Spatiotemporal Distribution of Potential Human-Elephant Conflict Hotspots in Eastern Thailand

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Abstract: In Thailand, human-elephant conflict (HEC) in the form of crop depredation by wild elephants have been intensified and negatively impacted local communities' quality of life. Despite increasing concern and urgent needs for solution, limited studies explore landscape-scale spatiotemporal pattern of this conflict. This study comprised of two parts. First, we identified HEC hotspots by applying Maximum Entropy modeling with remote sensing dataset which represent level of resource suitability (EVI, TRI, Forest%, KBDI, distance to forest and water) and human disturbance (human population density, distance to road, lit-up areas, and protected habitat). Two-dimensional conflict matrix based on thresholding approach was used to categorized predictive results into four groups (high, likely, low, and rare). In the second part, we quantified land cover on 2000, 2005, 2010, 2015, and 2018 using random forest classifier and overall land cover changes to that within high HEC zones. We found HEC probability were governed by distance to forest and protected areas, drought condition, changes in vegetation, and human density. However, land cover changes were unlikely a cause of increase in HEC, but some land cover type (e.g. plantation) may assist elephants to move through the landscape outside natural forest.

1. Background

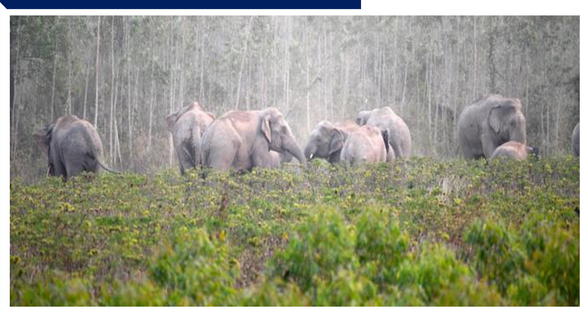


Fig.1: Wild elephant herd in feeding in cassava fields (matichon news, 2017)

Objectives

1. Model spatial pattern of HEC using satellite-derived data and maximum entropy modeling
2. Assess trend in HEC probability over 10 years period, 2009-2018
3. Quantify the changes in land cover within identified HEC hotspot compare to

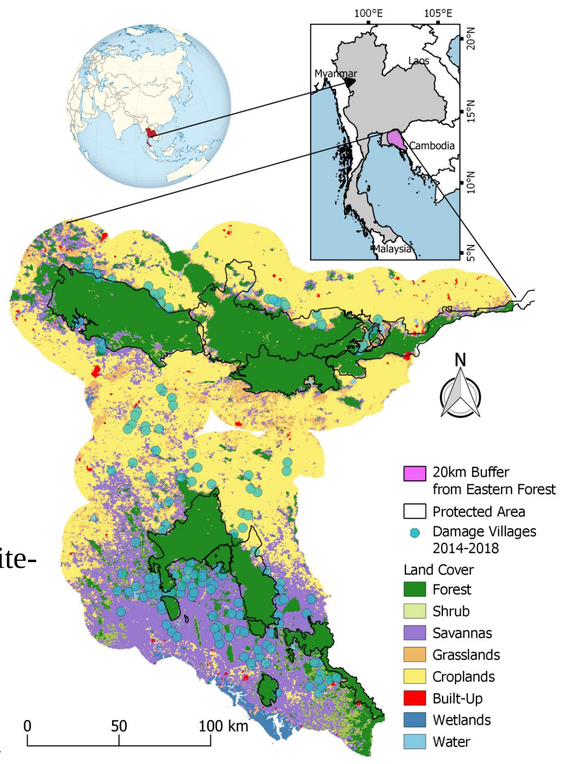
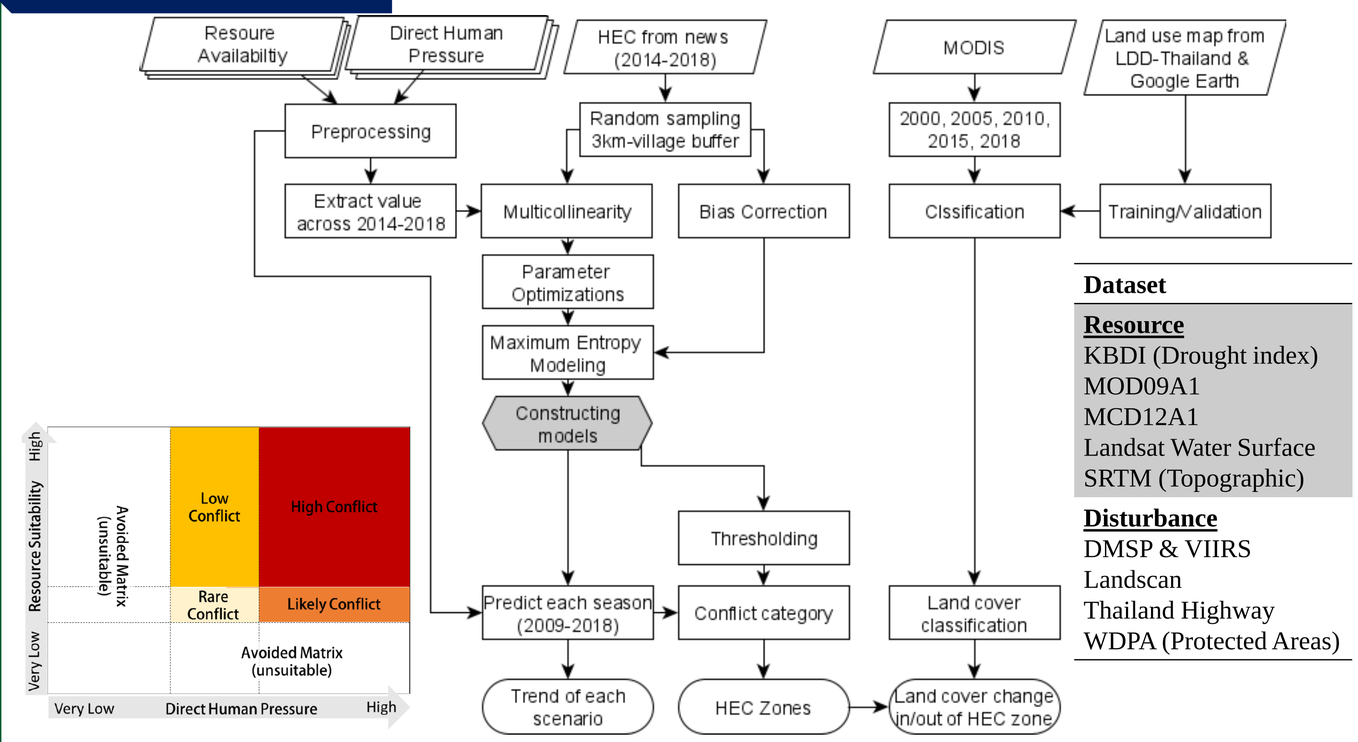


