First results from the LaVaCCA project: Assessing land value changes and developing a discussion support tool for improved land use planning in the irrigated lowlands of Central Asia

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ABSTRACT:

The LaVaCCA project, funded by the Volkswagen foundation (2015−2017), aims at analysing the spatial and socio-economic drivers of land use change in the downstream regions in Central Asia (CA), which lead to widespread agricultural land degradation and land abandonment, affecting food security. Immense losses of land productivity (LP) have been observed on eight million hectares of irrigated agricultural land in CA during the past decades. The aim of LaVaCCA is to develop satellite remote sensing based methods to analyse and quantify the extent and severity of land degradation and abandonment, and to assess associated changes in economic land value.

First, hotspots of agricultural land abandonment were identified with methods based on satellite remote sensing. In a case study in Kyzyl-Orda, Kazakhstan, multi-temporal data sets from the free Landsat archive were classified to create annual land use maps between 2009−2014 with five classes. A novel decision-fusion approach was tested to combine the results from random forest and support vector machines.

Although the single classifiers performed equally well, with annual classification accuracies between 85%−90%, the proposed fusion approach was significantly (i.e. at the 95% confidence level) more accurate, with overall accuracies ranging from 94−97%. The analysis of the temporal sequences of specific land uses between 2009−2014 at the per-field basis revealed that more than 20% of the agricultural fields in Kyzyl-Orda are abandoned. The observation length (i.e. the number of consecutive years) had a significant impact on the reliability of the method to detect agricultural land abandonment, ranging from 63.1% accuracy when only considering single years alone, and up to 78.5% when analysing the complete set of land use maps (2009−2014). The results will contribute to spatially explicit analysis of factors driving land abandonment in CA, which could be used to highlight areas for targeting rehabilitation measures like afforestation or pasture.

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