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Restoring a worn-out pasture: what impact on greenhouse gases exchanges?

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The restoration of permanent pastures is often required in order to restore a productive state and the palatability of the grass. The restoration process consists on destroying the former vegetation using herbicides followed by harrowing and reseed. The short term and long term impacts of such operations on the carbon cycle and N2O emissions are not well defined for old permanent pastures.

Therefore, a paired flux tower measurement campaign was started in March 2018 at the Dorinne Terrestrial Observatory in Southern Belgium, with the aim to study the impact of pasture restoration on CO_2 and N2O fluxes exchanged by the ecosystem. The site is a 100-year-old intensively managed grassland which last restoration was performed more than 40 years ago. It is grazed by Belgian blue beef cattle and fertilized with around 120 kgN ha-1 per year on average, reflecting common practices in the area. A former study carried out at the site showed that the pasture acted as significant carbon sink before the start of experiment.

Two adjacent parcels belonging to the same farm were both equipped with identical instrumentation including eddy covariance measurements of CO_2 (LICOR 7000) and N2O (Aerodyne Inc. quantum cascade laser) exchanges to allow the comparison between a control and a restored plot subject to identical pedo-climatic conditions. Preliminary results of greenhouse gas fluxes will be presented in relation to climatic conditions and management operations, along with the evolution of soil ammonium and nitrate:

- After glyphosate application and harrowing, CO_2 uptake was shut down for a few weeks while the ecosystem respiration seemed to be also reduced. Meanwhile, N2O emissions where enhanced for two weeks following harrowing.
- Reseeding the restored parcel had no visible effect on N2O exchanges but slowed down gross primary production.
- Three month after the beginning of the experiment, N2O fluxes in both plots followed similar dynamics (driven by precipitation); however, emissions were greater in the control parcel.