



Tropentag, September 20-22, 2023, hybrid conference  
“Competing pathways for equitable food systems transformation:  
Trade-offs and synergies”

## Novel metrics to describe deforestation dynamics in global commodity frontiers

MATTHIAS BAUMANN, ANA BUCHADAS, TOBIAS KUEMMERLE

*Humboldt-Universität zu Berlin, Geography Department, Germany*

### Abstract

Tropical deforestation is a major contributor to climate change and results in the widespread degradation of ecosystem services, important for local communities. A major cause of deforestation in the tropics is the expansion of various forms of agriculture by diverse actors, resulting in highly heterogeneous and complex deforestation frontiers. Better understanding and characterising these frontiers remains a major challenge for sustainability science. Here, we present a novel way to describe frontier processes in deforestation frontiers, and we showcase this for the South American Gran Chaco, a global deforestation hotspot. Using satellite-based land cover time series and decision trees we develop frontier metrics describing different dimensions of frontier processes, including baseline forest, speed of deforestation, level of activeness of deforestation, and the post-deforestation land-cover trajectory. Our results show that more than 19.3 million ha of woodlands were converted to agriculture 1985–2020, with clear distinctions of the proximate causes between the 1980s and 1990s when ranching expansion drove deforestation, and a period during the mid-2000s when cropland expansion was dominant. In addition, we found that direct conversions to croplands occurred in form of rapidly progressing frontiers, but the Chaco also contains many areas where slowly progressing frontiers dominate and where forests were initially cleared for ranching before eventually being converted to cropping, highlighting the need for considering post-deforestation land uses for better linking frontier dynamics to the underlying processes. Our concept of frontier metrics provides a robust and transferable way to move away from describing time series of land cover towards a deep process-understanding of processes in commodity frontiers in the world’s tropical dry forests. Our approach can identify high-level, recurring frontier types and can therefore be a step towards more context-specific monitoring and policy responses to deforestation.

**Keywords:** Chaco, commodity frontiers, deforestation, South America