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EGU26-8030

# Evaluating a semi-automatic landslide inventory for machine learning-based shallow landslide susceptibility assessment


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## 1. Study area and Methods

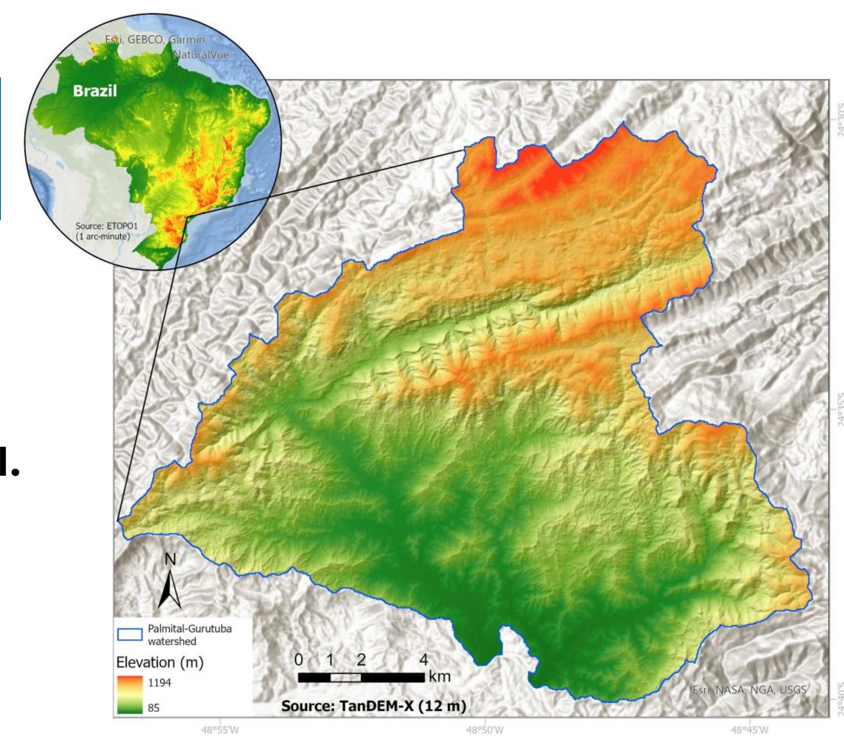



**Figure 1 – Palmital-Gurutuba watershed, Southeastern Brazil.**

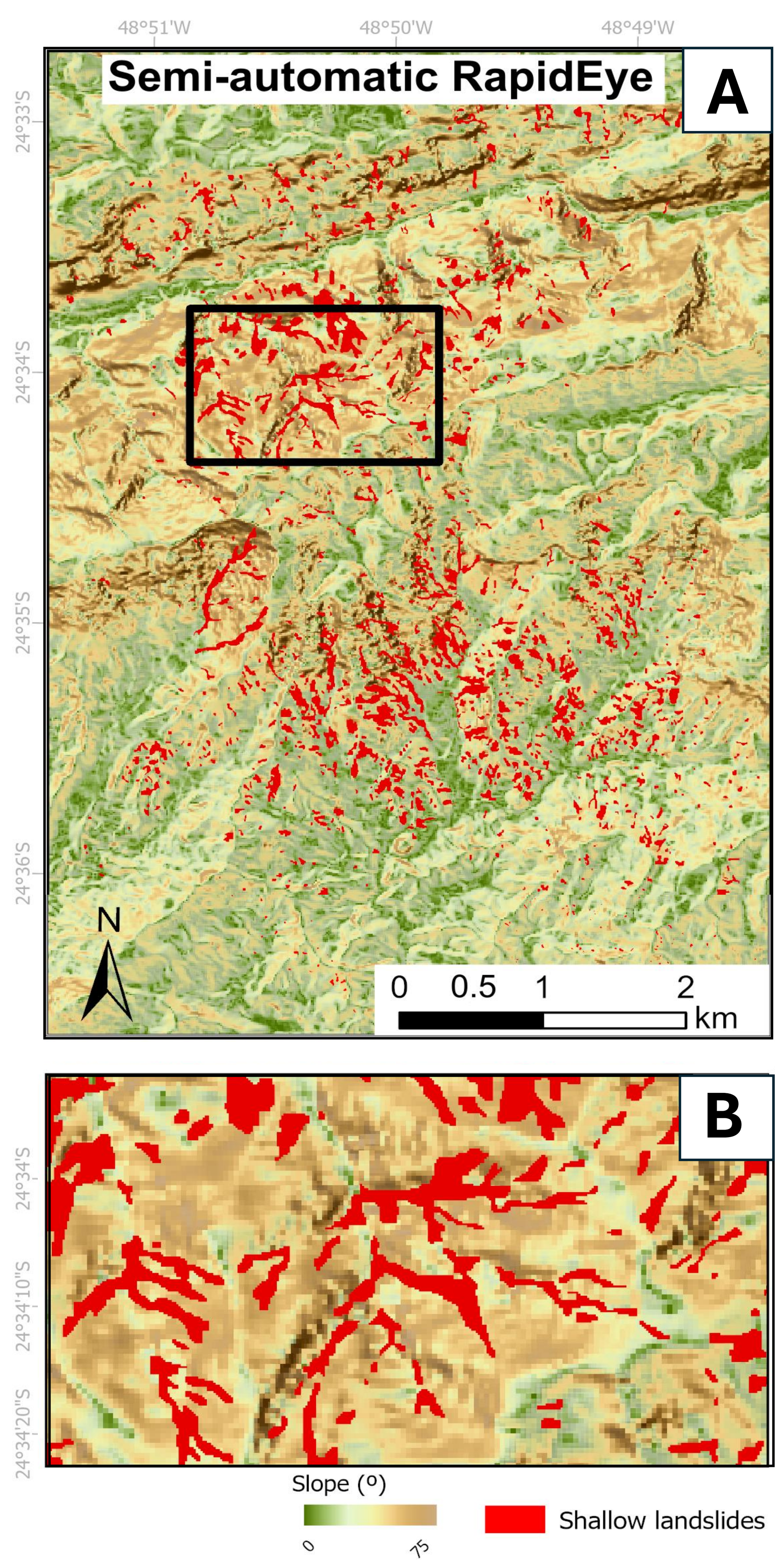



**Figure 2 – Shallow landslide inventory created using OBIA,**

**The study area is the Palmital–Gurutuba watershed located in the municipalities of Itaóca and Apiaí, São Paulo State, Brazil (Figure 1).**
**The inventory was constructed following a single extreme rainfall event that triggered landslides on January 15, 2014.**

**<u>Inventory (Figure 2):</u> shallow landslides were mapped using OBIA (Object-Based Image Analysis) in eCognition. Objects from multiresolution segmentation were classified based on low NDVI and refined using slope and drainage proximity. The satellite images used in this study were RapidEye (5 m).**

**<u>Susceptibility assessment models:</u> Logistic Regression (LR), Support Vector Machine (SVM), and eXtreme Gradient Boosting (XGBoost).**

**<u>Conditioning factors:</u> Lithology, soil, aspect, slope degree, curvature, flow accumulation and elevation. DEM: TanDEM-X (12 m).**

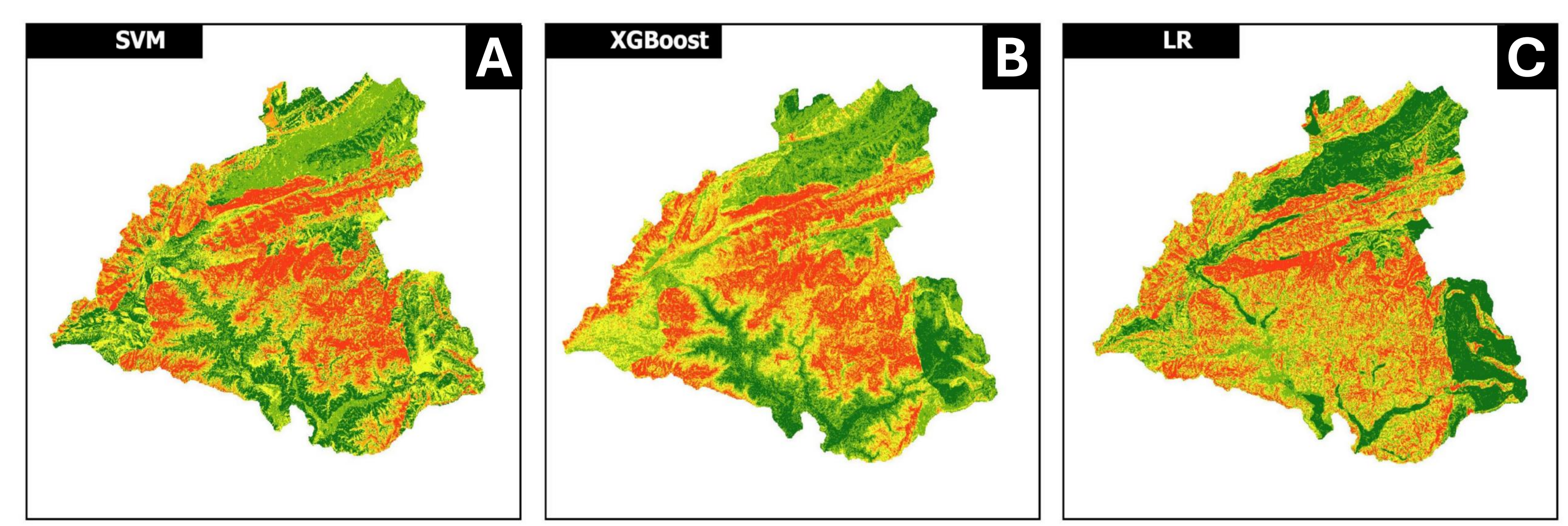
