

Unravelling drivers of global land use change

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It is well known that in the last decades the use of land worldwide has changed dramatically, and increasing concerns have been raised regarding forestland loss, degradation, and other forms of Land Use Changes (LUC). However, the factors driving these LUC are lesser known. This article aims to identify and quantify the main drivers of land use change for food purposes, bioenergy and forestry related purposes, at the global and country level from 1997 (after finding many challenges from then back to 1961, and agreeing on this year based on discussion with FAOSTAT experts) to 2013. Regarding the data and methods, making many statistics in physical units of the FAOSTAT database (production, trade balances, forestry statistics, and notably, the Supply and Utilization accounts which are the internal detailed data in FAO to construct the food balance sheets) as starting point, we firstly develop a consistent representation of this data in the form of a Multi-Regional Input-Output framework. Secondly, we develop a Structural Decomposition Analysis (SDA, see Dietzenbacher and Los (1997) Dietzenbacher and Los (1998), Su and Ang (2012) to quantify the contribution of each of a set of relevant factors to land use changes in the different regions of the world. These factors include Yield, Affluence, Demand propensity, Demand structure, Trade structure, Input Structure and population. Previous works have analyzed the links between land use changed, diets and bioenergy (e.g. Alexander et al., 2015; Kastner et al., 2012). We extend this analysis with novelties by 1. updating the data series with latest available information; 2. including bilateral trade data in the analysis in order to estimate the share of land use change in one country due to imports from other countries and to analyze the impact of bilateral trade, 3. including land use changes related to forestry; 4. including affluence as an additional driver; 5. developing a statistical analysis to assess the correlation between different factors (e.g. affluence and land requirement, similar to Arto et al., 2016, for the case of energy and affluence). From the global assessment of forestland we can conclude that between 1997 and 2014, the harvested area has increased by 3.2 Mha (+18%), from 18.4 Mha to 21.6 Mha. The results show an increase in the forestland harvested that is embedded in trade (+33%). The global assessment of cropland reveals that between 1997 and 2013 harvested area has increased by 7% (+160 Mha), from 1,390 Mha in 1997 to 1,550 Mha in 2013. Similarly to what we find for forestland, the share of cropland harvested dedicated to satisfy the foreign demand for agricultural products increased from 19% in 1997 to 22% in 2013. Harvested cropland area increased in more than 10 Mha in four countries: Brazil, India, China and Indonesia; in Russia harvested area decreased in almost 30 Mha. The assessment of the drivers of LUC reveals that domestic changes contributed to increasing the harvested area in 35 Mha and foreign changes contributed to an increase of 125 Mha. The increase in affluence was the main driver for the expansion of harvested cropland followed by the expansion of population. Among those drivers that contributed to moderate the increase in cropland, we find the reduction due to the change in the propensity to demand agricultural products, and the change in the domestic trade and inputs structures.