A Quantitative Comparison of Completely Visible Cadastral Parcels Using Satellite Images: A Step towards Automation

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SUMMARY

Estimates suggest that 70 percent of the world's population has little or no access to formal land administration systems and hence their rights are often neither recognized nor secured by governments. A system of organized land rights information, embedded in a broader land administration system, is argued as a key pillar for underpinning any sustainable economy and equitable economic development. Cadastres are a core ingredient of any land administration system. Traditional methods for cadastral surveying and mapping are however, often lengthy and labor intensive. In response, remote sensing based techniques have great potential and are being increasingly employed for rapid creation and upgrading of cadastral maps: the Global Land Tool Network (GLTN)'s fit-for-purpose (FFP) land administration guidelines provide ample evidence in this regard. Furthermore, (semi)-automatic methods for detecting cadastral boundaries are currently under development. These methods seek to make use of very high resolution (VHR) satellite images or sensors capable of similar resolutions. Creating approaches that are both highly automated and transferable between contexts remain a challenge owing to diverse morphologies of parcel boundaries found across contexts. Anyhow, object-based image analysis methods appear highly promising as they mimic the human interpretation process to identify features from an image.

A pre-step to utilizing any of these methods should be determining the quantity of the boundaries that are actually identifiable through visual interpretation. Therefore, in this paper, we assess the quantity of visible/non-visible boundaries in different contexts with the aim of determining the percentage of known cadastral parcels that are completely visible via VHR satellite images. For this purpose, we selected subsets from case locations in the contexts of Ethiopia, Ghana, Kenya, Mozambique, Rwanda, Guatemala and Nepal. To cover different landscapes, a combination of rural, peri-urban and urban areas were included. In each case, control cadastral data (i.e. vector files or existing cadastral maps) served as a reference for the assessment. Results show significant

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difference between visual identification for the samples from seven contexts. The percentage of completely visible cadastral parcels ranged from zero to 71 percent when compared to the reference cadastral map. These were parcels for which all boundaries were fully visible, i.e. a closed polygon.

Considering the result of the study, it appears that (semi)-automated cadastral boundary extraction methods using VHR imagery will have high utility in specific contexts (e.g. smallholder and rural), whereas their use in complex urban environments may be challenging and require other methods or data. Nonetheless, an approach like this will greatly enhance the application of FFP approach in Land Administration for cadastral mapping in areas where no relaible data exists, for e.g. even if a small amount of boundaries could be automatically generated (e.g. 30 percent), potentially large cost reductions in cadastral surveying and mapping could be achieved.