Fig.2: Location of study area in Eastern Thailand

2. Methodology



Dataset

Resource
KBDI (Drought index)
MOD09A1
MCD12A1
Landsat Water Surface
SRTM (Topographic)

Disturbance
DMSP & VIIRS
Landscan
Thailand Highway
WDPA (Protected Areas)

Fig.3: Dataset and flow of this study

3. Results

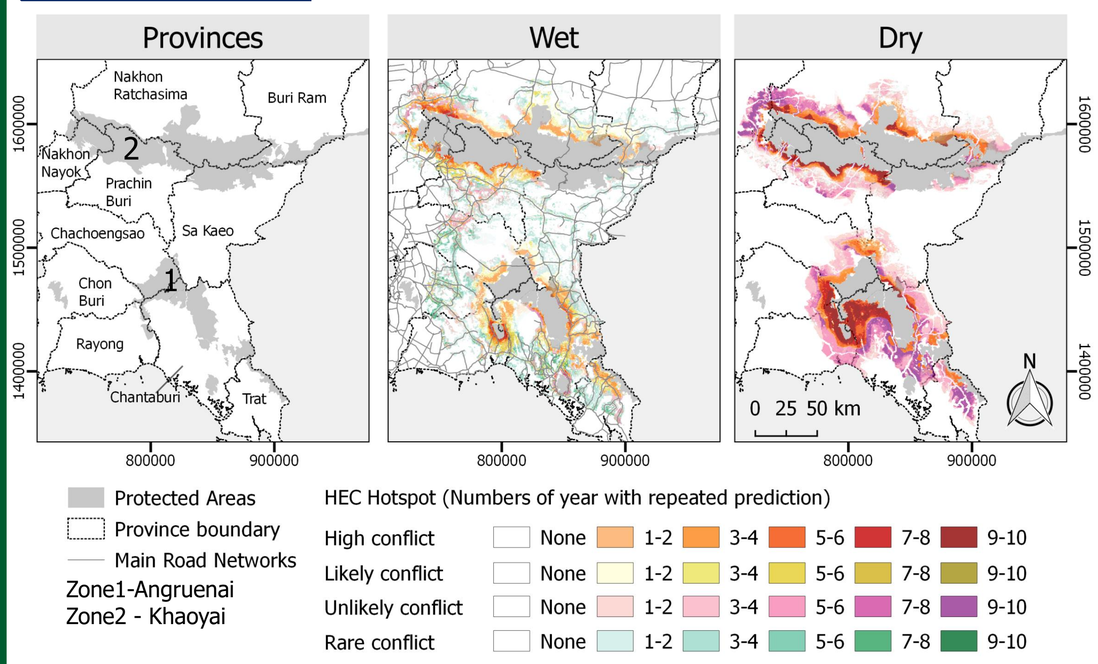


Fig.3: Simulated HEC zones based on location of reported HEC cases and relevant environmental responses

