Applications of Remote Sensing in Land and Environmental Monitoring

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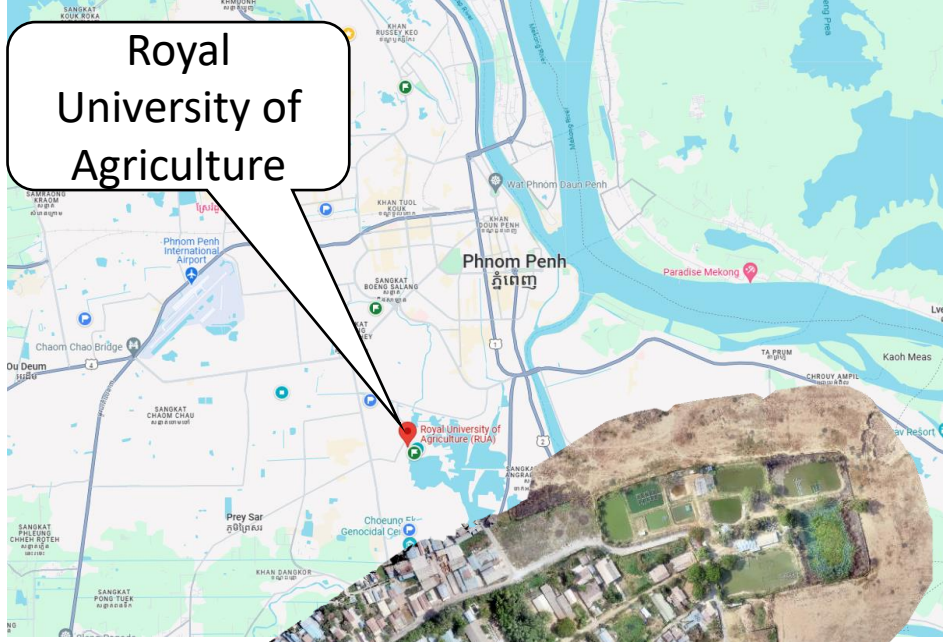
- Introduction to Laboratory of Remote Sensing at FLMLA, RUA
- Highlights of research activities and findings

Introduction to Laboratory of Remote Sensing

- **Location:** Faculty of Land Management and Land Administration, Royal University of Agriculture



Research Areas

- Land use and land cover change
- Cropland mapping/monitoring
- Urban planning/environment

