Determining regional-scale carbon losses from tropical peatlands using InSAR

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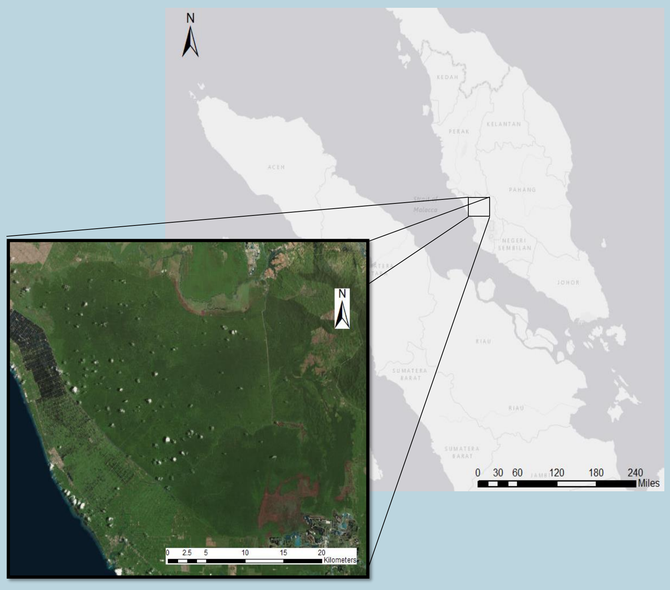
***Aim*: to determine whether rate of subsidence of the peat surface measured by Interferometric Synthetic Aperture Radar (InSAR) is a proxy for rate of carbon loss in tropical peatlands in southeast Asia.**

Widespread agricultural development of tropical peatlands in SE Asia (e.g. pulp wood, palm oil) is leading to increased drainage, peat decomposition and large-scale forest fires, contributing significantly to global greenhouse gas emissions. However, carbon losses and subsidence from these remain poorly quantified due to the challenging scale and inaccessibility of dense tropical peatland forests. Field-based subsidence measurements are therefore a spatially-limited approach for assessing carbon losses from tropical peatlands. Alternatively, space-based platforms enable regular and efficient pan-regional monitoring. The **'intermittent small baseline subset' (ISBAS)** modelling technique determines surface deformation under the tropical forest canopy using Sentinel-1 C-band InSAR data. Enables continuous monitoring of surface motion ranging from 0.1 – 40 cm/yr at spatial scales ≥ 90 x 90m.

The ambition of this project is to deliver regional carbon loss rates from tropical peatlands in SE Asia following land use change, derived from InSAR measurements. This is a novel approach as InSAR is yet to have been used to determine subsidence of tropical peatland sites.

Primary study site

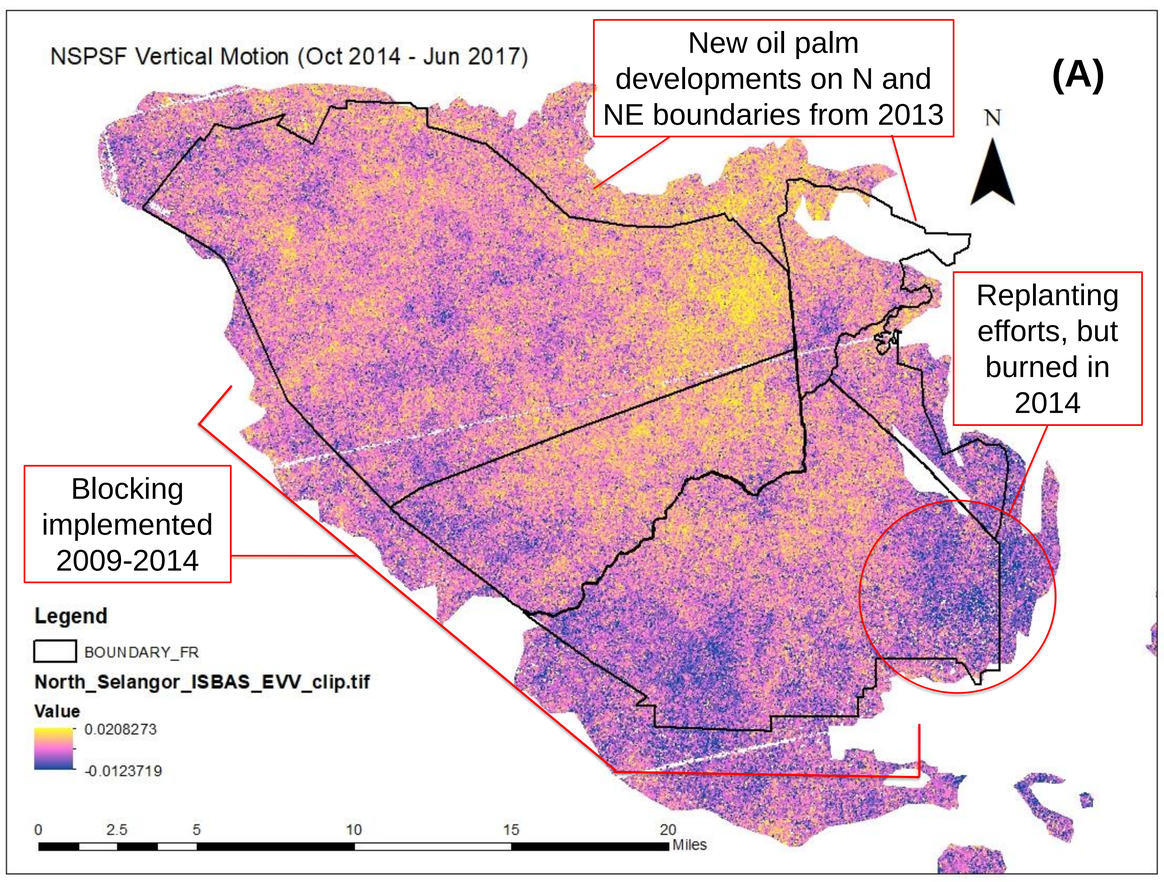
- North Selangor Peatland Swamp Forest (NSPSF) is located in Selangor, peninsular Malaysia.
- Area: ~815 km².
- Past disturbances (e.g. uncontrolled deforestation) have resulted in secondary mixed swamp forest.
- Gained reserve status in 1990.
- Integrated management plan introduced in 2014, restoring water table by blocking, fire management and replanting.