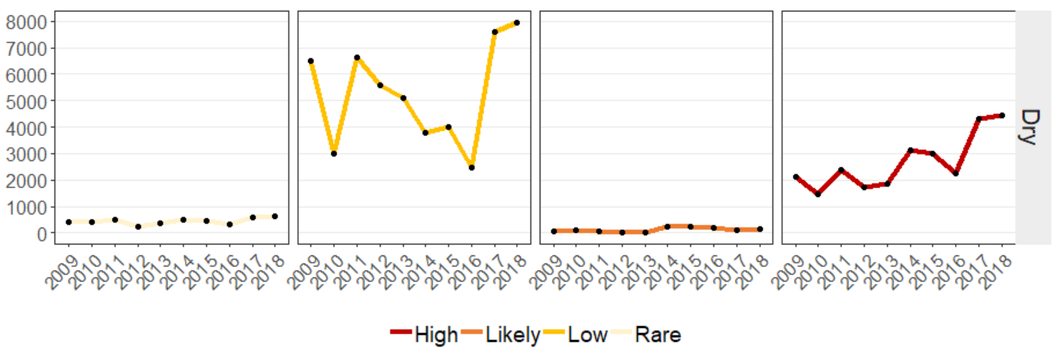


Fig.4: Total areas of HEC during dry season under each category, an increasing trend in high HEC can be observed

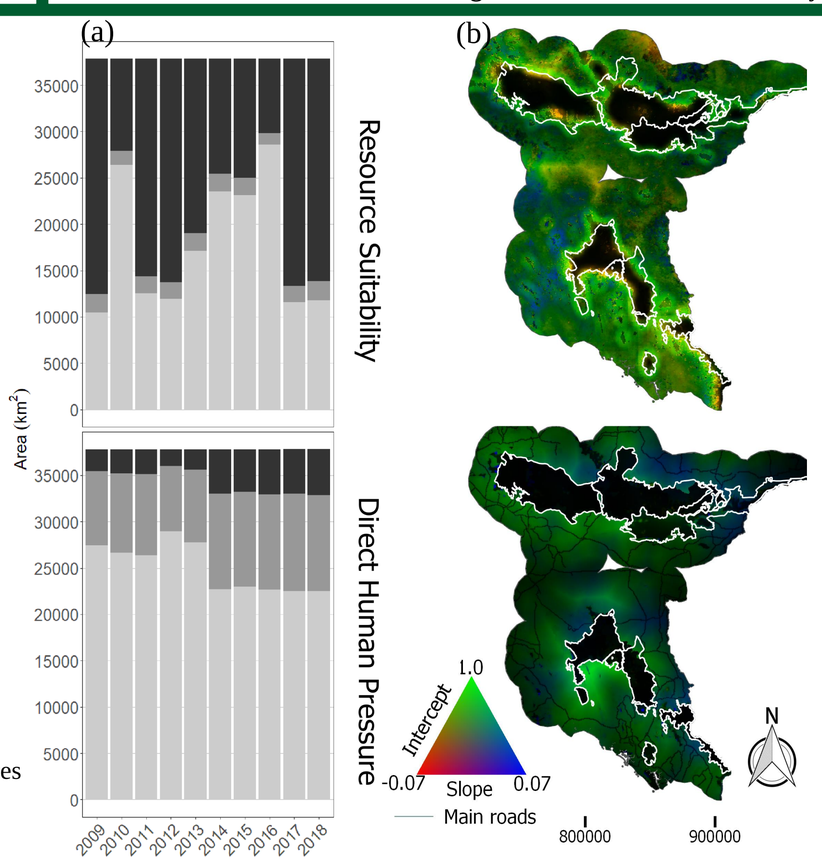


Fig.5: Extracted from dry season, the high HEC season, (a) Temporal distribution of areas predicted as High, Low, and Very Low category during 2009-2018, and (b) Changes in HEC probability from 2009 to 2018 visualized using RGB composite, Red: negative slope (decreasing trend), Green: intercept (baseline of HEC probability in 2009), and Blue: positive slope (increasing trend).

