

## Background

Effective land management necessitates accurate monitoring of land use and land cover (LULC) and terrestrial carbon dynamics. Here, we used a time-series model coupled with a spatiotemporal carbon bookkeeping model to model LULC change and associated carbon emissions and removals in the Mekong Basin.

## Analysis

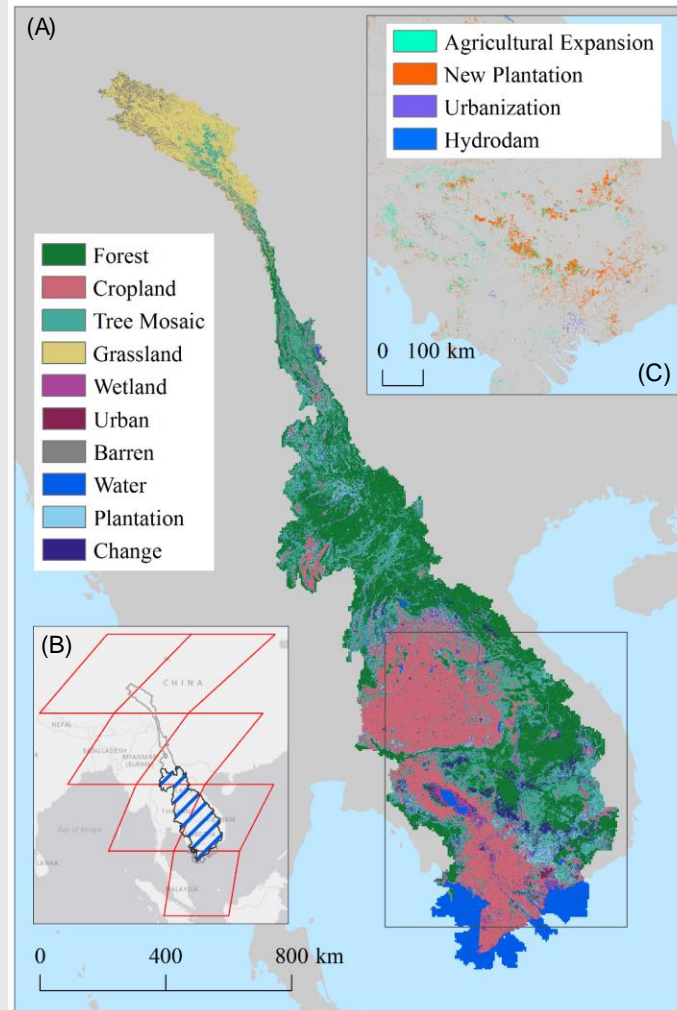
We applied a modified CCDC model using the MODIS Vegetation Indices product. A rule-based enhancement process was applied to utilize the MODIS Land Cover Types and the MODIS Vegetation Continuous Fields products to improve the classification results. The LULC product was combined with annual tree canopy cover maps as activity data for the spatiotemporal carbon bookkeeping model to estimate the carbon emissions and uptake from all forest disturbances.

## Results

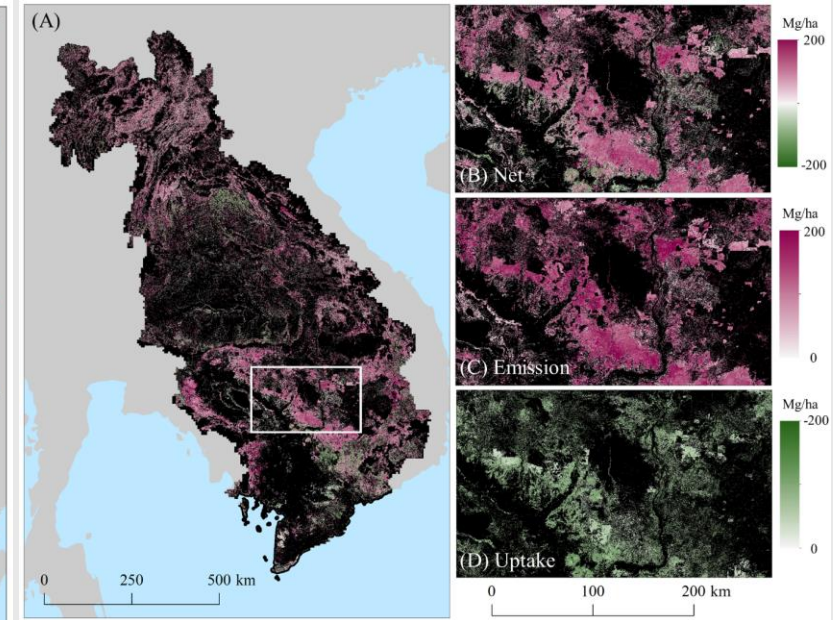
For the Mekong River Drainage Basin (approx. 919,618 km<sup>2</sup>), we estimated a total of 33,617 ± 7,342 km<sup>2</sup> of new plantations added, and a total of 14,915 ± 4,682 km<sup>2</sup> of agricultural expansion during the period 2001-2016. We estimated carbon emissions of 72.9 ± 6.2 Tg C yr<sup>-1</sup> and carbon removals of -35.5 ± 4.9 Tg C yr<sup>-1</sup>.

## Significance

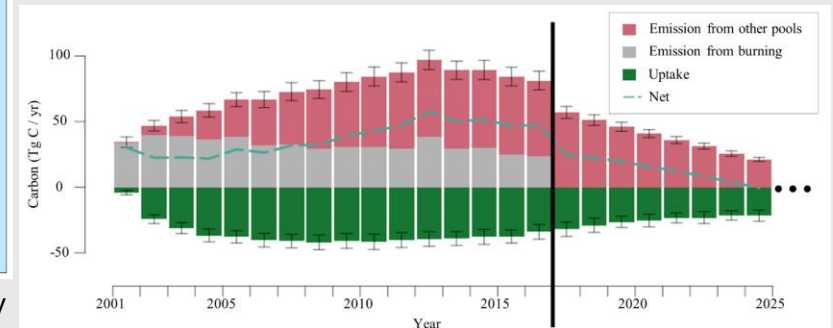
Two of the largest components of LULC change in the region are the establishment of plantations and agricultural expansion. Carbon uptake from new plantations offsetting almost half of the emissions from deforestation in this area. Assessment of post-deforestation land use is crucial for quantifying the short- and longer- term carbon consequences of LULC change.



**Fig. 1:** Boundary of the Mekong Drainage Basin (grey polygon in B) overlaid with the MODIS tiles (red box in B), as well as maps of LULC (A) and LULC change (C) for the study region.



**Fig. 2:** Net emission from 2001-2019 for the entire study region (A). Zoom-in view (right panel) shows both carbon emissions (C) and uptake (D), and mostly positive net emission (B).



**Fig. 3:** Annual carbon emissions from burning and other carbon pools, uptake, and net emission.