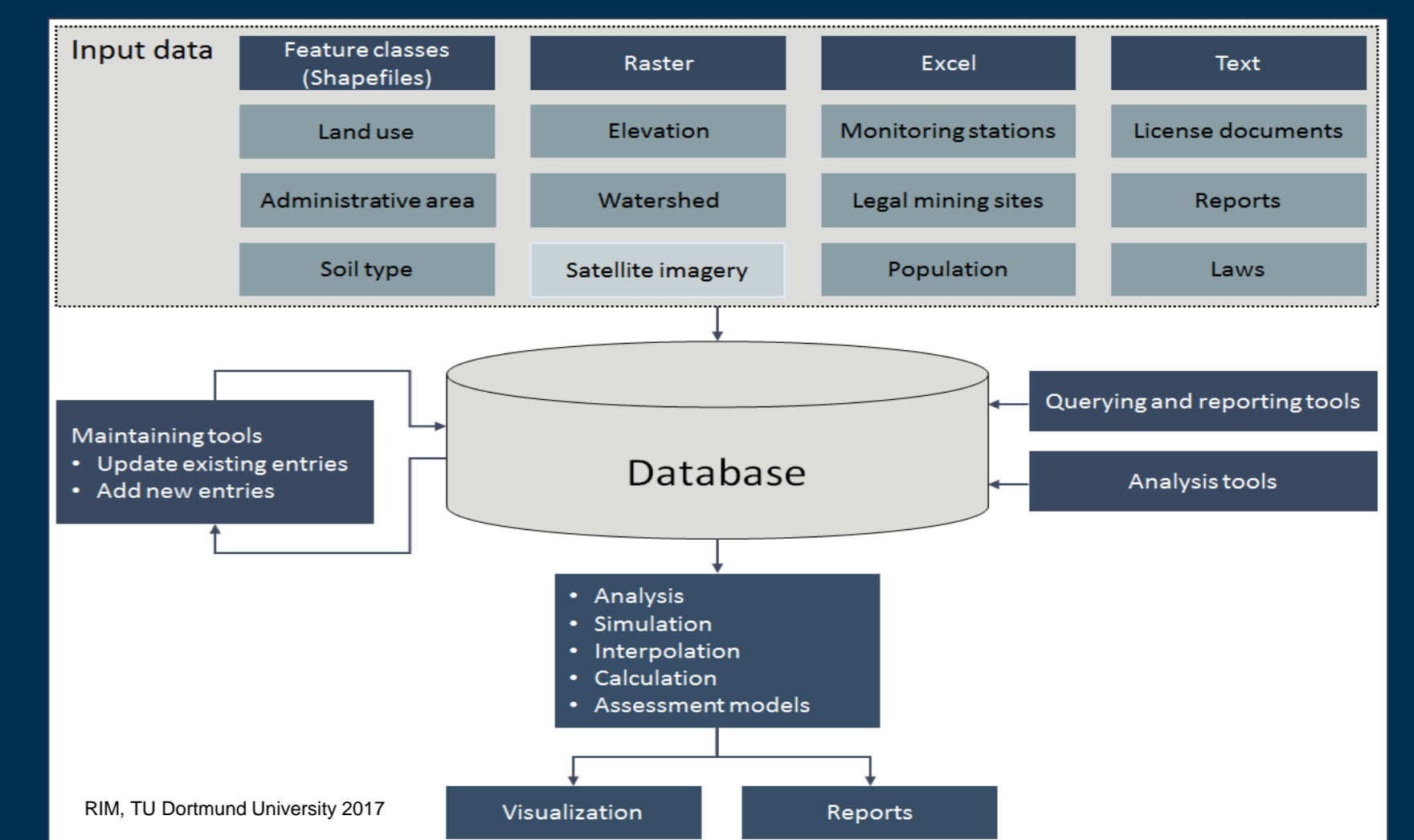


Monitoring of Mineral Resource Extraction and Analyzing its Impacts in the Hoa Binh Province

Motivation and Objective



- Massive and uncoordinated mining activities for many years in Hoa Binh
- Risk of environmental impacts due to extensive mining including devastation of landscape, soil degradation, loss of biodiversity, contamination of air, water and soil.
- Aiming at environmental monitoring of mining activities and developing software tools for mining industry and administration in Hoa Binh, Vietnam.

