Monitoring tropical forest disturbance using repeatedly acquired digital aerial photography from unmanned aerial vehicle

Tetsuji Ota, Sie Thu Minn, Tual Cin Khai, Nobuya Mizoue, Shigejiro Yoshida
Kyushu university, Fukuoka, Japan.

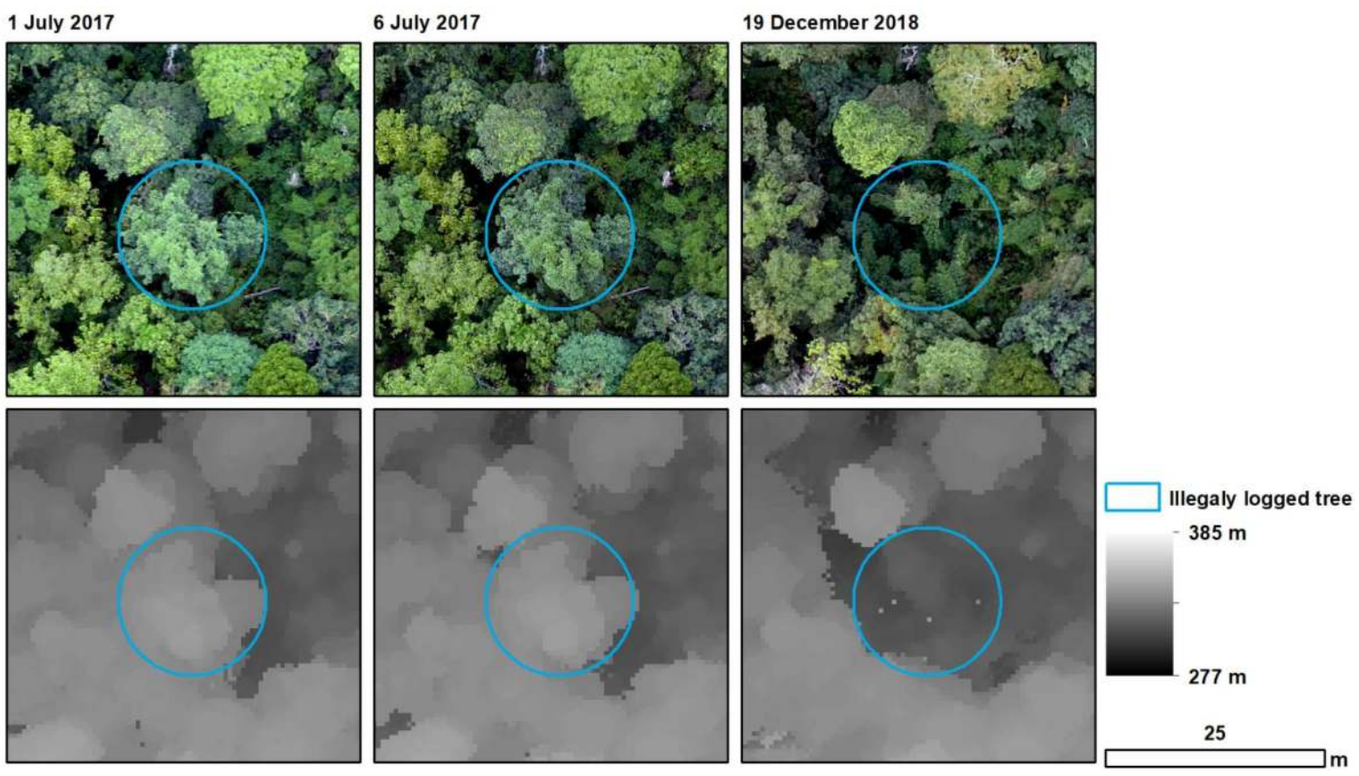
Introduction

Small scale disturbance such as selective logging is one of the factors causing forest degradation in tropical forests. Thus, a methodology monitoring small scale disturbance is required. However, conventional remote sensing technologies are not enough as the methodology because of low spatial resolution or cost limitation. Here, we evaluate the utility of repeatedly acquired digital aerial photographs (DAPs) from a lightweight unmanned aerial vehicle (UAV) to monitor small scale disturbance in tropical forest.