## 2. Results

**The results indicate good applicability of the semi-automatic shallow landslide inventory across all three models (Figure 3). For LR, the AUC-Success and AUC-Prediction were 0.77 and 0.80; for SVM, 0.88 and 0.82; and for XGBoost, 0.94 and 0.85. The Cohen's Kappa index (k) was employed to evaluate the level of agreement among the susceptibility maps. The results showed an overall mean k value of 0.5; this constitutes a moderate level of agreement.**

**All models concentrate landslides in the "very high" susceptibility class. LR presents a more dispersed distribution across classes, indicating lower predictive accuracy, while SVM and XGBoost show more consistent results.**

**These findings reinforce the potential of semi-automatic landslide inventories as a reliable basis for susceptibility modelling, particularly in scenarios where rapid responses are required after extreme events. Although semi-automatic approaches may still present limitations related to classification errors or the need for expert validation, they substantially reduce the time and effort needed to produce consistent inventories. Their integration with machine learning models demonstrates that, when properly constructed and validated, semi-automatic inventories can effectively support susceptibility assessments and contribute to more efficient hazard mapping and risk management strategies.**

**Figure 3 – Shallow landslide susceptibility using SVM (A), XGBoost (B), and LR (C).**





**Acknowledgements:** Trimble Inc for providing na eCognition licence. São Paulo Research Foundation (FAPESP) supported HCD (#2019/17261-8, #2022/01534-8) and CHG (#2019/26568-0, #2018/08402-4).