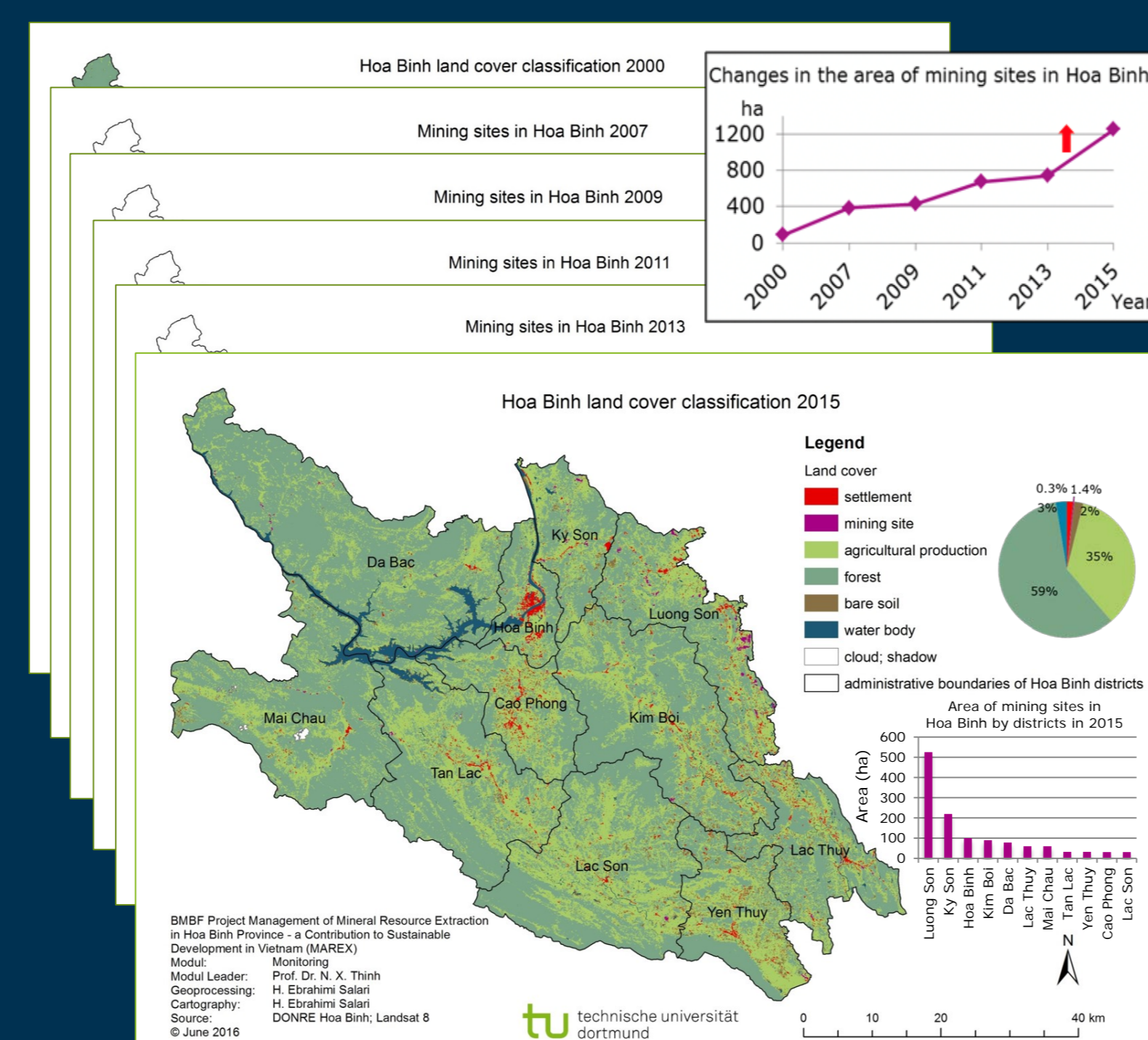


Data and analysis

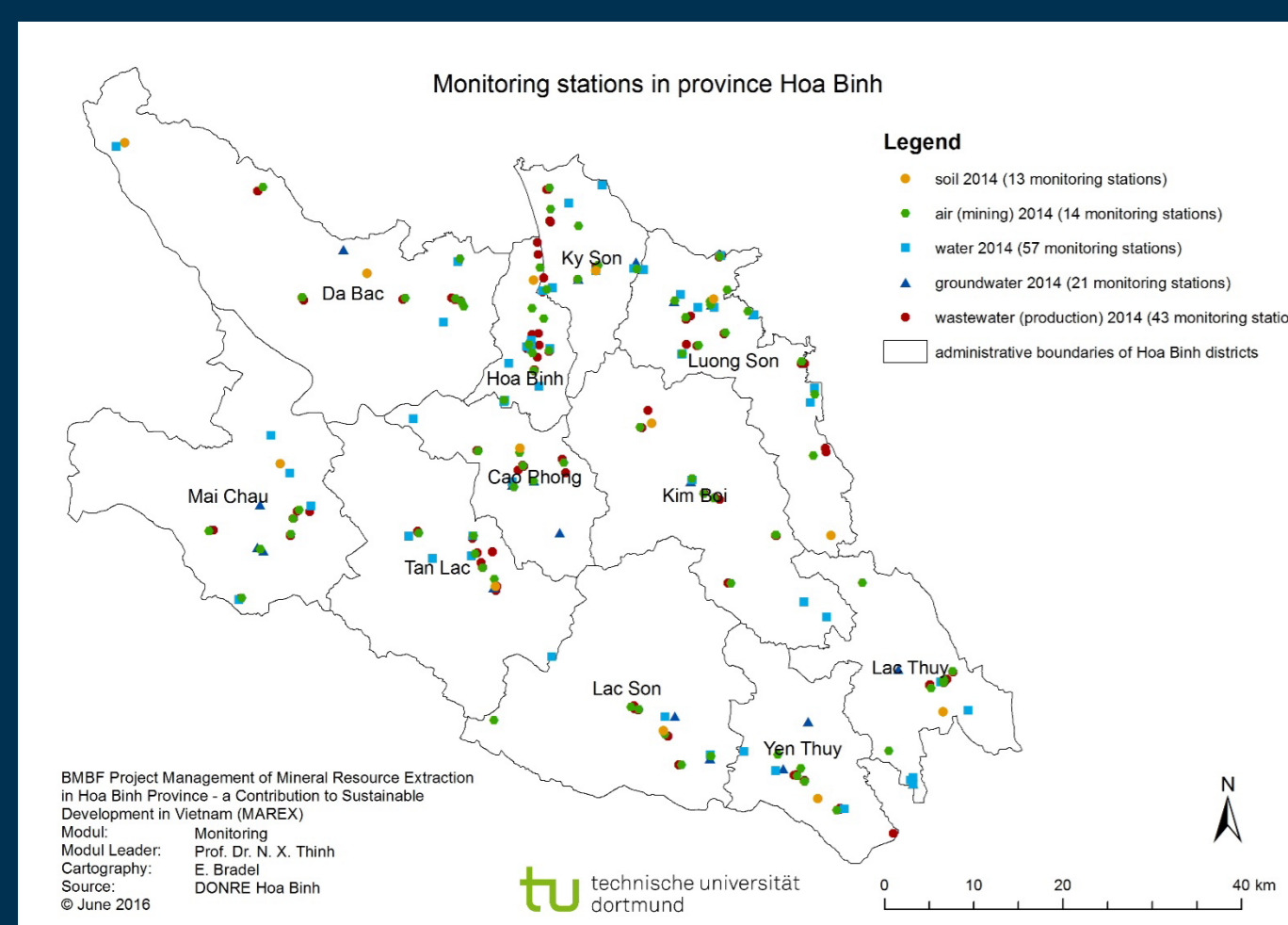
