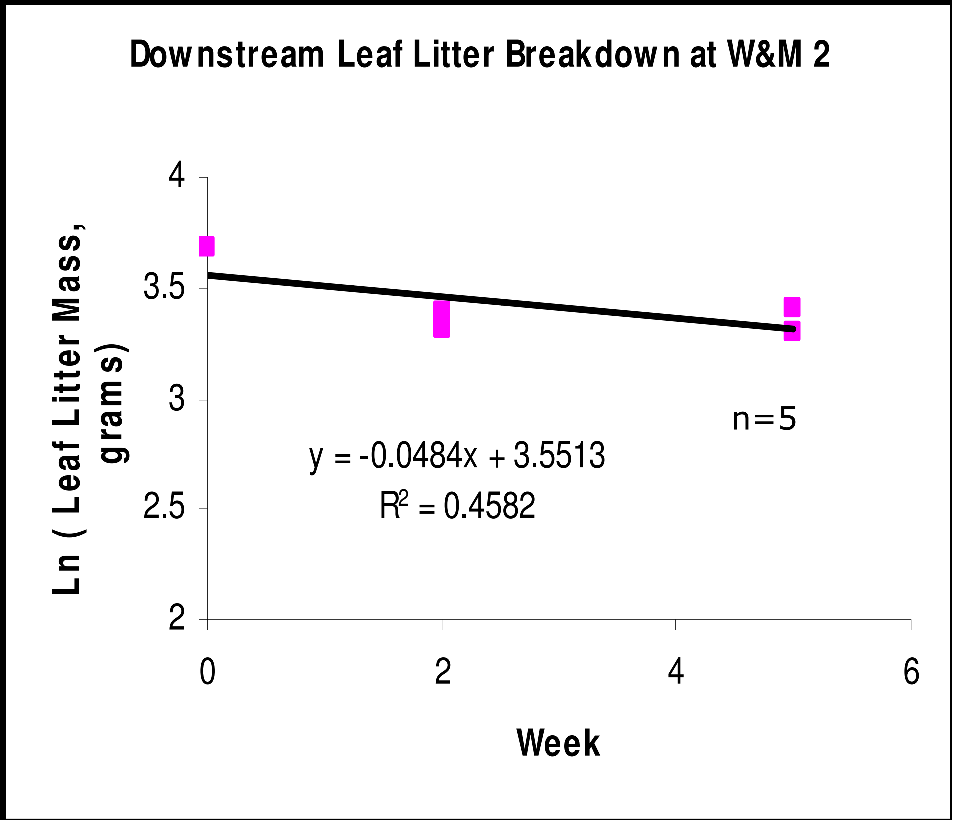
Results: Invertebrates

Site	Upstream	Downstream
Ironbound Village	93	<u>224</u>
Mulberry Place	<u>294</u>	210
Crimdell	63	<u>329</u>
Yates	<u>9785</u>	223
Campus	348	<u>394</u>
	10583	**1380***

*Paired two sample t-test, p=0.197258

Results: William and Mary (Yates)





