1. Introduction

Fine-roots (<2 mm diam.) are considered important sources of soil C and N in forest ecosystems, however the primary factors that control fine-root C and N mineralization rates in temperate forest soils are not well understood. Changes in forest productivity are thought to reduce the inputs of above and belowground C to soils, limiting belowground C storage (Crow et al. 2009). In addition, expected increases in atmospheric N deposition have the potential to induce changes in litter decomposition (Knorr et al. 2005, Forman & Tilman 2012). We conducted a 2-year field study to examine the influence of long-term litter inputs and N additions on Acer rubrum (red maple) fine root C and N dynamics in a temperate forest soil, and answer the following specific questions:

How do litter inputs and N additions affect the:

- Retention and stabilization of fine root C and N in soils?
- Losses of fine root C as CO2?
- Vertical transport of fine root C as dissolved organic C (DOC)?

Approach: we followed the fate of 13C and 15N from 13C/15N dual labeled red maple root litter in soils, respired-CO2 fluxes, and DOC.

2. Two-year field study

Experimental manipulation field site:

Long-term Detritus Inputs and Removal Treatment (DIRT), initiated in 2004, University of Michigan Biological Station, Pellston, MI

In 2009, red maples (Acer rubrum) were enriched with 13CO2 and 15NH4Cl and K15NO3 in a temperature-controlled chamber located in the greenhouse facility at Queens College.

In 2010, fine-roots (1 g C and 0.02 g N) were applied to the top 1-4 cm of mesocosms (PVC, 10 cm diameter) installed in the top 20 cm of soils within the following DIRT treatments:

- Added N: soils received N additions as NH4Cl, 30 kg N ha-1 yr-1 (n = 3).
- No belowground inputs: roots were excluded by trenching (n = 3).
- No above and belowground: aboveground litter were removed using a mesh screen to collect the falling litter; roots were excluded by trenching (n = 3).
- Control: no removal of litter inputs or additional N added (n = 3).

In situ measurements included in litter manipulation treatments.

3. The exclusion of above and belowground inputs increased the retention of root litter N in soils

4. The addition of nitrogen to soils affected the retention of root litter N

5. Losses of root litter C as DOC and CO2

Table 1. Isotopic and elemental composition of red maple root litter

<table>
<thead>
<tr>
<th>Litter</th>
<th>C</th>
<th>N</th>
<th>C:N ratio</th>
<th>δ13C</th>
<th>δ15N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine roots</td>
<td>10.6</td>
<td>1.2</td>
<td>8.8</td>
<td>-24.7</td>
<td>-3.2</td>
</tr>
<tr>
<td>Added N</td>
<td>10.0</td>
<td>1.3</td>
<td>7.7</td>
<td>-25.2</td>
<td>-3.3</td>
</tr>
</tbody>
</table>

6. Conclusions

Overall, the retention of root litter C and N in our study was lower than that reported for a temperate forest in Sierra Nevada, CA (Bird and Torn, 2006) and mountain grasslands in Spain (Garcia-Pausas et al. (2012)).

There was a significant vertical loss of root-C as DOC in our study site.

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7. References

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