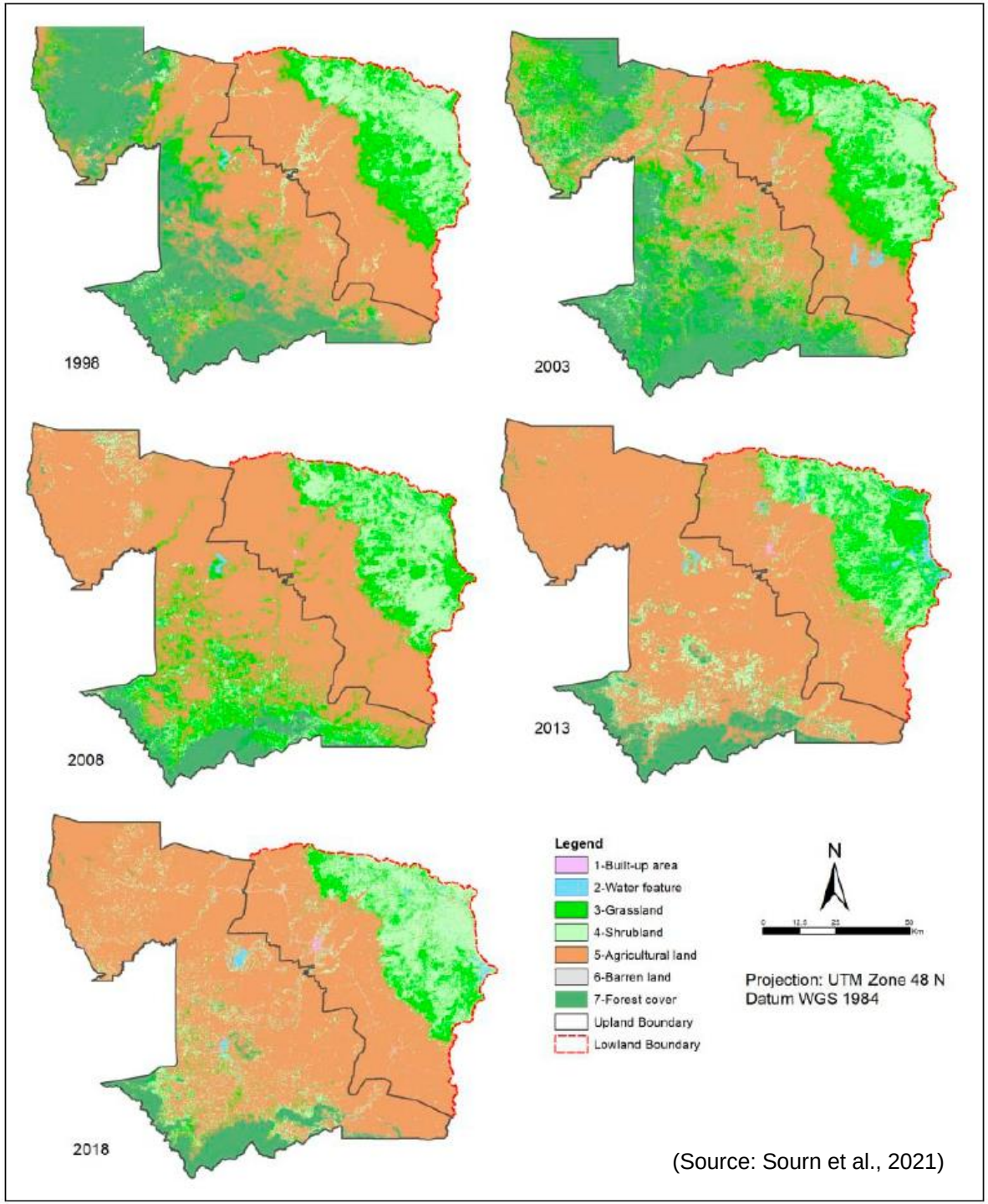
Land use and land cover change

- We use remote sensing to map local and regional land cover change

- We highlight the drivers of the change

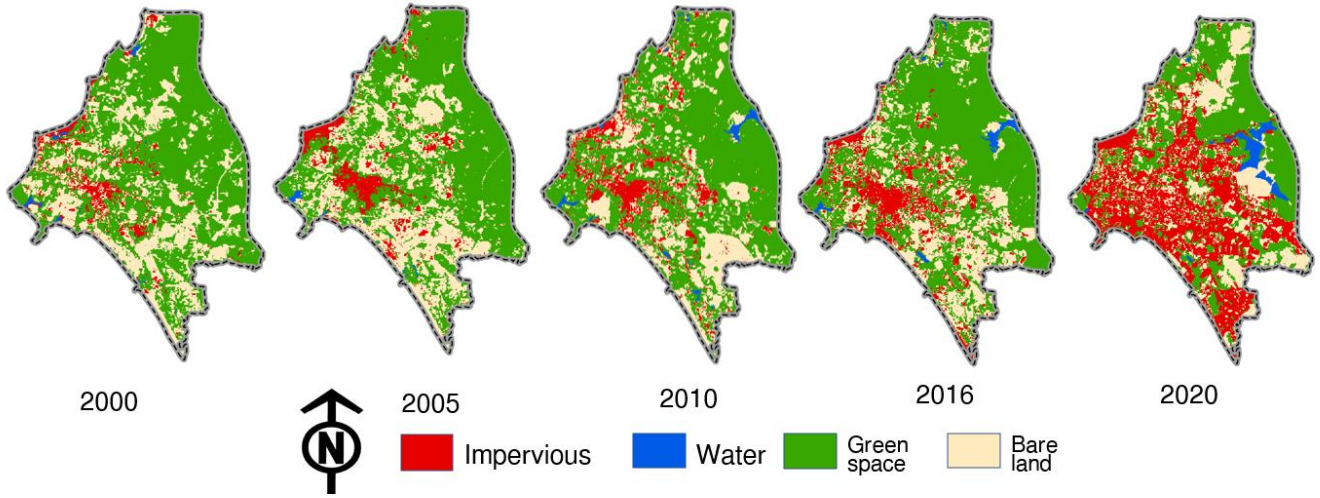
Evaluation of Land Use and Land Cover Change and Its Drivers in Battambang Province, Cambodia from 1998 to 2018

- A significant increase in agricultural land (54%)
- A large decrease in forest cover (79%).
- Most of the changes in both LULC types occurred during 2003–2008.
- Main drivers:
  - Population growth
  - Demand for agricultural land
  - Land concessions
  - Landmine clearance projects



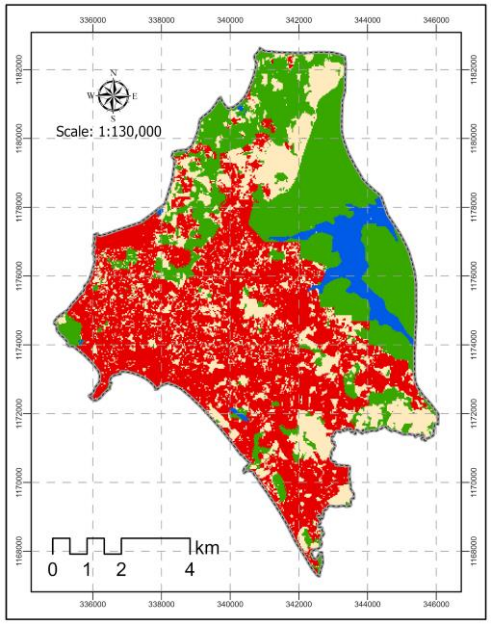
(Source: Sourn et al., 2021)

Land Use/Cover Change Analysis and Prediction in Preah Sihanouk Municipality

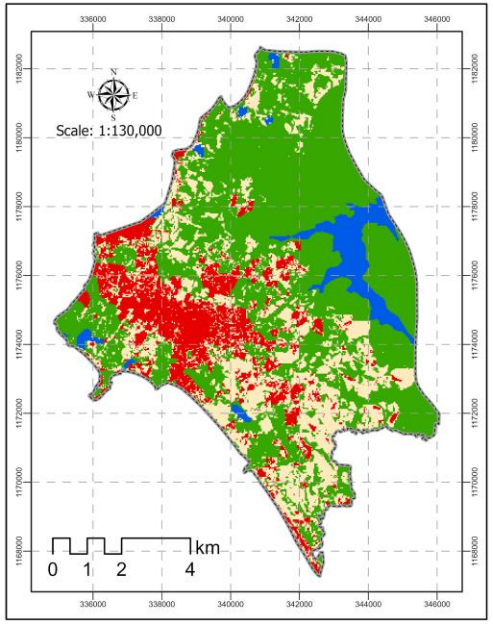


- Understand past LULC changes
- Predict LULC change based on different scenarios

Predicted LULC 20230
Scenario 1



Predicted LULC 20230
Scenario 2

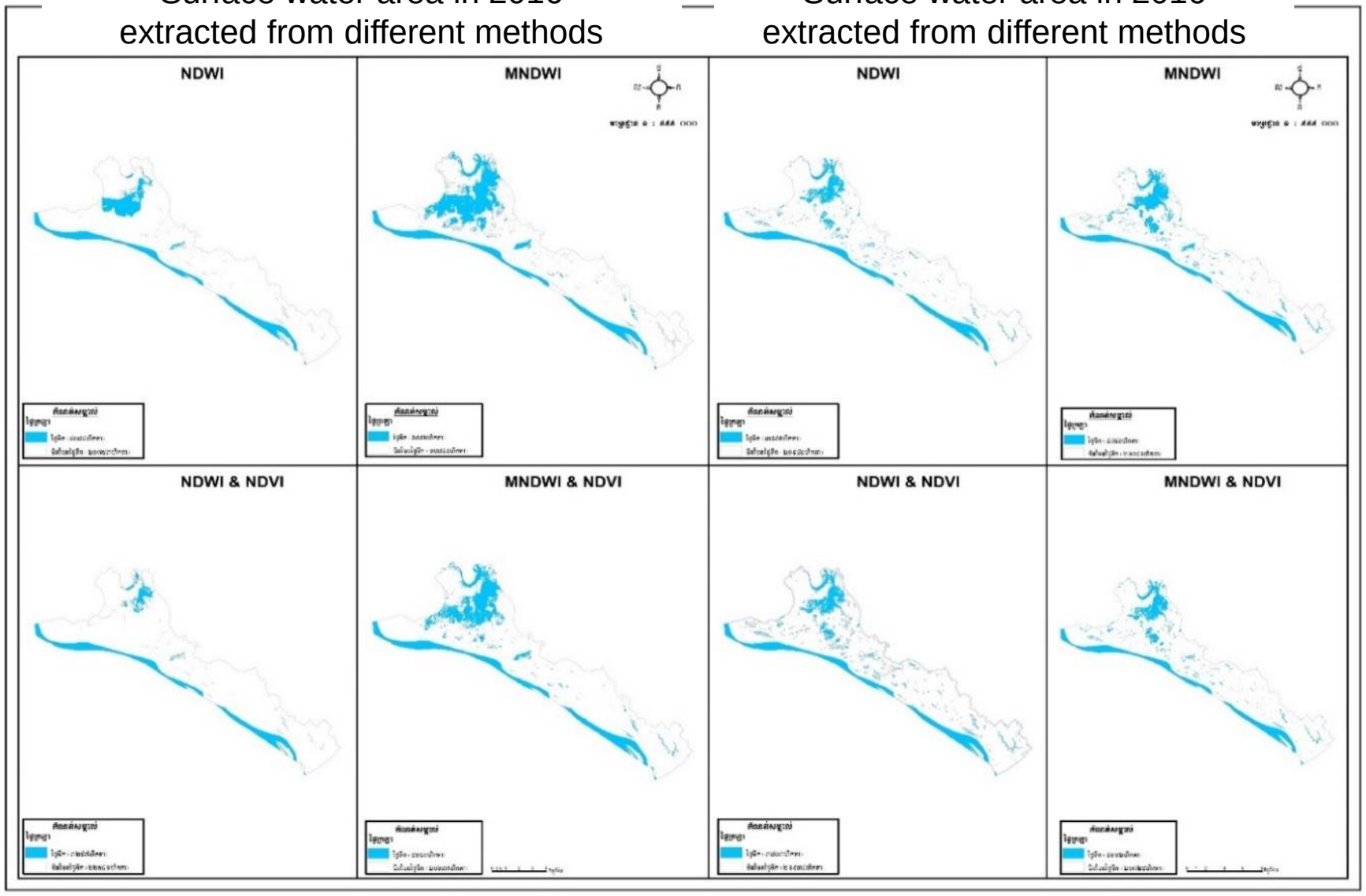


(Source: Sothea Voeun, 2023)

Surface water mapping and change in Lvea Aem district, Kandal province

- Use Sentinel-2 images
- Extract water features using:
  - NDWI
  - MNDWI
  - NDWI & NDVI
  - MNDWI and NDVI
- MNDWI & NDVI method had the highest accuracy
- Change of water area between 2016 and 2020 was obtained

Surface water area in 2016 extracted from different methods



Surface water area in 2016 extracted from different methods

(Source: Sreyneath Moeun, 2021)

Cropland mapping/monitoring

Our research questions:

- Can global cropland maps from different sources be used in Cambodia?
- What are the accuracies of these maps?
- What methods are most appropriate for mapping cropland, crop types and cropping intensity in Cambodia?

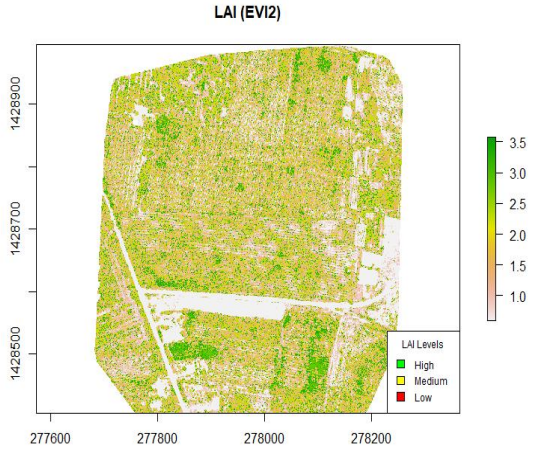
Dataset	Year(s)	Res. (m/px)	Model Scale	Coverage	Definition of Cropland
DEA Cropland Extent	2019	10	AEZ	Continent	"A piece of land of minimum 0.01 ha that is sowed/planted and harvestable at least once within the 12 months after the sowing/planting date."[27,49]
Dynamic World	2015–2024	10	Global	Global	"Human planted/plotted cereals, grasses, and crops"[21]
Esri LULC	2017–2022	10	Global	Global	"Human planted/plotted cereals, grasses, and crops not at tree height; examples: corn, wheat, soy, fallow plots of structured land."[23,50]
ESA WorldCover	2020–2021	10	Global	Global	"Land covered with annual cropland that is sowed/planted and harvestable at least once within the 12 months after the sowing/planting date. The annual cropland produces an herbaceous cover and is sometimes combined with some tree or woody vegetation. Note that perennial woody crops will be classified as the appropriate tree cover or shrub land cover type. Greenhouses are considered as built-up."[22,43,51]
ESA CCI Africa	2016	20	Continent	Continent	No explicit definition provided[28,52]
GFSAD	2015	30	AEZ	Global	"Cropland that is cultivated and harvested for food, feed, and (or) fiber, one or more times during a 12-month period; Cropland that is left fallow, even when equipped for agriculture; and Cropland that is permanently cropped with plantations (for example, orchards, vineyards, coffee, tea, and rubber)."[29,53]
Nabil *et al.*	2016	30	Mixed	Continent	"all agricultural annual standing croplands, cropland fallows, and permanent plantation crops"[24,54]
GLAD	2003, 2007,2011, 2015, 2019	30	1° × 1°	Global	"[…] land used for annual and perennial herbaceous crops for human consumption, forage (including hay) and biofuel. Perennial woody crops, permanent pastures and shifting cultivation are excluded from the definition."[30,55]
Copernicus Land Cover	2015–2019	100	Biome	Global	"Cultivated and managed vegetation/agriculture. Lands covered with temporary crops followed by harvest and a bare soil period (e.g., single and multiple cropping systems). Note that perennial woody crops will be classified as the appropriate forest or shrub land cover type."[31,56]
ESA GlobCover	2005, 2009	300	Strata	Global	"Post-flooding or irrigated croplands," "rainfed croplands," "Mosaic Cropland (50–70%)/Vegetation (grassland, shrubland, forest) (20–50%)," and "Mosaic Vegetation (grassland, shrubland, forest) (50–70%)/Cropland (20–50%)"[32,57]
ASAP Crop Mask	2017	1000	Mixed	Global	"arable land and permanent crops…independently of their life forms (e.g., tree forms), production systems (i.e., both rainfed and irrigated), and density of cover"[11,13,58]

