

Referee #2 :

General comments

The paper represents a significant contribution to the elucidation of N flows in trees. There is no new concept or method in this study but the use of three different ^{15}N -labelling periods (spring year n-1, autumn year n-1 and spring year n) and two labelling techniques (soil and leaf labelling) allows a good description of the contribution of leaves to the constitution of winter reserves and the contribution of N reserves to spring growth. It is clearly shown that the main contributor to the synthesis of new leaves is N stored during previous autumn. It is also shown that soil micro-organisms are good competitors for soil ^{15}N but a significant part of the N is returned to the tree because of microbial turnover. This is a well-written paper, and a well-thought out analysis. In my opinion, the subject and the core-content of the ms are appropriate and relevant to Biogeosciences. The findings are reliable because the methods developed are appropriate. I have just a problem concerning xylem and phloem measurements. Nothing is mentioned concerning phloem and xylem sampling and how the contribution of these pools to ^{15}N partitioning is estimated.

Response: At each sampling date, two small disks of bark (14 mm diameter, 10 mm depth) were collected at 1.3 m height using a corer. Thereafter phloem and xylem tissues were separated by hand with a cutter blade."

Also, for obvious technical reasons, ^{15}N allocated to coarse roots and trunk is not taken in account in this study. It is known that these organs represent a substantial pool of N reserves and this should be discussed.

Response: Discussion was complete : L270-275 : "Indeed, data currently available on woody plants show that nitrogen is re-translocated from leaves to storage sites such as old branches, trunk or coarse roots (Valenzuela Nunez et al., 2011; Bazot et al., 2013)."

Specific points Abstract Line 12 is this proportion (30 %) true for all labelling periods?

Response: Yes, for L1 and L2, 32% of administered ^{15}N was recovered L173; for L3 and L4, 70% of administered ^{15}N L189, and for L5 and L6, 51.5% of administered ^{15}N was recovered L236.

Material and methods Sampling. One can understand that the authors used only two replicates for each labelling for technical reasons even if it is difficult to generalize from six trees. However, the authors should be much more accurate concerning the samplings (number of sampling per tree, soil, phloem and xylem sampling) to improve this section and strengthen the validity of the conclusion.

Response: The sampling procedure was completed:

L110-118: "Leaves, twigs, trunk phloem and xylem and soil monoliths (15 cm depth, very few fine roots were present below 15 cm deep) of each labelled trees (1, 2, 3, 4, 5, 6) were sampled regularly after labelling until the end of 2010 (Table 1). At each sampling date 20 leaves and 20 twigs were collected randomly throughout the crown. Sampling was always performed between 10:00 and 12:00 h UTC. The leaves were rinsed with distilled water to remove any excess ^{15}N . At each sampling date, two small disks of bark (14 mm diameter, 10 mm depth) were collected at 1.3 m height using a corer. Thereafter phloem and xylem tissues were separated by hand with a cutter blade."

L121-129: “All plant tissues and soil samples were brought to the laboratory in a cooler, frozen, lyophilized and ground to a fine powder with a ball mill before analyses. For analyses, all sampled of each compartments were pooled. An aliquot of each powder (1 mg) was transferred into tin capsules (Elemental Microanalysis, UK, 6 x 4 mm, ref. D1006, BN/139877). Total N concentration of plant and soil samples, was analysed by dry combustion using an N auto-analyser (Flash EA 1112 series, Thermofinnigan). ¹⁵N abundance was quantified in the same plant and soil fine powder aliquots with a mass spectrometer (PDZ Europa, University of Davis, Isotopes Facility, California)”.

Results Line 144-145 there is no verb in this sentence.

Response: The sentence was rewritten

I presume also there is a mistake, L2: 3+4 instead of 2+3 and L3: 5+6 instead of 3+4.

Response: It was corrected

Discussion Line 343-348. The authors should be much more careful here. I really do not know why the authors mention the Glutamine synthetase/Glutamate synthase pathway as no results shown in the paper concern amino acid metabolism. I presume this hypothesis is based on published literature which is not mentioned.

Response: Our team has conducted analyzes of root enzyme activities in mature oaks throughout a season, the results show a reduction in activity GS GOCAT in winter, these data are published in Trees structure and Function : Bazot et al., 2013.

Also, the Morot-Gaudry reference is not in the reference list, and I am not sure it concerns tree physiology. I suspect there are more appropriate references concerning tree N assimilation.

Response: Morot Gaudry also presents conclusion about tree N assimilation in this book.