Forest Damage Detection Using High Resolution Remotely Sensed Data

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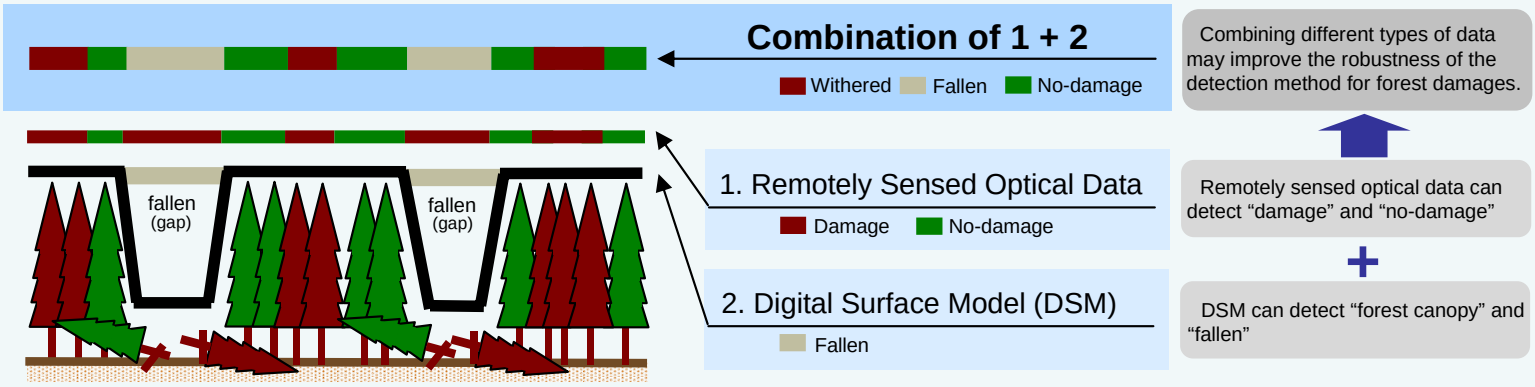
1. Introduction

- Conventionally, Japanese forest has been managed precisely by administrations. However, the change of the circumstances surrounding the forestry (e.g. decrease of working population, increase of imported wood) in Japan is causing degradation in value of lumbers and devastation of forest. Forest damage surveying kept as an important work for forest administrators to keep the forest. An effective survey method is urged in the field of forestry.
- High resolution remotely sensed optical data and Digital Surface Model (DSM) generated from LiDAR has adequate resolution for detecting forest damage areas.
- Various forest damage types can be categorized into fallen damage (snow and windstorm) and withered damage (pine beetle and mass mortality of oak trees).
- The method developed in this study aims to detect the forest damage, and distinguish the damages into fallen and withered by utilizing High resolution remotely sensed optical imagery and DSM.

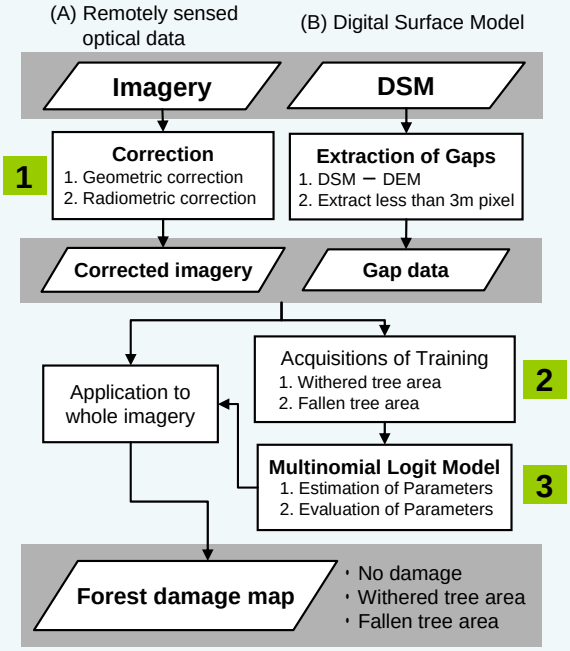
→ Withered tree (Pine beetle)

↑ Fallen damage (Snow damage) →

2. Effectiveness of data combination



3. Detection flow



1 Correction of remotely sensed optical imagery includes both geometric and radiometric. The gap extraction method, which was developed by Koukoulas and Blackburn (2004), is applied in this study.

2 Training data was settled by interpreting the damaged areas manually. Training data must contain both non damaged areas and damaged areas.

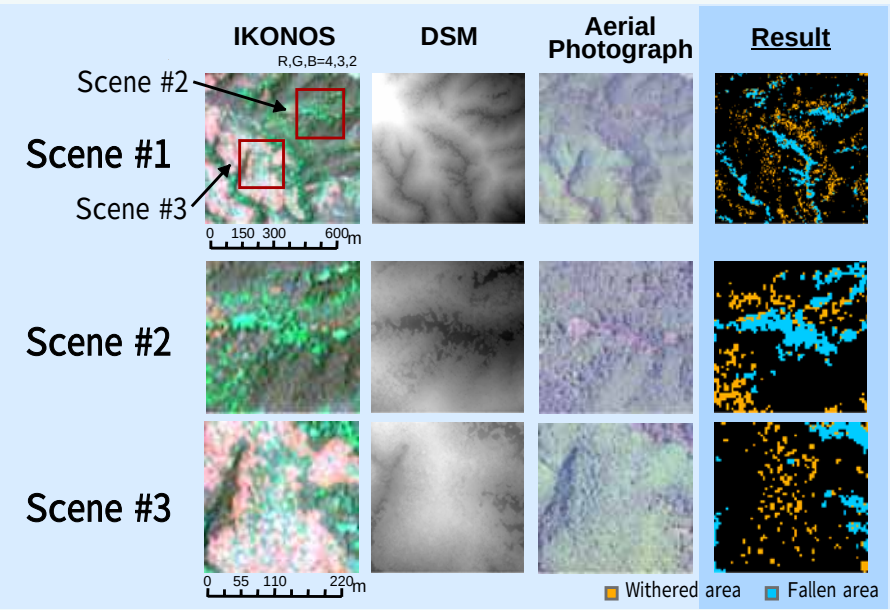
3 Multinomial logit model which is simple discrete choice model is applied to classify damage detection categories.
Explaining variables are (1) Gap areas extracted by DSM and (2) Spectral radiances of remotely sensed imagery. Dependent variables are no damage, fallen and withered.

4. Results

The test site “Minami” is located in the center of Gifu Prefecture, Japan. The site experienced serious forest damages by weight of snow in January 2002. There are withered areas still existing in the site.

IKONOS imagery was taken on May 2003; LiDAR data (footprint: 2.5m) was taken in early summer of 2004. Significant difference was not observed from statistical values among withered, fallen and no damaged area in band 1 and 2. Band 3 and 4, which showed apparent difference were used instead.

Following detection flow, results are shown bottom figure.



5. Conclusions

The method succeeded in (1) detecting fallen and withered areas separately, and (2) detecting extensive damaged areas. The effectiveness of adapting multinomial logit model as a detection method was confirmed by evaluation of the results.

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