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Understorey vegetation drives surface runoff and soil loss in teak plantation-based system of Northern Laos

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Background

Population increase → Demand of agricultural product → Improper land management → Landuse and hydrological changes → Soil erosion

➢Conditions in Laos

- Laos: humid tropical mountains
- Steep slopes
- Heavy rains
- High surface runoff
- Soil erosion

➢Effects soil erosion

On site

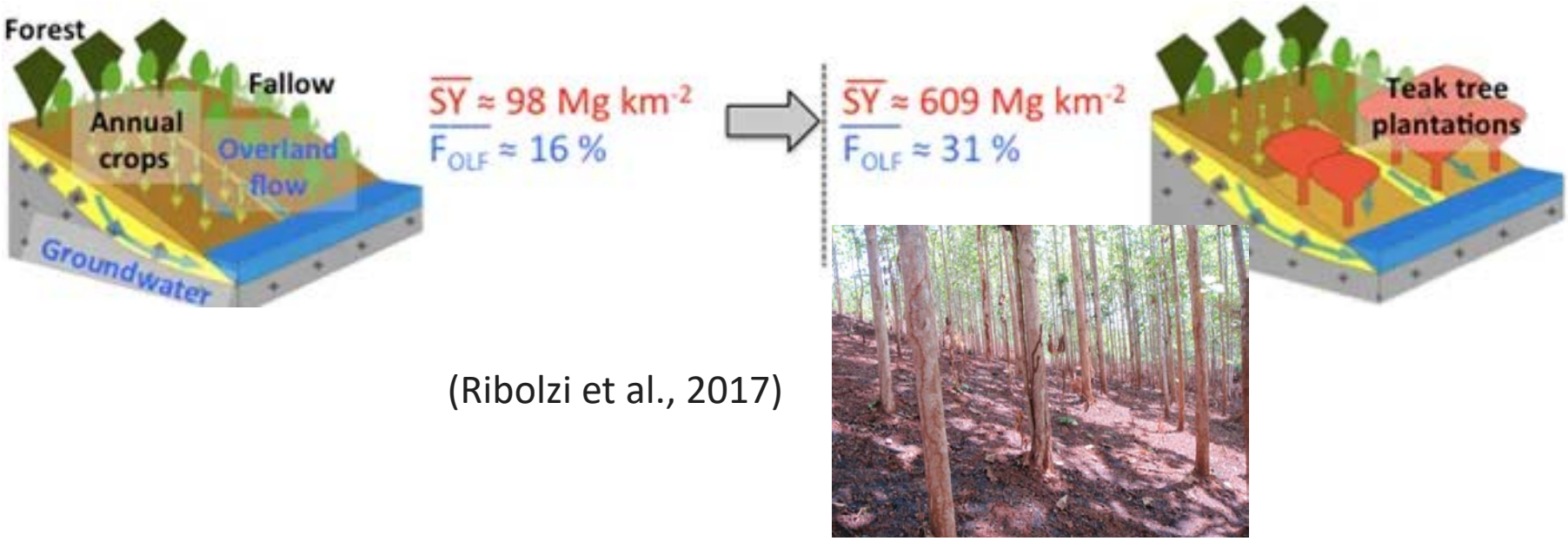
- Soil loss
- Soil quality reduction
- Decline of agricultural production

Off site

- Water-related disasters
- Diminution of groundwater
- Water source pollution (high sediment, bacteria)
- Dam siltation

Economic loss

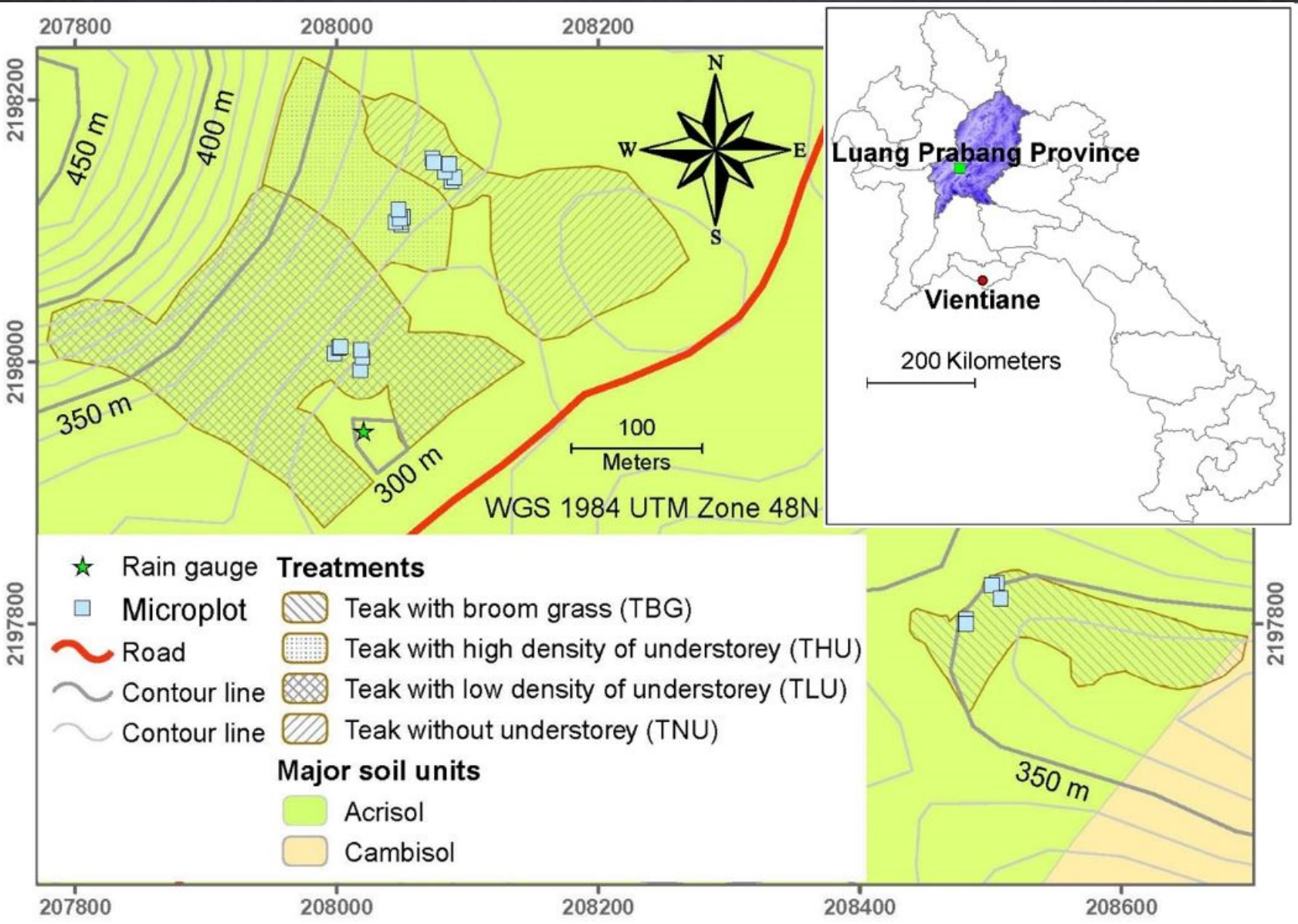
Questions and objective



(Ribolzi et al., 2017)

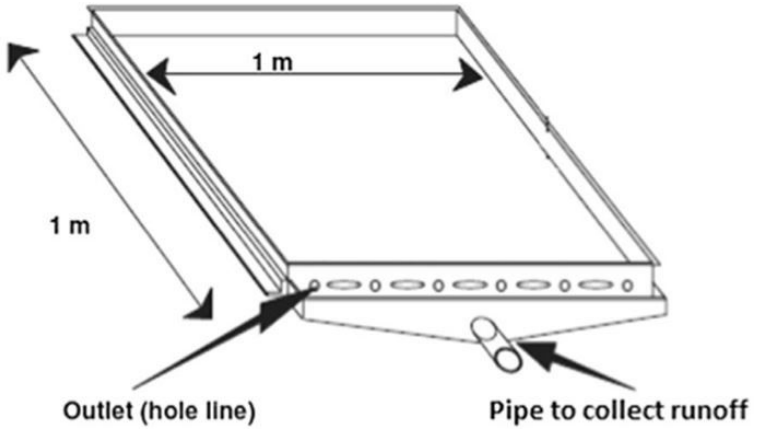
- The natural forests are known for their protective effect against soil erosion and Crop incorporated with tree could reduce soil erosion (Sidle et al., 2006).
- Will keeping understorey enhance surface runoff and prevent soil erosion?
- What is the role of understorey, such as broom grass, in teak tree plantation?
- **Objective: to assess the effects of land use management on surface runoff and soil losses in teak tree plantation area.**

Materials and Methods: Ban Kokgnew, Laos

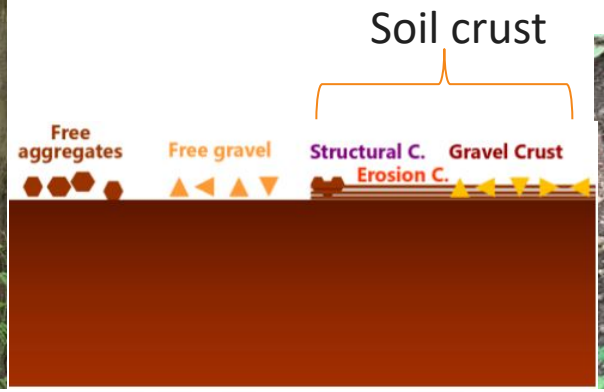


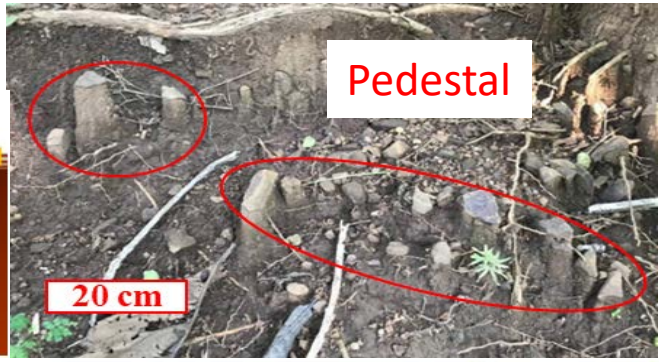
Materials and Methods

- Soil surface features (structural crust, erosion crust, gravel crust, free aggregates, free gravel including pedestal
- Percentage of cover and height of teak tree and understorey
- Rainfall: 22 samples (97 rainfall events) during the rainy season of 2017 (June to October)
- Runoff and soil loss -> sediment concentration

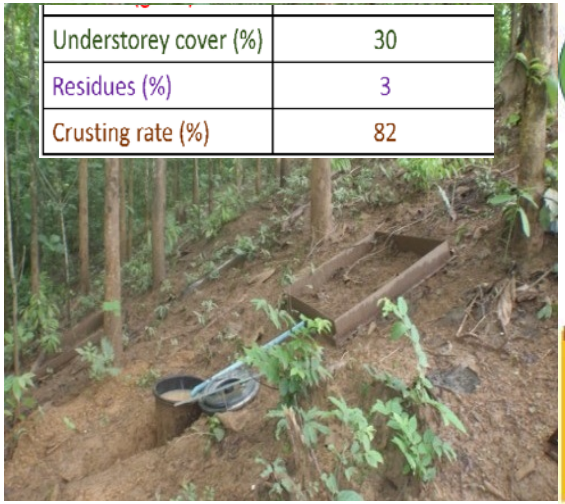


Sketch of microplot used to catch runoff and sediment

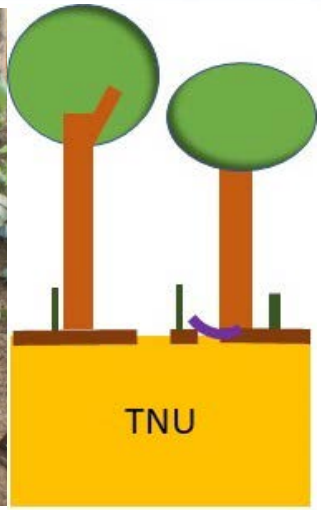




Materials and Methods

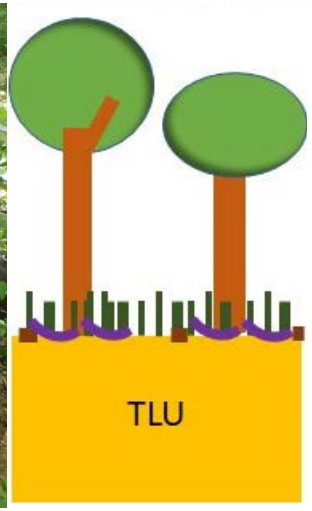


Understorey cover (%)	30
Residues (%)	3
Crusting rate (%)	82

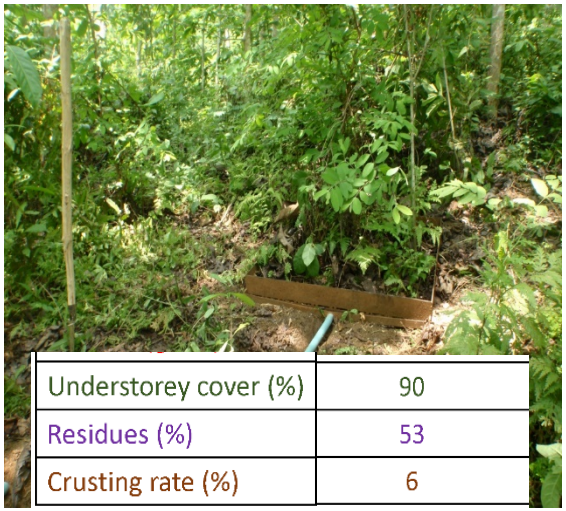


Teak without understorey

Understorey cover (%)	75
Residues (%)	58
Crusting rate (%)	9

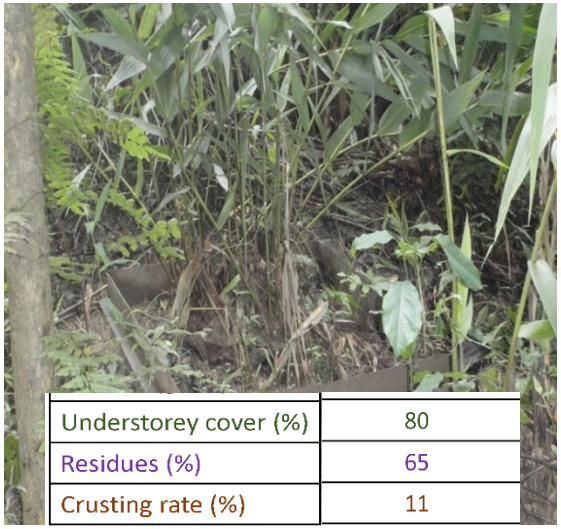


Teak with low density of understorey



Understorey cover (%)	90
Residues (%)	53
Crusting rate (%)	6

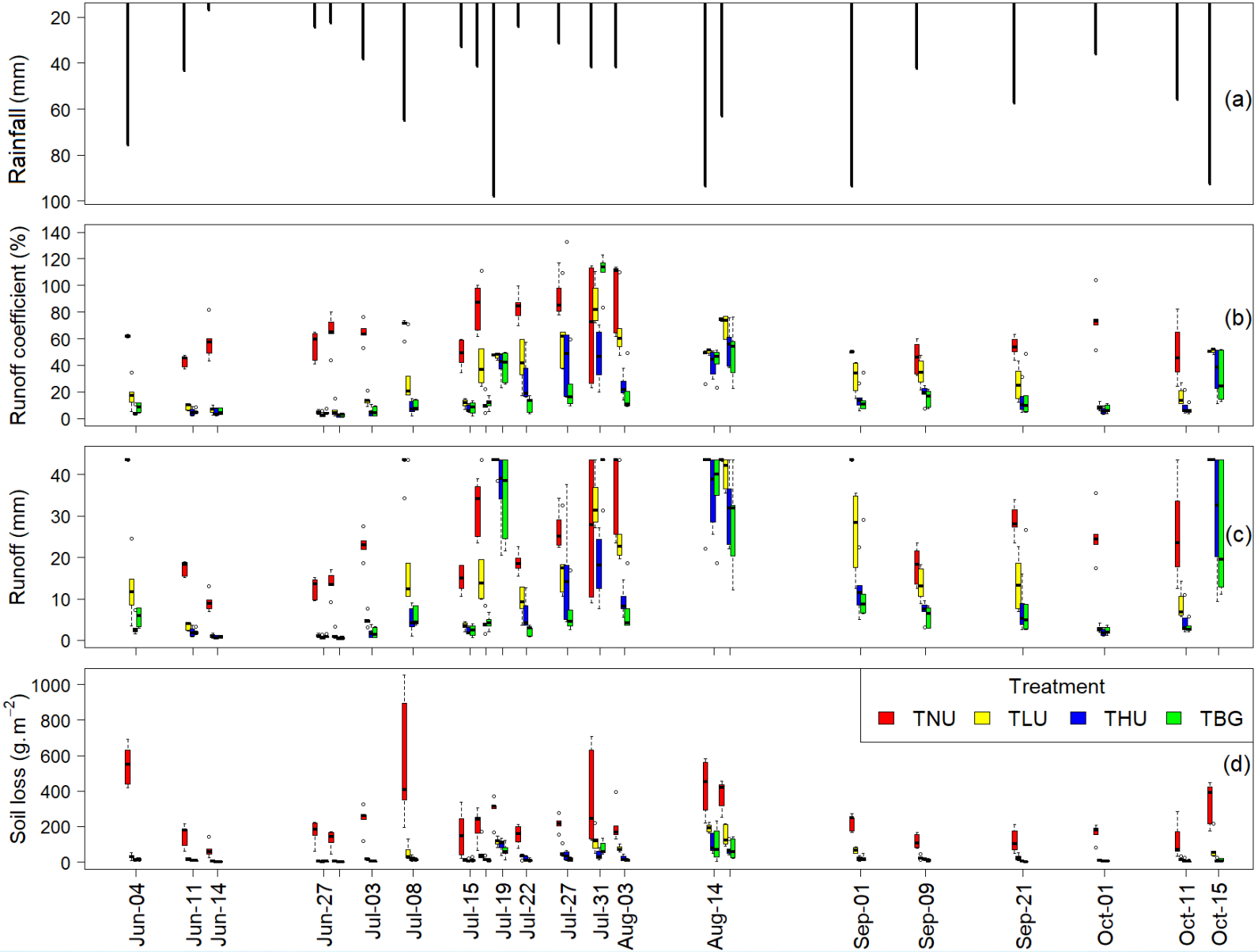
Teak with high density of understorey



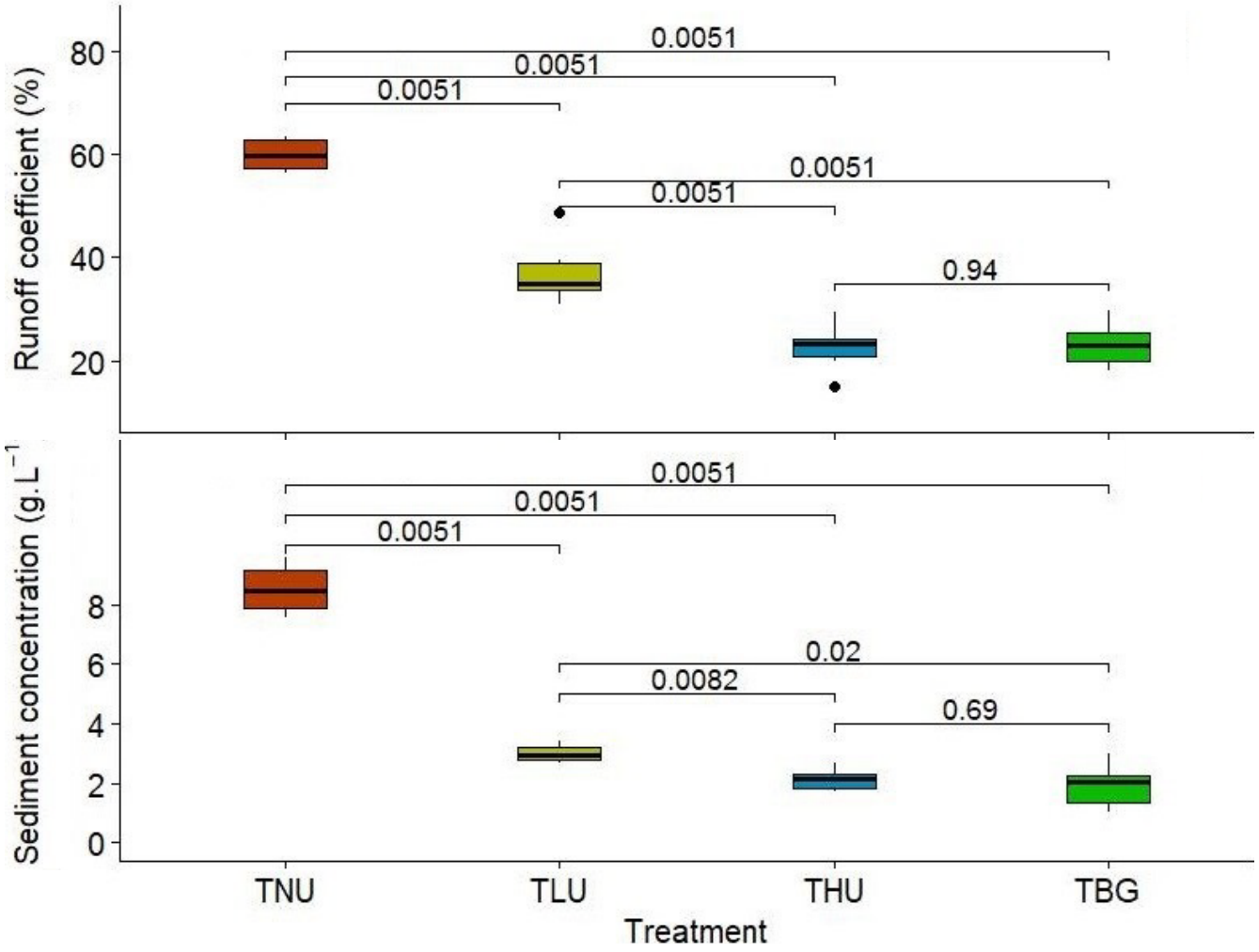
Understorey cover (%)	80
Residues (%)	65
Crusting rate (%)	11

