

## MSc thesis (Spring semester 2019) project: The carbon balance of perennial crops

### Background

Modern agriculture is associated with numerous environmental predicaments, such as land degradation, water pollution, and greenhouse gas emission (Montgomery 2007, Foley et al. 2011). Socio-economically, it is characterized by a treadmill of technological change, increased mechanization, and economic consolidation, while depressing economic returns to farmers (Crews et al. 2018). A root cause is the dominance of annual plants cultivated in monocultures (Crews et al. 2014). Annual crops require the yearly clearing of vegetation, often combined with mechanical soil disturbance, resulting in soil erosion, nutrient leakage, and other forms of ecosystem degradation. Monocultures are susceptible to agricultural pests and weeds. By contrast, perennial polycultures informed by natural ecosystems, promise more sustainable agroecosystems with the potential to also revitalize the economic foundation of farming and hence rural societies (Crews et al. 2018). The most important barrier to embrace a more ecologically sound agriculture has been the lack of perennial crops. About 40 years ago scientists at The Land Institute in the USA started on a bold mission: to develop new perennial cereal, legume, and oilseed crops in order to radically re-invent agriculture (Jackson 1980). Recently we have seen very rapid progress around the world in both domestication of new crops and in breeding existing crops for perenniality (Baker 2017), see also figure to the right.

### The research

In September 2018 the Högstad & Christinehof Estate (hereafter Högsta) planted 25 ha of the newly domesticated perennial cereal Intermediate Wheatgrass (Kernza). The experiment is part of an emerging collaboration on perennial polycultures between Lund University, the Swedish Agricultural University and The Land Institute (Salina, KS). At Högsta **we offer opportunities to investigate the carbon balance of a perennial cereal intercropped with a nitrogen fixing legume.** This is the first experiment of its kind outside The Land Institute in Kansas. It is an important pilot project to investigate how the very promising Intermediate wheatgrass grows in Northern Europe (where both soils and climate are very different from the Great Plains in the USA). It is also an experiment to investigate the potential of perennial crops to significantly reduce the emission of GHG (CO<sub>2</sub> and N<sub>2</sub>O), and how this could be integrated into future climate policies. The co-operation with Högsta (one of the largest agricultural estates in Scandinavia) also offers opportunities to investigate how perennial crops and mixed cultures can be integrated into modern farm operations.

### Practicalities

INES will provide equipment (eddy covariance tower) for the quantification of CO<sub>2</sub> flux in the field sowed with Kernza in September 2018, to become intercropped with alfalfa during Spring 2019 in order to establish the seasonal carbon balance. For more information: [Jonas.ardo@nateko.lu.se](mailto:Jonas.ardo@nateko.lu.se) and/or [Lennart.olsson@lucsus.lu.se](mailto:Lennart.olsson@lucsus.lu.se)



Links to more information:

<https://www.cambridge.org/core/journals/global-sustainability/article/is-the-future-of-agriculture-perennial-imperatives-and-opportunities-to-reinvent-agriculture-by-shifting-from-annual-monocultures-to-perennial-polycultures/0F69B1DBF3493462B4D46EB8F0F541EE/core-reader>

<https://academic.oup.com/bioscience/article/67/4/325/3106118>

<https://www.atl.nu/lantbruk/flerariga-spannmalen-klarade-torkan/>

<https://www.landlantbruk.se/lantbruk/flerariga-grodor-ar-osakra-klimatvinnare/>

<https://www.nytimes.com/2013/10/23/opinion/bittman-now-this-is-natural-food.html>

<https://green.blogs.nytimes.com/2012/09/27/q-and-a-farming-for-an-uncertain-future/>

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