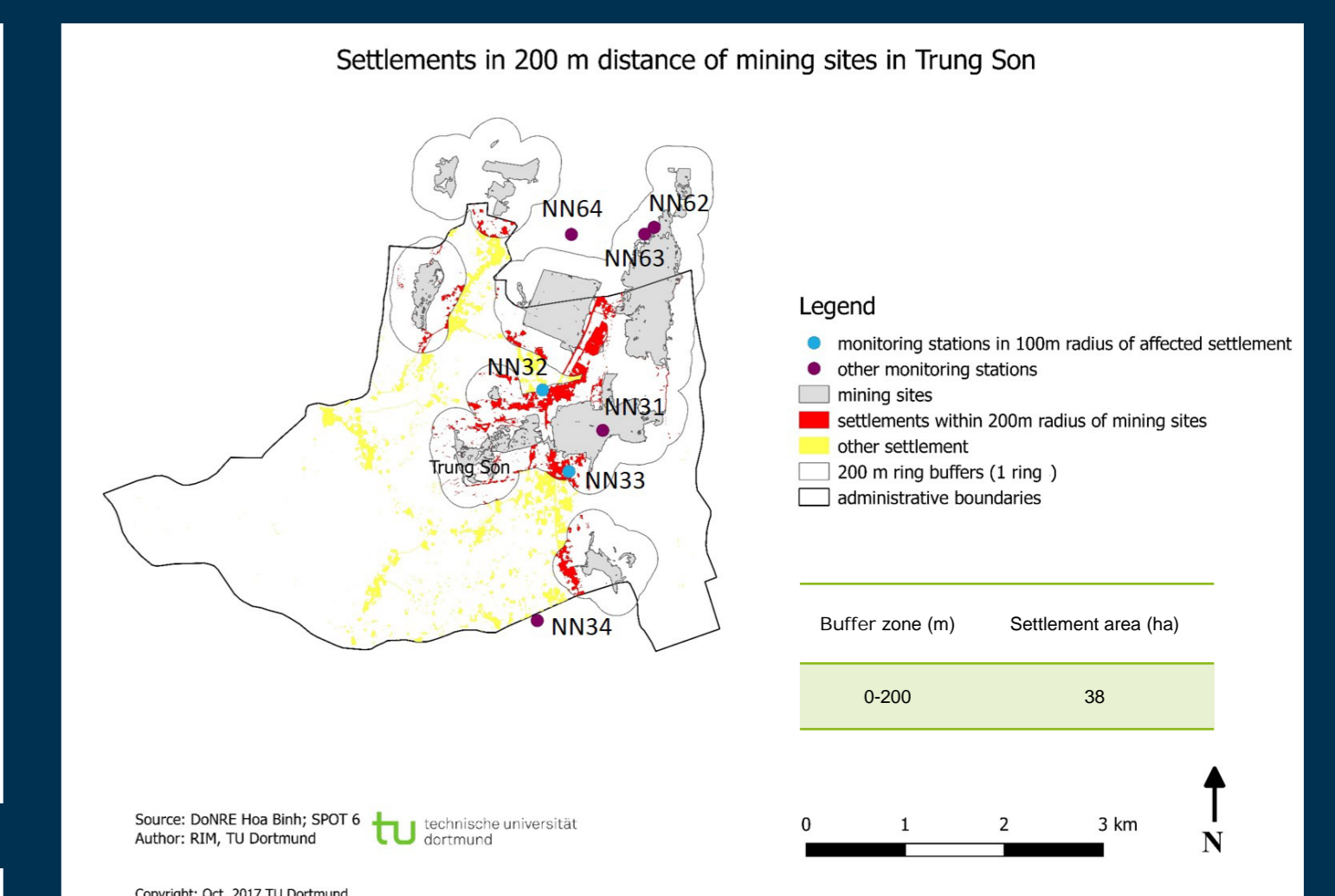
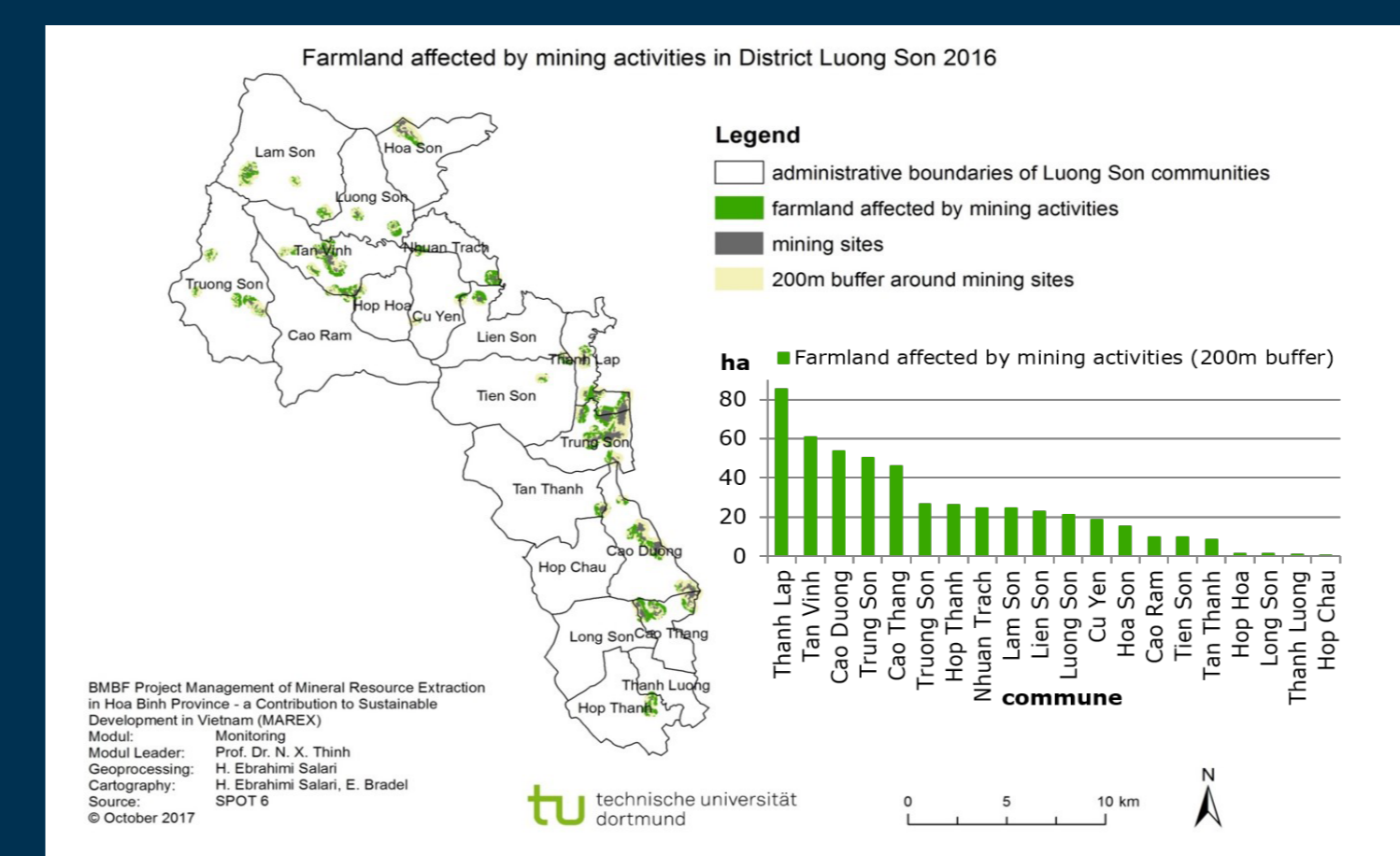
Measurements of monitoring stations 2014 – 2017 (DONRE and IEA 2017)

