Title: Effects of climate change on feed availability and the implications for the livestock sector

Authors: Petr Havlík*, David Leclere, Hugo Valin, Mario Herrero, Erwin Schmid, Michael Obersteiner

Affiliations:

a International Institute for Applied Systems Analysis, Schlossplatz 1, A-2361 Laxenburg, Austria (havlikpt@iiasa.ac.at, leclere@iiasa.ac.at, valin@iiasa.ac.at, oberstei@iiasa.ac.at)

b Commonwealth Scientific and Industrial Research Organisation 306 Carmody Road, St Lucia, 4067 QLD, Australia (mario.herrero@csiro.au)

c University of Natural Resources and Life Sciences, Feistmantelstraße 4, A-1180 Vienna, Austria (erwin.schmid@boku.ac.at)

* Corresponding author phone: +43 2236 807-511

ABSTRACT

Global mean surface temperature is projected to rise by 0.4-2.6°C until 2050, and the contrast in precipitations between wet and dry regions and wet and dry seasons will also increase according to the IPCC 5th Assessment Report (2013). The climate change will impact livestock in many ways going from heat stress through livestock diseases to feed quality and availability (Thornton et al., 2009). Recently, projected climate change impacts on crop and grassland productivity became available with high spatial resolution at global scale through the AgMIP and ISI-MIP projects. The objective of this paper is to investigate how climate change impacts on crops and grassland will influence livestock production globally and its distribution across regions.

This analysis is carried out using the global partial equilibrium agricultural and forestry sector model GLOBIOM (Havlík et al., 2013). The model represents agricultural production at a spatial resolution going down to 5 x 5 minutes of arc. Crop and grassland productivities are estimated by means of biophysical process based models (EPIC and CENTURY) at this resolution for current and future climate. Livestock representation follows a simplified version of the Seré and Steinfeld (1996) production system classification. This approach recognizes differences in feed base and productivities between grazing and mixed crop-livestock production systems across different agro-ecological zones (arid, humid, temperate/highlands).

Our study highlights that the differential impacts of climate change on crop and grassland productivity will influence the relative competitiveness of different livestock production systems. Maintaining livestock production in some regions will depend on their capacity to adapt. Institutional and physical infrastructure will be needed to facilitate these transformations.

Keywords: Livestock, grassland, climate change, adaptation, production systems, international trade

References:

