G.J. Heij and J.W. Erisman (Editors). Acid Rain Research: Do we have enough answers?

CARBON PARTITIONING IN DOUGLAS-FIR

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1. INTRODUCTION

A field gas exchange laboratory, with specially developed branch assimilation chambers operable throughout the year, was installed in a 32-year old Douglas fir stand in the central part of the Netherlands. During 1992 photosynthesis of current-year and 1-year-old needles from 5 crown levels was monitored.

2. RESULTS

Data on total number of needles and needle surface area were combined with data on net assimilation to determine the contribution of different months and different crown levels to total net CO_2 uptake over 1992 (Figure 1).

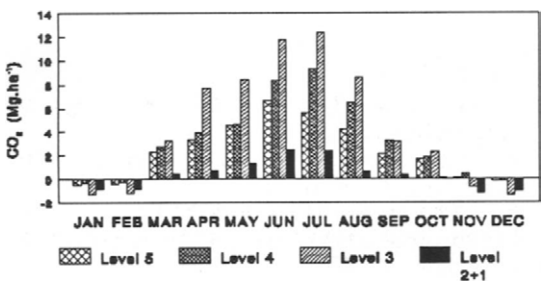

Figure 1:Total net CO_2 uptake per month and per crown level in 1992.

Total net CO_2 uptake was not evenly distributed over the crown. Net assimilation rate increased with tree height and current year needles had higher assimilation rates compared to 1-year old needles. Needles around the canopy closure point (level 3) were responsible for more than 40% of the total uptake in 1992, due to the large number of needles and associated needle surface area at this level. Although 33% of total needle surface area was associated with

crown levels 1 + 2, these levels contributed only 3% to total CO_2 uptake in 1992.

A carbon budget for 1992 is presented in Table 3. A total 31.7 Mg C per ha was taken up by the stand. As no major flowering occurred during the growing season, the allocation of carbon to growth and production of cones was neglected. Of the total carbon taken up by the stand, 47% was used for biomass increment: 37% above ground and 10% below ground. As needle respiration is already included in the total carbon uptake, 53% of total carbon uptake by the stand was associated with growth- and maintenance respiration of fine roots and that of woody tissues in branches, stems and coarse roots. The amount of carbon used for mycorrhiza and in exudation might be important, but was not determined.

Table 3: Carbon budget for 1992 in Mg C per ha.

Net uptake	Biomass	increment
Needles	31.7*	3.6
Branches		0.8
Stem		7.4
Roots		3.2**
Total	31.7	15.0
Respiration		16.7

* Needle respiration included
** From Olsthoorn (1991)

3. CONCLUSIONS

- Major part of total CO_2 was taken up in June and July and in the winter months no net CO_2 uptake was found
- 40% of total CO_2 uptake was associated with the needles around the canopy closure point
- 47% of total CO_2 uptake was used for biomass increment
- 53% of total CO_2 uptake was associated with respiration of fine roots and woody tissues