Monitoring data	Number of monitoring sites			
	2014	2015	2016	2017
Year				
Site location	Hoa Binh province	Hoa Binh province	Luong Son district	Luong Son district
Air	75	75	48	48
Soil	13	13	24	24
Groundwater	21	11	24	24
Surface water	57	30	24	24
Wastewater	113	150	24	24

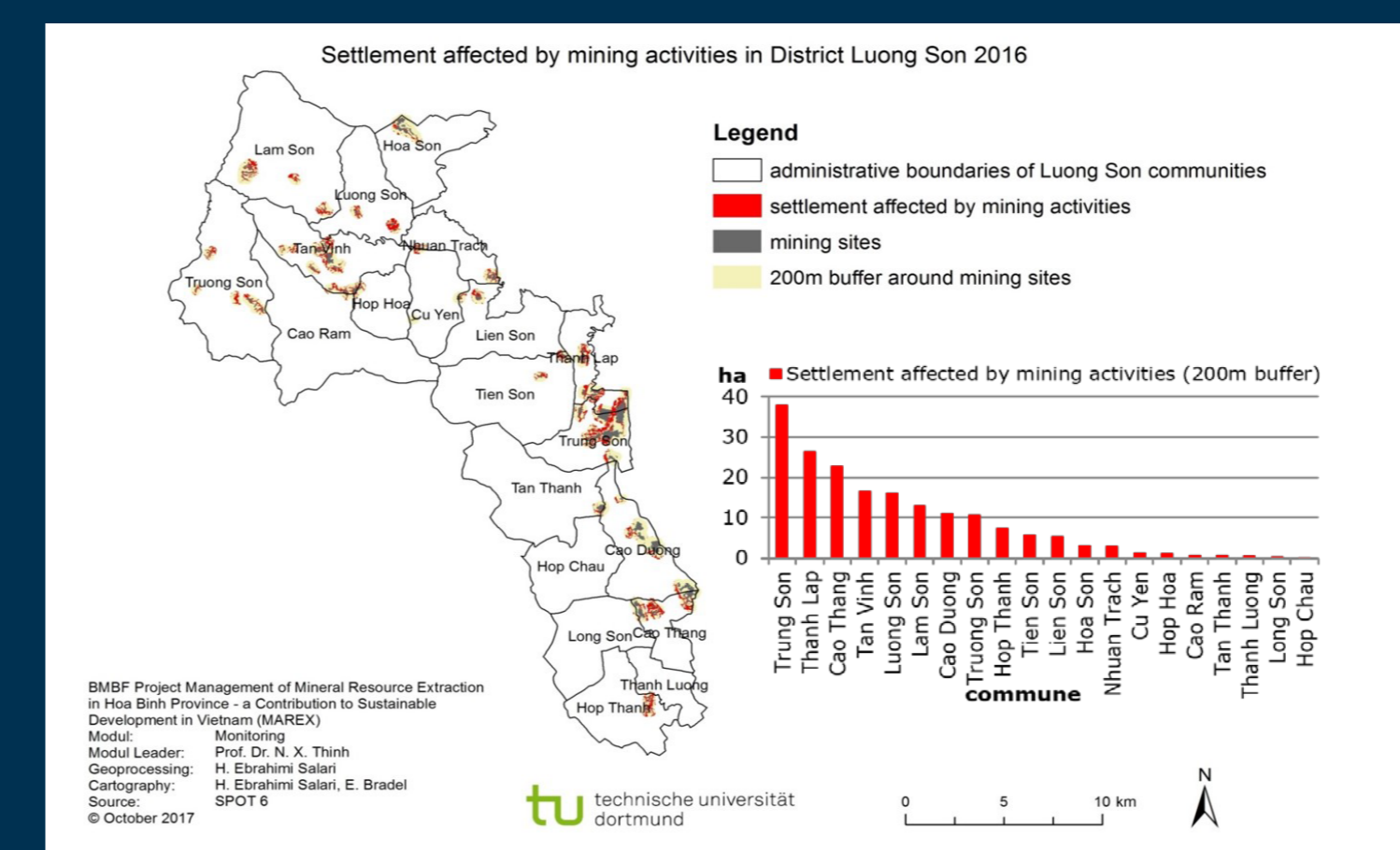
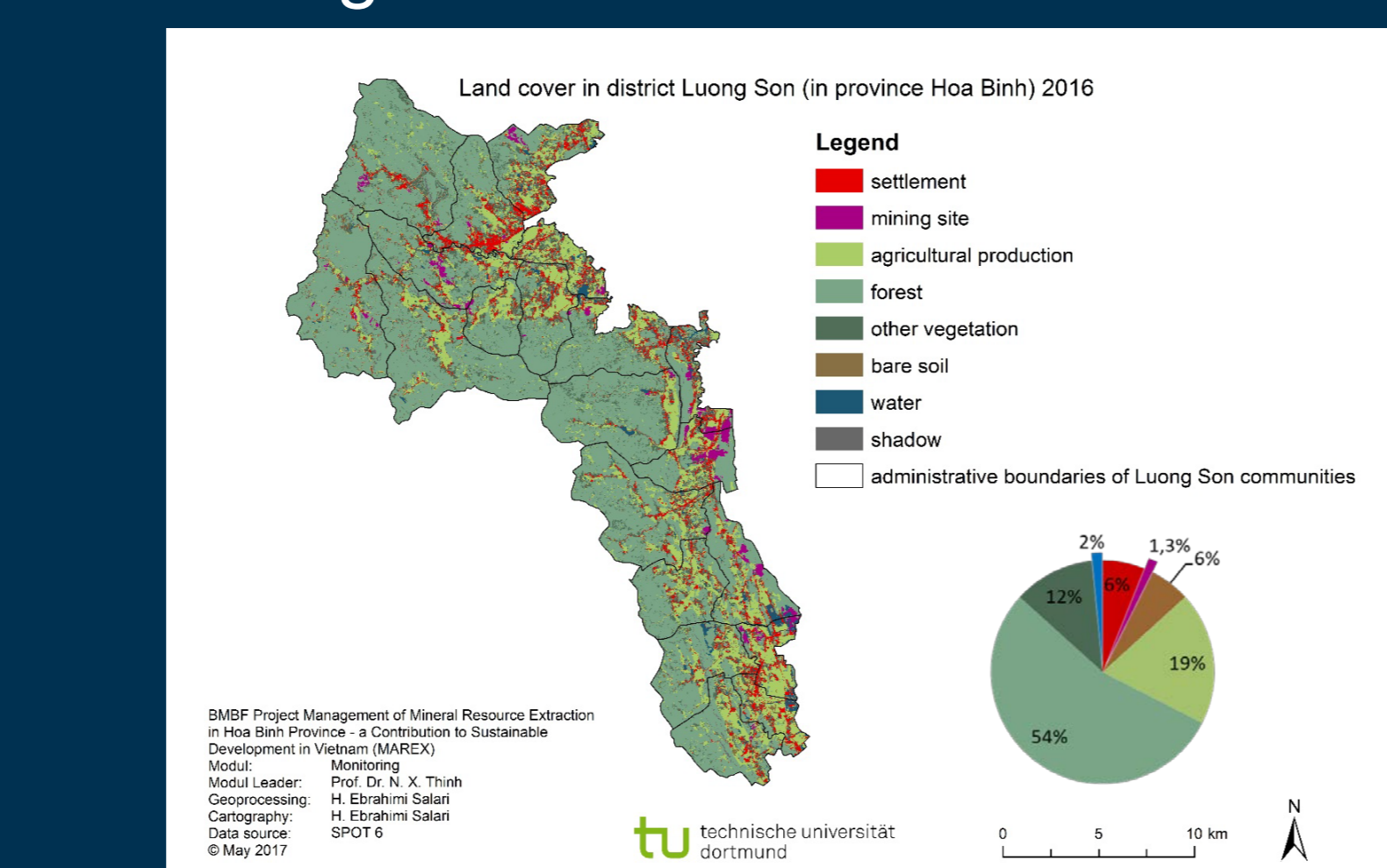
Monitoring mining sites using Landsat data from 2000 to 2015