Teak with broom grass

Results

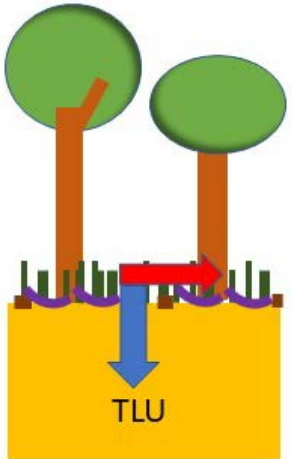


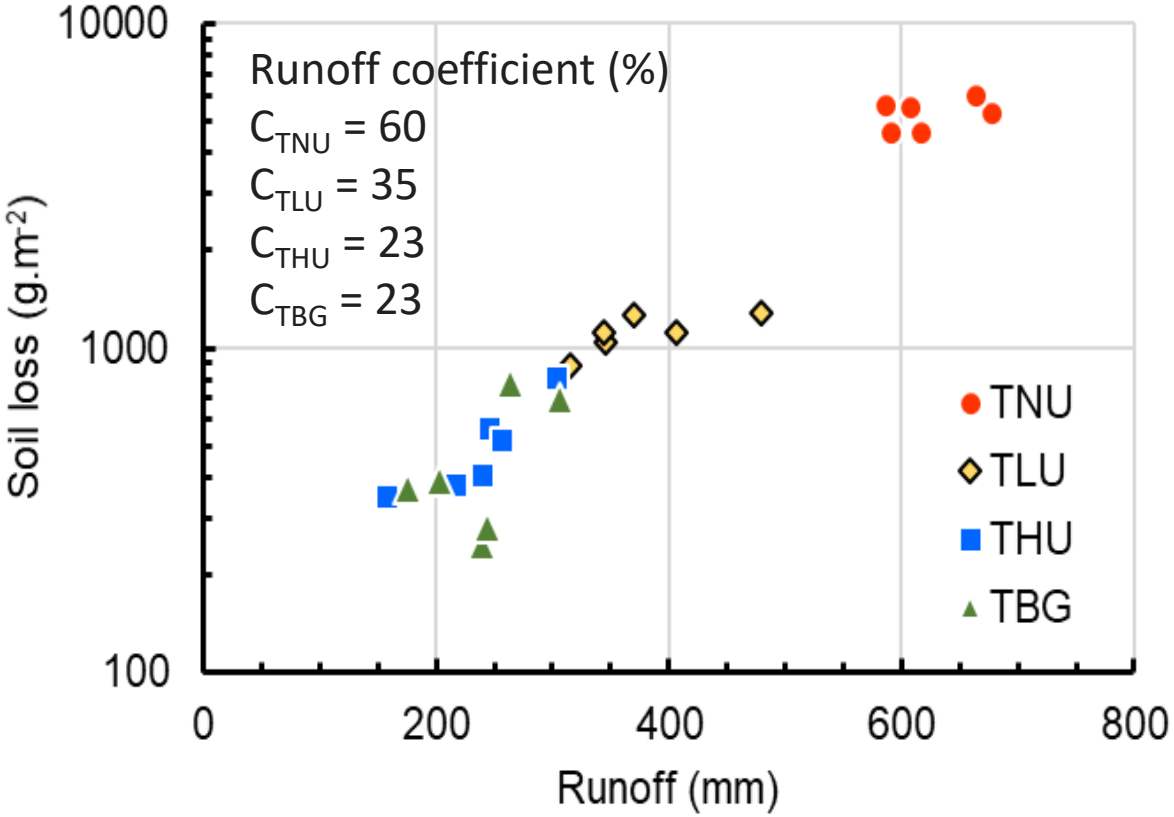
Results

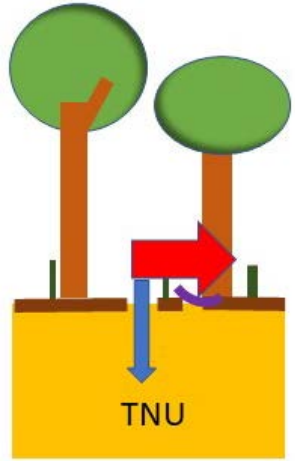


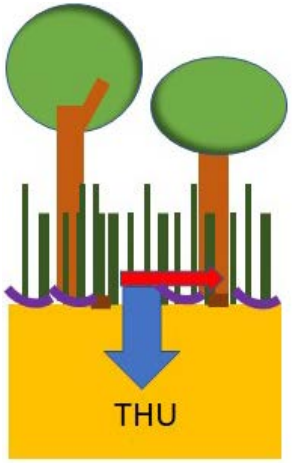
Each value in the graphs represents the p-value of Wilcoxon test between two groups of treatments