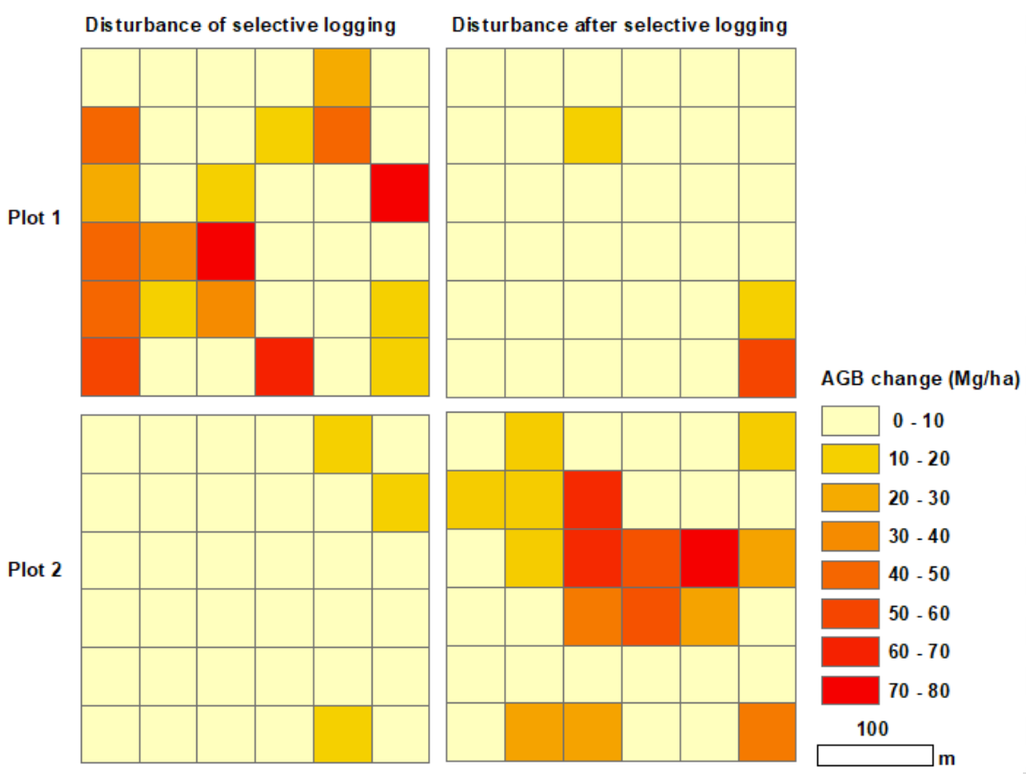
Conclusion

1. **UAV photogrammetric point cloud can accurately estimate forest disturbances in tropical forests.**
2. **AGB change due to selective logging (i.e. legal logging) was 1.2 times larger than AGB changes due to disturbance after selective logging (i.e. illegal activity), but the difference was not significant.**
3. **We conclude that UAV is a cost-effective approach to quantify small scale disturbance..**