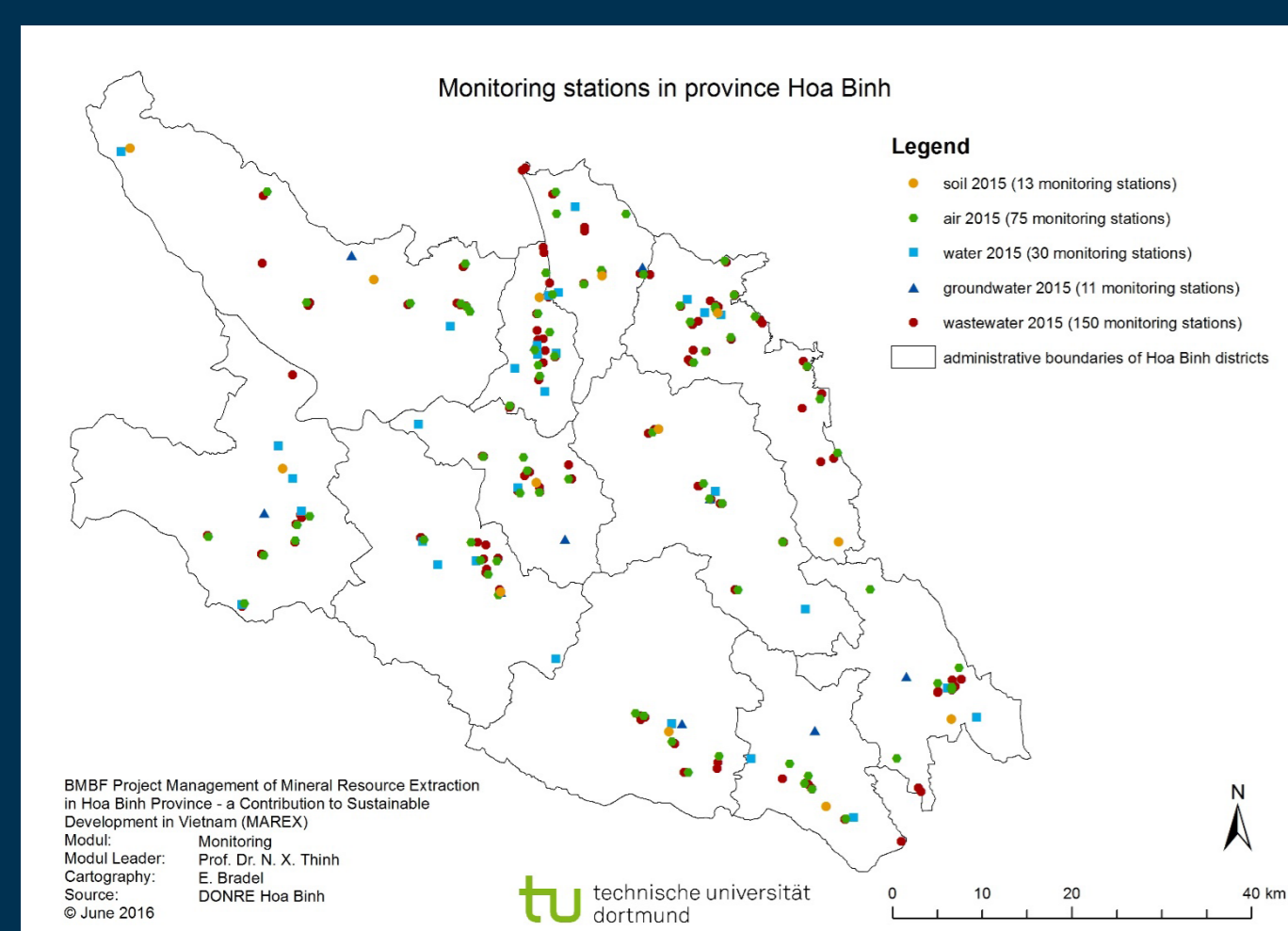
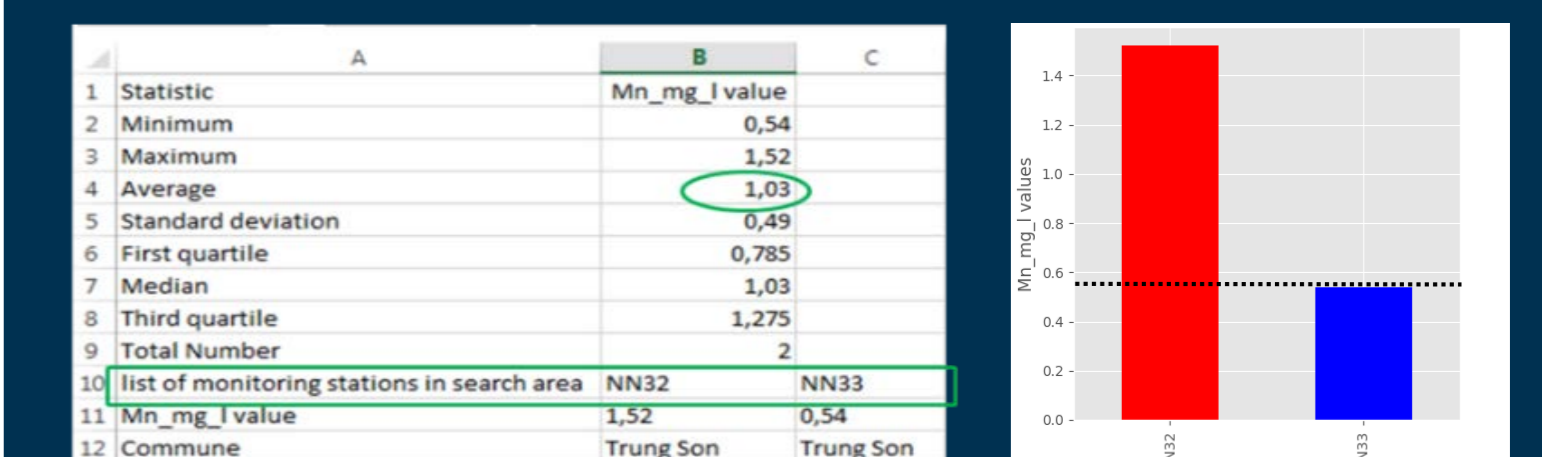
Analysis of land-use conflicts using high resolution SPOT 6 2016 and monitoring stations



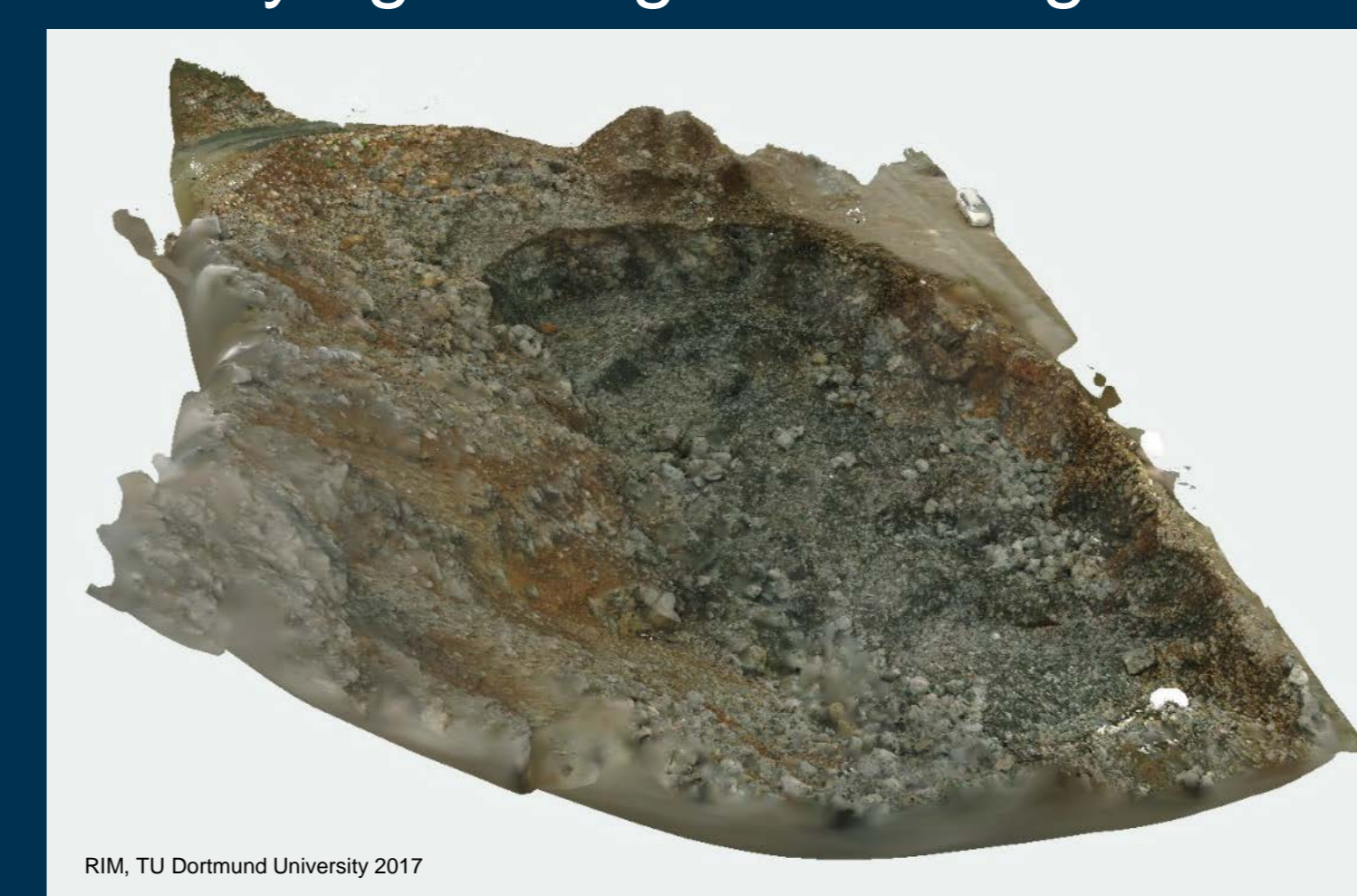
Highest share of mining site in district Luong Son land use/cover detection in district Luong Son - SPOT 6 2016



