UABDIVULGA
BARCELONA RECERCA I INNOVACIÓ

11/11/2016

Resin-based rainwater collectors, an useful tool for measuring atmospheric deposition of nitrogen

Human activity has caused an increase in nitrogen emissions. The use of resin-based rain collectors will allow a less frequent sampling of nitrogen deposition than with conventional collectors. This will enable to extend the deposition monitoring to remote areas, such as mountainous areas, which, on the other hand, are the most sensitive.

View of the basin Torrent de La Mina (municipality of El Brull, mountain massif El Montseny)

The global alteration of the nitrogen cycle (N) has led to an increased N deposition that can threaten ecosystems, e.g. causing eutrophication (nutrients excess within the ecosystem) or the loss of biodiversity. A recent modeling exercise of N deposition in habitats within the Spanish Natura 2000 network has shown that some areas of the Pyrenees and the Cantabrian range and mountainous areas around Barcelona and Madrid are receiving N loads above the threshold considered safe for the protection of ecosystems (Gómez-García et al. 2014). These areas have a complex topography and thus are difficult to access, which prevents the development of monitoring networks. And yet, these regions require the greatest attention, according to the mentioned study.

Traditionally, the atmospheric deposition has been measured with wet deposition or with global deposition collectors. Wet deposition collectors are only open to the atmosphere when it rains.

They have a lid that moves at the start of the rain, requiring a mechanism connected to the electrical power system. The bulk deposition collectors simply consist of a funnel attached to a bottle. As they do not need electricity, bulk collectors are more economical. In both cases, a weekly sampling is recommended to avoid chemical changes in the collected rainwater before transport to the laboratory..
Ion exchange resin collectors consist of a funnel connected to a tube filled with resin (Amberlite IRN150). The collected rain flows into the resin that retains the nitrogen compounds of interest, namely NH4+ and NO3-, at the exchange sites of the resin. Since ions are retained within the resins, sampling of resin collectors can be more spaced in time than that of traditional collectors (Fenn and Poth 2004).

CREAF technician Irene Fraile preparing a collector of trascol (water that has crossed the canopy of the forest) in an oak grove of La Castanya (terme d'El Brull, massis del Montseny)
CREAF technician Irene Fraile preparing a collector of trascol (water that has crossed the canopy of the forest) in an oak grove of La Castanya (municipality of El Brull, mountain massif El Montseny)

Because resin collectors are quite inexpensive and allow to substantially reduce the number of sampling visits, they can be a good solution for long term monitoring in remote areas that up to now have remained insufficiently characterized.

In this study, we evaluated the response of resin collectors compared to conventional ones. For this purpose, we implement three holm oak (Quercus ilex) plots near Madrid, Pamplona and Barcelona, respectively, with resin and conventional collectors. At each site, and for both collector types, we set up from 2 to 4 collectors for bulk deposition and from 8 to 12 for throughfall (water that has passed through the forest canopy).

The resins showed excellent absorption efficiency. The comparison of N deposition according to the two methods showed a better fit for NO3 than for NH4, as also found in other studies (Fenn and Poth 2004). We have identified several processes that explain this result, e.g. the fact that resins contain amine groups that can liberate NH4+ or the possibility that water collected in the conventional collector can undergo some processes that remove NH4+ from the sample, such as nitrification or volatilization of NH4+. To correct some of these sources of variation, the use of field blanks for resin collectors is recommended.

Anna Avila Castells
Centre de Recerca Ecològica i Aplicacions Forestals (CREAF)
Facultat de Ciències
anna.avila@uab.cat

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Text from:

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Citations:

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