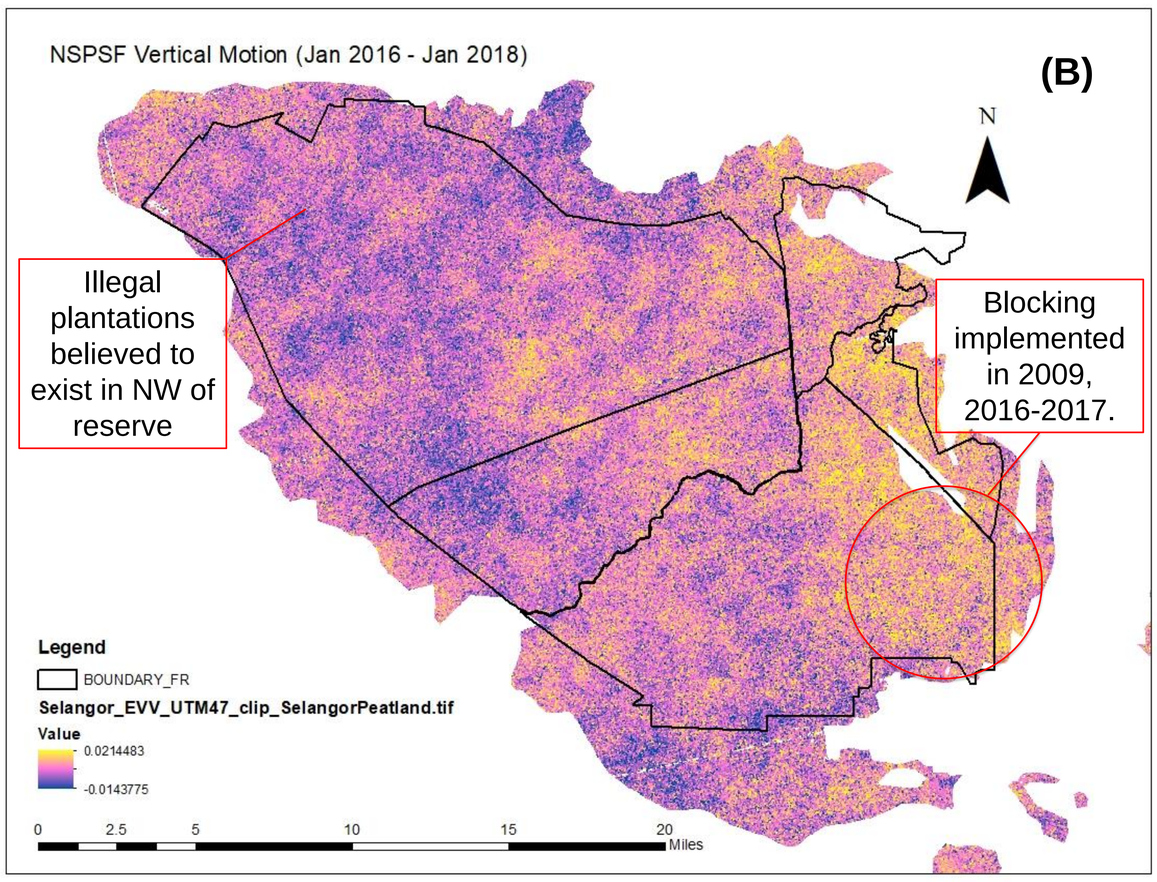


Method

- InSAR maps of NSPSF have been created to track the relative vertical movement of the peat surface over time.
- InSAR and field measurements of subsidence will be combined with peat carbon stock data using statistical regression modelling techniques to validate the use of subsidence as a proxy for carbon loss.
- To date, 18 ground resolution cells have been set up in forest, oil palm and burned peatland areas. They include:
  I. 16 subsidence poles, randomly distributed.
  II. 3 piezometers.

InSAR results





- Maps show that system is dynamic. Supports reproduction of maps annually on a sliding-window basis.
- Possible explanations for InSAR results:
  I. Response to management practices to restore peatland stability and reduce subsidence.
  II. Alternatively, InSAR may reflect water table dynamics as a result of drought and rainfall. The 2014-2016 El Niño event inducing prolonged drought in the region, likely reducing water table levels.

What next?

- A trip to NSPSF in November 2018 to collect first dataset. A trip with more frequent data collection time points will take place during rainy season in Spring 2019.
- Collate rainfall data for the region to compare with InSAR and ground data results.
- A study into the penetration of radar into tropical peat profiles will be conducted in the lab and on site using a portable radar system in July 2019. This will help to disentangle the relative influence of rainfall and management practices on subsidence rates determined by InSAR.

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