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“Development on the margin”

## Mapping Cropland Marginalisation in the Downstream of the Amu Darya River, Uzbekistan

OLENA DUBOVYK<sup>1</sup>, ASIA KHAMZINA<sup>1</sup>, CHRISTOPHER CONRAD<sup>2</sup>, GUNTER MENZ<sup>3</sup>

<sup>1</sup>*University of Bonn, Center for Development Research (ZEF), Germany*

<sup>2</sup>*University of Wuerzburg, Geography Department / Remote Sensing Unit, Germany*

<sup>3</sup>*University of Bonn, Dept. of Geography, Remote Sensing Research Group, Germany*

### Abstract

In Uzbekistan, where about 16 million people depend on irrigated agriculture, cropland marginalisation due to water shortages, soil salinity and eventual withdrawal of unproductive fields significantly affect agro-ecosystem services and economic growth. The challenge of simultaneously maintaining sufficient agricultural production and environmental sustainability can be addressed via setting aside marginalised cropland parcels for ecological restoration. Such approach requires spatial assessment of degraded croplands where remedial practices need to be applied. This study therefore aimed at developing a remote sensing based method for mapping land degradation (LD) trends in the downstream of the Amu Darya River, Uzbekistan. LD was defined as a long-term decline in vegetation biomass, measured using the normalised difference vegetation index (NDVI) as a proxy. Satellite images from the Moderate Resolution Imaging Spectroradiometer (MODIS) were used to calculate the NDVI time series for the period between 2001 and 2009. An adaptive Savitzky-Golay filter was applied to distinguish between inter-annual long-term biomass changes and short-term seasonal variability in the time series. The filtered NDVI images were tested for the presence and magnitude of the LD trends, applying the non-parametric Mann-Kendall test. The analyses revealed that the croplands experiencing LD were mainly located in the north-east of the study area, covering about 13 % of the territory. The resulted degradation severity map agreed well with an independent spatial assessment based on yields as an indicator of the cropland marginality. An evaluation of our findings showed that the decline in vegetation biomass was mainly restricted to peripheral locations with crop rotation under fallows. The results of this spatial assessment can be applied in developing remedial land use options for the degraded marginalised areas, such as afforestation with well-adapted tree species capable of high biomass production under saline conditions.

**Keywords:** Marginal cropland, MODIS time series, NDVI, Remedial land use, Uzbekistan