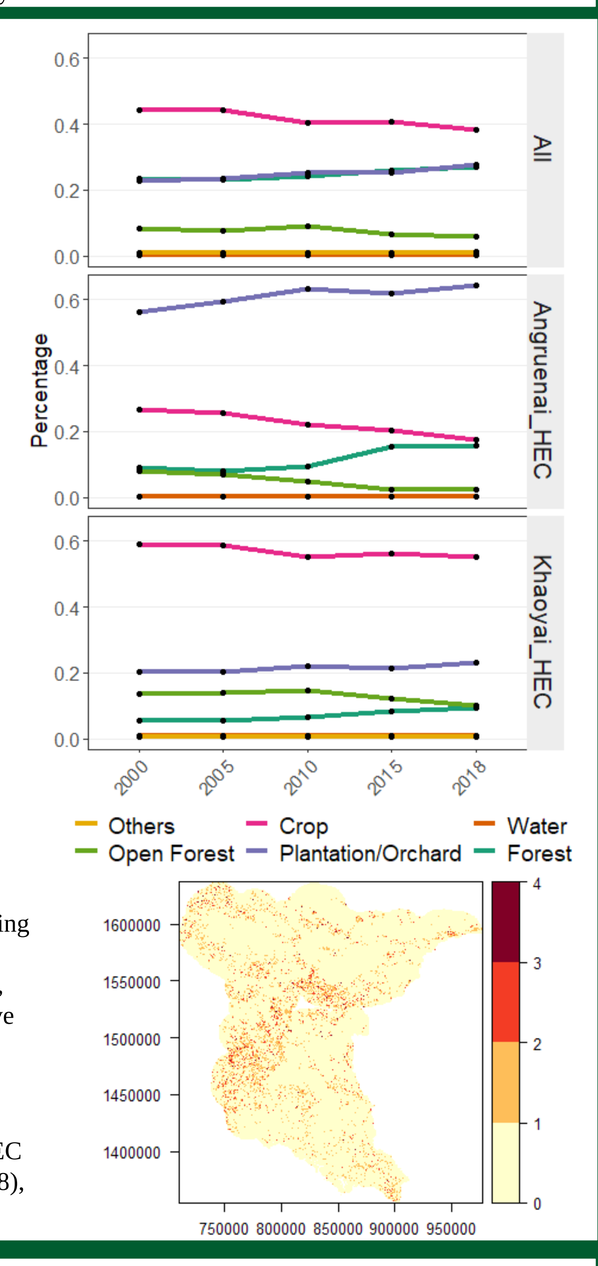


Fig.6: (a) Land cover changes for the whole study area and two high HEC zones extracted from 5 selected years (2000, 2005, 2010, 2015, and 2018), and (b) number of land conversion between the same selected years

4. Discussions & Future Work

- Overall, HEC occurrences are concentrated near protected areas and forest
- Drought condition, vegetation changes (e.g. green-up), and human population density influence spatial and temporal distribution of HEC
- Potential High HEC zones are estimated mostly in 2 areas: i) around Ang Rue Nai WS (Rayong, Chonburi, Chantaburi) and ii) clusters near Khao Yai NP (Nakhon Ratchasima, and Prachinburi)
- Actions for each HEC zone, i) Rare: elephant-vehicle-collision ii) Low: land-use iii) Likely: human behavioral change , iv) High: both land management (e.g. fences) and human awareness
- Since 2000, forest continuously increased. Plantation expanded. However, composition of land cover differed in each HEC cluster
- Land cover is unlikely the cause of increase in HEC, but may assist in movement
- Drought condition and its relationship to HEC, as well as response of each land cover type to drought should be further studied

Reference

[1] Matichon News (2017). "Elephant conflict escalated as dry season approaches". [2] Mateo-Tom´as, Patricia et al. (2012). "Alleviating humanwildlife conflicts: Identifying the causes and mapping the risk of illegal poisoning of wild fauna". In: Journal of Applied Ecology 49.2, pp. 376–385 [3] N. Kitratporn & W. Takeuchi, "Spatiotemporal Distribution of Human–Elephant Conflict in Eastern Thailand: A Model-Based Assessment Using News Reports and Remotely Sensed Data," Remote Sensing, vol. 12, no. 1, pp. 90, dec 2019. [4] Phillips, Steven J., Robert P. Anderson, and Robert E. Schapire (2006). "Maximum entropy modeling of species geographic distributions". In: Ecological Modelling 190.3-4, pp. 231–259.

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