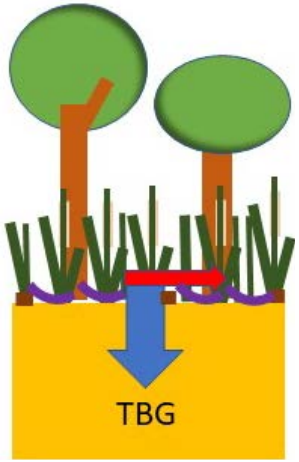
Results

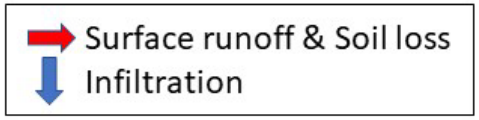






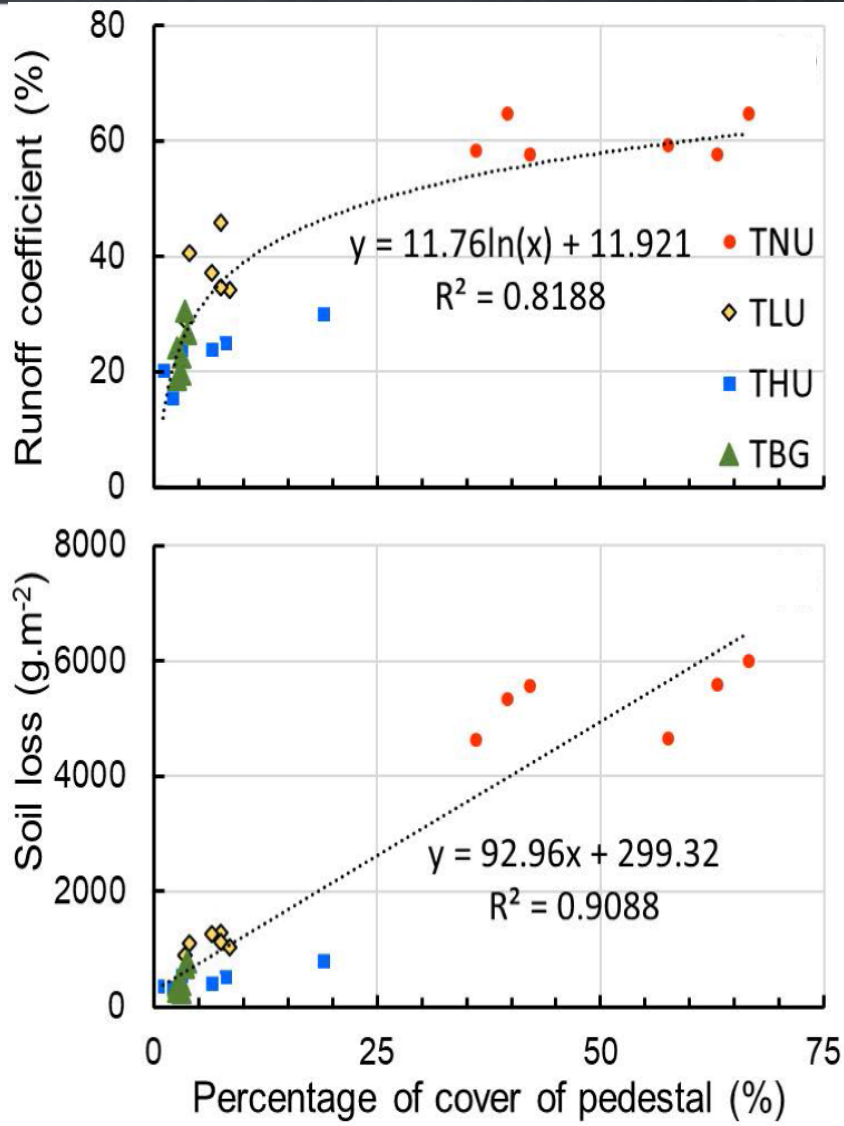




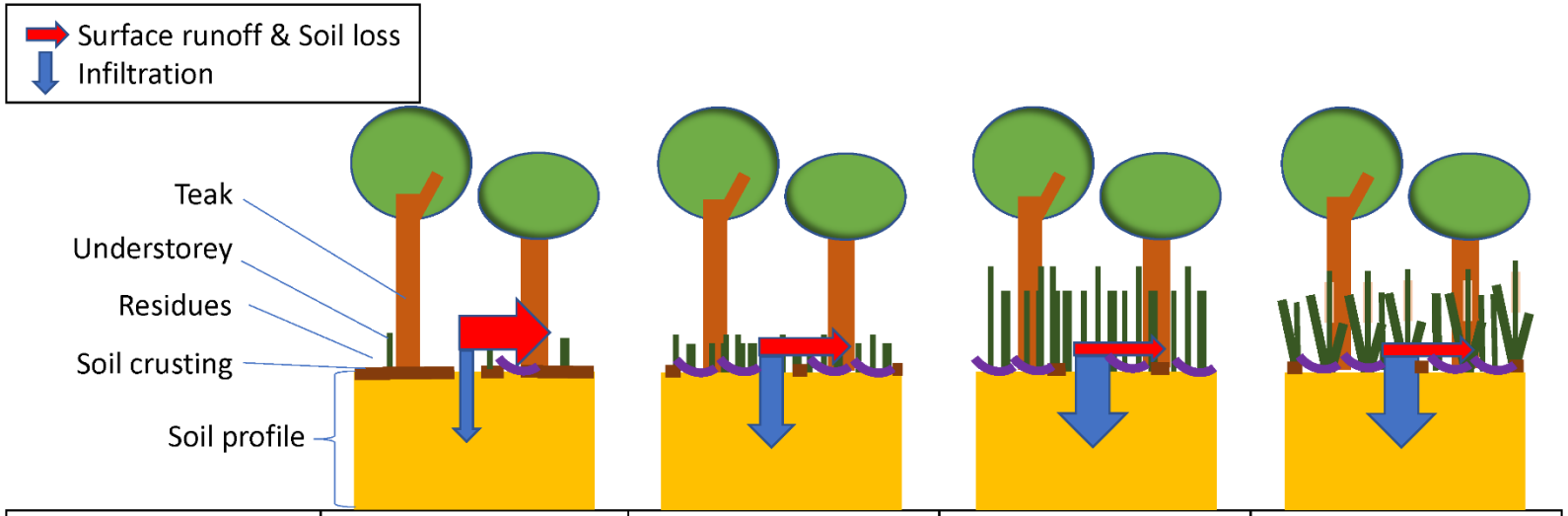


Results

- Percentage of cover of pedestal is a good indicator of surface runoff and soil erosion based on good correlations between runoff coefficient and soil loss and percentage of cover



Conclusion



	TNU	TLU	THU	TBG
Runoff coefficient (%)	60	35	23	23
Soil loss ($g.m^{-2}$)	5455	1115	465	381
Understorey cover (%)	30	75	90	80
Residues (%)	3	58	53	65
Crusting rate (%)	82	9	6	11

- Keeping understorey such as broom grass could save 45 ton ha^{-1} of soil during the rainy season.

Acknowledgements

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