Manganese concentration in groundwater monitoring stations in 100 m radius of affected settlement



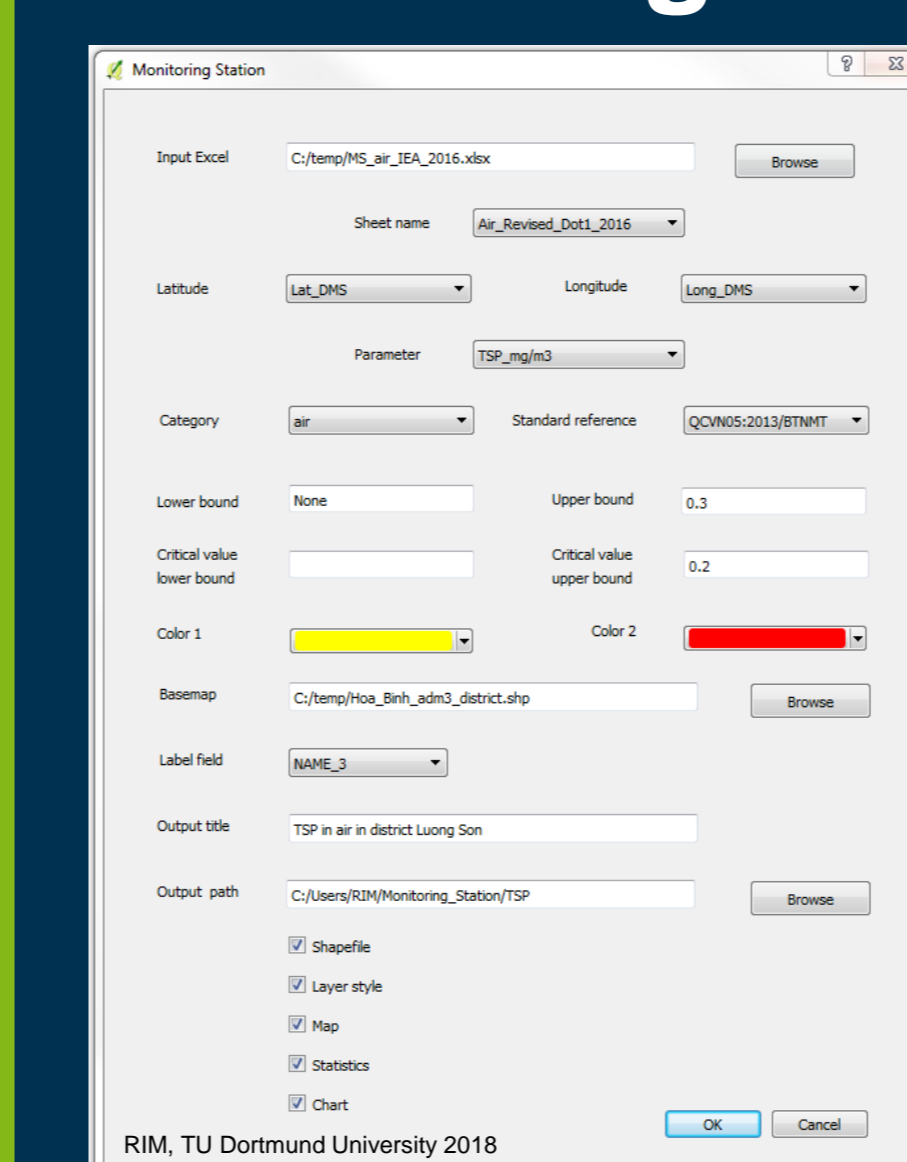
Surveying mining sites using 3D laser scanning technology



Main Results

- Evidence of negative environmental impacts of mining activities
 - High TSP concentration and noise
 - High TSS concentration in surface water and wastewater
 - High manganese concentration in groundwater
- Exceedance of licensed exploration areas of some mining sites
- Mining sites in licensing procedures in protected areas
- District Luong Son the most affected district with residential areas in immediate vicinity of mining sites

Monitoring tool as a new QGIS plugin for Hoa Binh



- Storage automation and management; spatial representation on geographical maps
- Querying and reporting functions; retrieving data from database as shapefile, map/table
- Analysis functions; detecting monitoring stations with exceedance of limit values; evaluating land use conflicts around mining sites; and cluster monitor stations to determine level of environmental contamination