Litterfall and decomposition in forested riparian area

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Abstract

Riparian ecosystems are adjacent to rivers or streams. They are located at the interface between terrestrial and aquatic ecosystems. The riparian zone has direct interactions with the terrestrial and aquatic ecosystem resulting in the exchange of species and movement or transformation of energy and nutrients. The objective of this study was to understand the patterns of litter fall and the rate of leaf litter decomposition in a riparian forest. Accumulation of leaves, sticks, and fruits and flowers was monitored for 12 months along the Rio Cupeyes in western Puerto Rico. Leaf decomposition rates were estimated in both the stream and the riparian area. Initial decomposition was fast in both the stream and the riparian area. After two months the rate of decomposition in the riparian area slowed down. Peak litterfall occurred in June, which corresponds to the dry season. Understanding litter fall dynamics and leaf decomposition is important for understanding nutrient fluxes and habitat quality for streams systems and their biota.

Introduction

Riparian areas:
- Typically narrow that are periodically inundated with surface or subsurface waters.
- The plant communities are generally productive and diverse.
- Characterized by the combination of high species diversity, densities and high productivity.
- Decomposition of organic matter in riparian ecosystems is undoubtedly related in the intensity and duration of flooding.
- The timing of litter input to the soil microenvironment may have a substantial influence on decomposition processes.
- Forested land cover is important in maintaining healthy stream conditions

Objective

- Determine the rate of leaf decomposition
- Estimate litter production

Material and Methods

- We placed 10 0.25 m² litter basket along a 250 m transect of the riparian area of the Rio Cupeyes.
- We collected litterfall every month for 12 months, oven dried the leaves and sorted and weighed leaves, sticks, flowers and fruits and other.
- Decomposition bags were constructed of a fine mesh and 10 g of freshly dried leaves were placed inside
- Decomposition bags were placed next to the litterfall traps and 1 bag was collected each month for 6 months.
- Tree community analysis was done using a 50 m² belt transect centered on the leaf basket.
- All tree canopies that crossed the line transect were recorded.
- Trees greater than 2.5 dbh were measured if they fell within the plot.
- Importance values and the Shanon Index of diversity were calculated to determine the species that were likely to contribute most of the litter production to the riparian and stream area.

Results

Figure 1: Weight of leaves, sticks, flowers/fruits and other in the baskets.

Figure 2: Percent of initial weight remaining in the decomposition bags each month.

Figure 3: Importance values calculated from vegetation surveys.

Conclusions

Litter Production:
- Peak litterfall is spring, particularly in March (Figure 1), with leaves contributing most of the litter mass.
- Total litterfall was 6,935 kg/ha per year
- Peak litterfall was 24.45 g and peak fruit and flower production was 6.50 g
- The amount of litter production is within the range found in other tropical forests

<table>
<thead>
<tr>
<th>Site</th>
<th>Total Litterfall</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rio Cupeyes</td>
<td>6,935</td>
<td>This study</td>
</tr>
<tr>
<td>Guanica Dry Forest</td>
<td>2,884</td>
<td>Lugo et al. 1978</td>
</tr>
<tr>
<td>Pterocarpus officinalis</td>
<td>11,900</td>
<td>Euse and Ade 1999</td>
</tr>
<tr>
<td>forest in PR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest service Arboretum in Luquillo in PR</td>
<td>8,100 – 14,300</td>
<td>Cuevas &amp; Lugo 1998</td>
</tr>
<tr>
<td>Cloud Forest in Luquillo Mountains</td>
<td>3,100</td>
<td>Weaver et al. 1986</td>
</tr>
<tr>
<td>Tropical forest in India</td>
<td>5,630 – 8,650</td>
<td>Sundarapandian &amp; Swamy 1999</td>
</tr>
<tr>
<td>Floodplain forest of the Amazonian Rainforest</td>
<td>7030</td>
<td>Nebel et al. 2001</td>
</tr>
</tbody>
</table>

Decomposition in the riparian area:
- In the first 3 months 35% of leaf mass was lost very quickly, and never went below 50% even after 6 months.
- Based on linear regression of the initial part of the curve, leaves decayed at about 1,438 g/month. Decomposition seems to stop at this point (Figure 2).
- The decrease in decay rate is likely due to the drier conditions of the spring.
- Based on other studies done in neotropical forests the decrease in decomposition rate is likely do to a decrease in precipitation.
- Both litter production and decomposition seem to be controlled by precipitation associated with the wet season. Warmer temperatures and higher precipitation result in higher rates of decomposition, faster litter turnover, and less organic matter accumulation.

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