Results and discussions

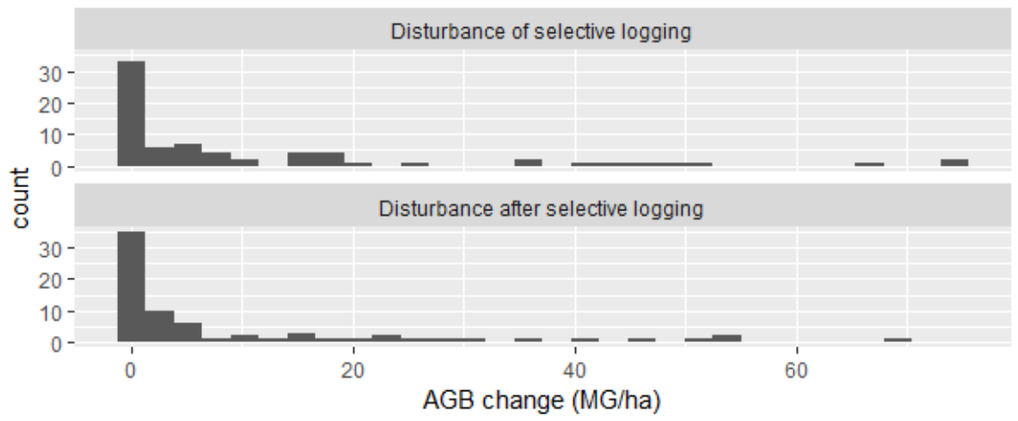


Representative example of orthophotographs and DSMs



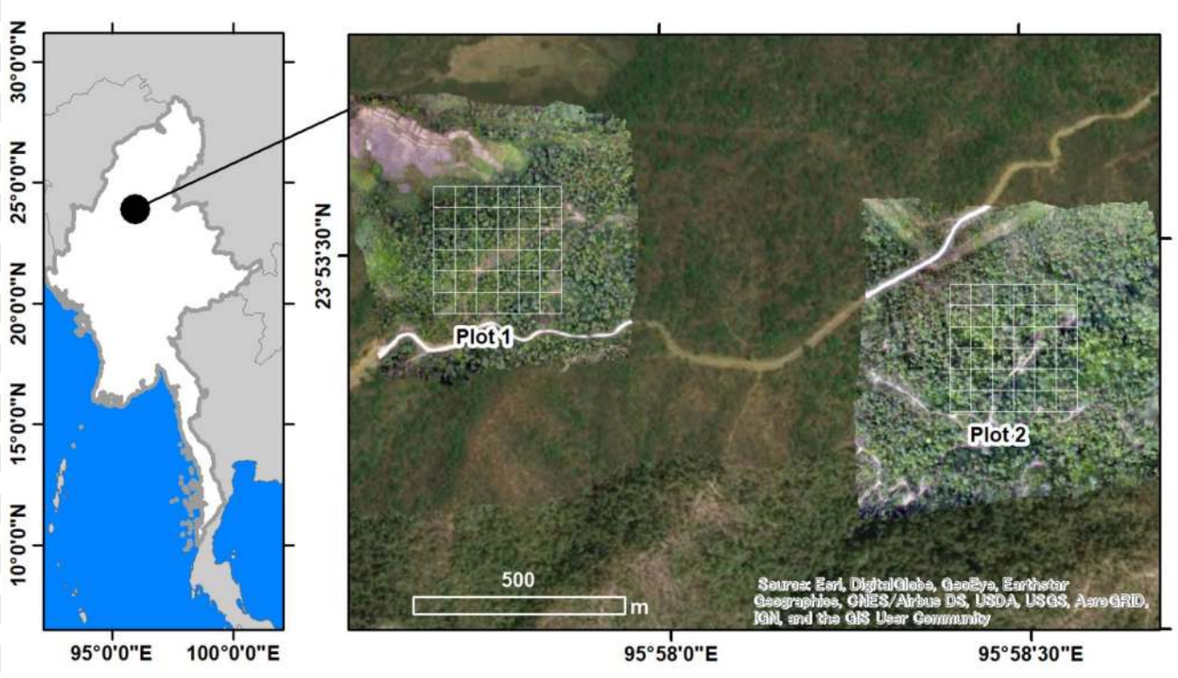
Spatial patterns of estimated AGB changes

1. DSM derived from UAV photogrammetric point cloud could capture single tree level forest disturbances
2. AGB changes was accurately estimated from the metrics derived from ΔDSM.
3. The AGB changes because of selective logging was 1.2 times higher than the AGB changes after selective logging. However, the difference was not significantly different (Welch's t-test, $p = 0.48$)



Estimated AGB changes between two periods

Materials and methods



Study area.

DAPs from a lightweight UAV were acquired three times, which were immediately before selective logging, immediately after selective logging and 1.5 year after selective logging.

Photogrammetric point cloud (PPC) was created from each of DAP. Digital surface models (DSMs) were then constructed from the PPCs. We obtained two sets of the differences in values between DSMs (ΔDSM), which were 1) between immediately after selective logging and before selective logging, and 2) 1.5 year after selective logging and immediately after selective logging.

Using the created ΔDSM forest cover changes were estimated using the equation developed by Ota et al (2019)