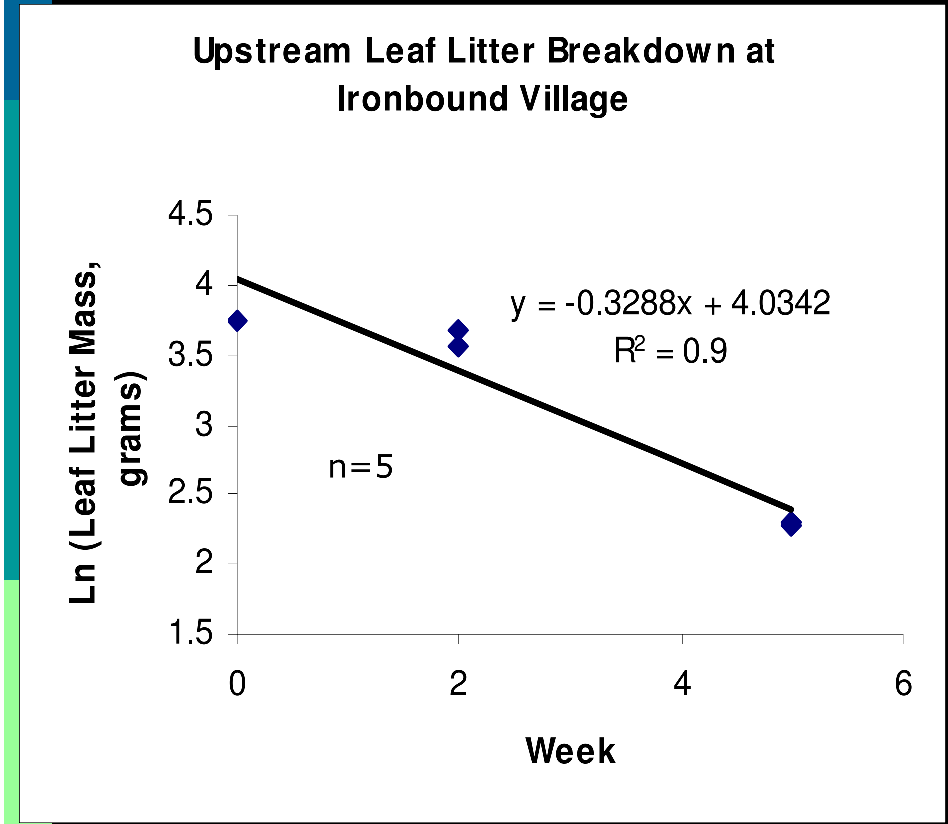
9785 invertebrates

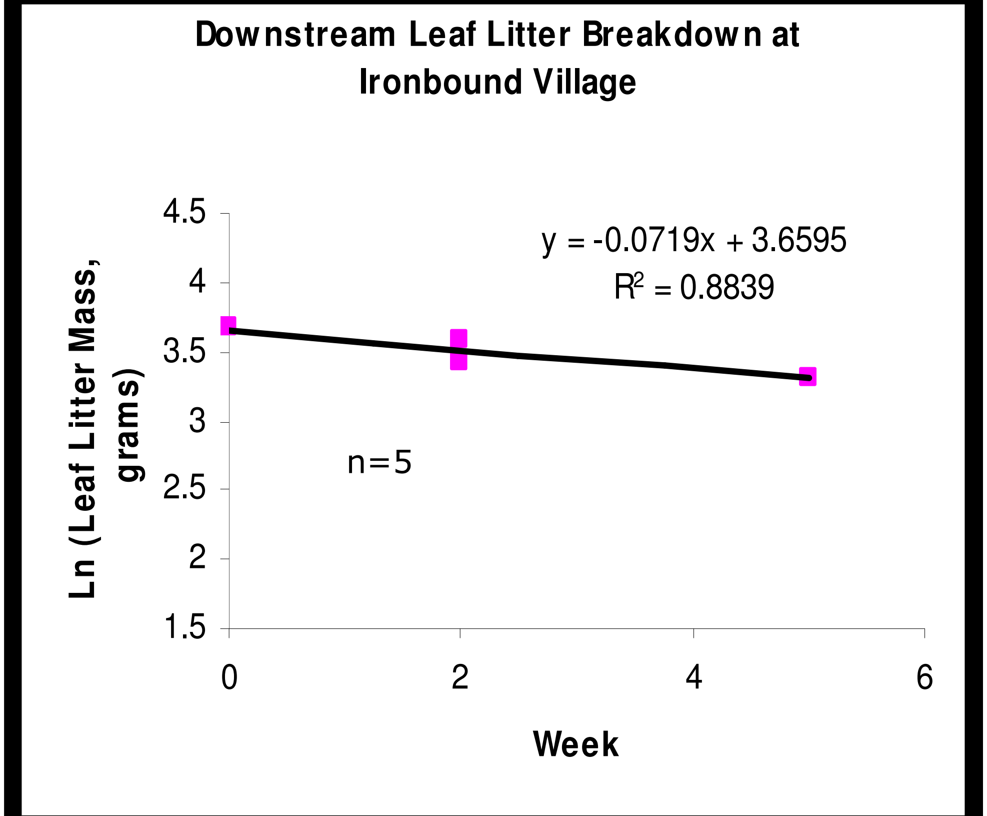
*Higher decay

223 invertebrates

Lower Decay

Results: Ironbound Village





93 invertebrates

*Higher decay

224 invertebrates

Lower Decay

Discussion

- Do storm water retention ponds affect leaf decomposition?
  - On average no, but it varies with basins.
- If yes, what accounts for that change?
  - Changes in Invertebrate Communities
  - Storm Water Discharge

Conclusion

- What does decomposition tell us about ecosystem integrity?
  - Difficult to say – many factors
  - Baseline data is important
  - Improve Design

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