

Remote Sensing in the Gishwati–Mukura Landscape

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Part I: Contemporary (2023-2025) mapping of major land-cover classes

- All Sentinel-2 imagery from the past three years (2023–2025) were used to generate a set of spectral temporal metrics (STM), comprised of five statistical metrics (mean, median, standard deviation, 10th and 90th percentile), across six multi-spectral bands and a set of four spectral indices (EVI, MSAVI, NDMI, NBR*). This stack of 200 bands served as input-features for the classification.
- Training data were collected in the field and further generated through on-screen digitization. A total of 500 polygons were collected across 7 land cover classes. Both the STM and the training data were combined in a Random Forest Classification.
- The classification was validated following best practices (Olofsson et al. 2014), and unbiased area estimates for all classes were calculated.

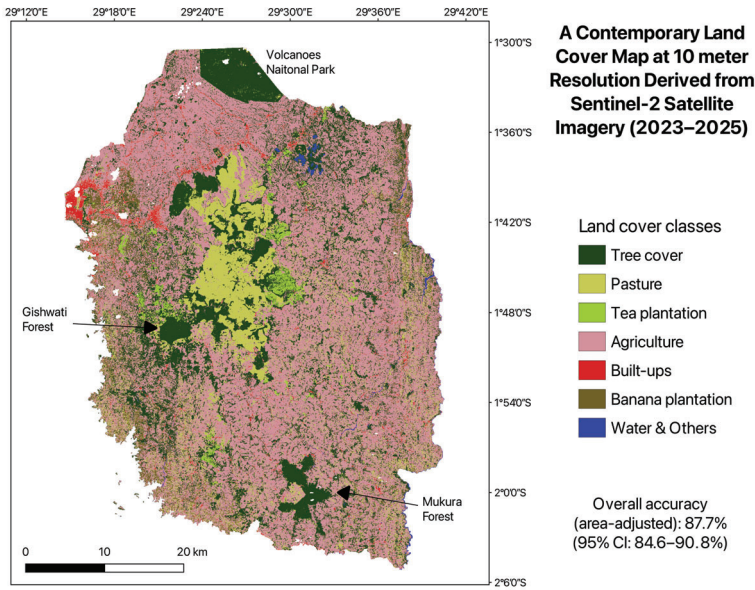


Table 1: Class-wise user's and producer's accuracies for the seven land cover classes

Class	PA	95% CIs	UA	95% CIs
Tree cover	81%	71-90%	92%	87-98%
Pasture	88%	70-100%	75%	63-87%
Tea plantation	92%	52-100%	73%	57-89%
Agriculture	95%	90-100%	90%	86-94%
Built-ups	79%	36-100%	77%	61-92%
Banana plantation	58%	24-92%	77%	61-92%
Water & Others	81%	0-100%	83%	70-97%

Note: Producer accuracy (PA); User accuracy (UA); Confidence intervals (CIs); *EVI: Enhanced Vegetation Index; MSAVI: Modified Soil-Adjusted Vegetation Index; NDMI: Normalized Difference Moisture Index; NBR: Normalized Burn Ratio. Olofsson, P., et al. (2014). "Good practices for estimating area and assessing accuracy of land change." Remote sensing of Environment 148: 42-57.

Part II: Long-term (1985-2025) fractional woody cover reconstruction

- All Landsat imagery were acquired to generate an annual set of STM. These were combined with manually digitized woody cover fractions at the 30m level in a Random Forest Regression Framework. The result is a time series of annual woody cover fractions 1985-2025
- Low image availability during the 1990s caused substantial data gaps; though, the time series itself is consistent. Uncertainties remain, particularly in the middle domain (i.e., 30%-60% woody cover) which will be addressed through extended training data collection.
- The graphic shows the trajectory of one pixel in the study area, showcasing the type of time series analyses that will be possible.
- Next steps: (1) model improvement and cleaning of final model predictions, (2) combination of remote sensing outputs with historic topographic maps (ca. 1930) and CORONA spy satellite data (ca. 1960s)