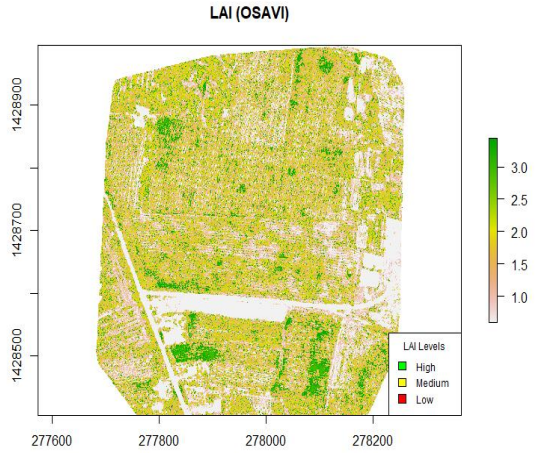
(Source: Kerner et al., 2024)

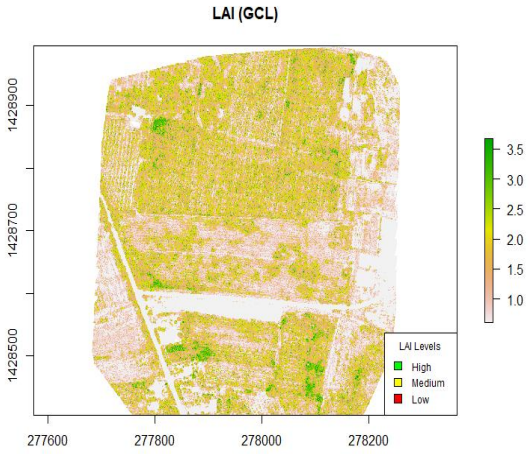
Estimating Leaf Area Index of Cassava Plantation using Aerial Imagery

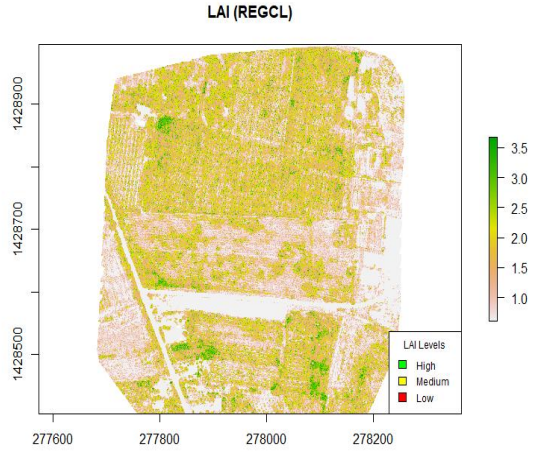
- Drone with multispectral camera flown over cassava plantation
- Field measurement of LAI using LAI-2200c plant canopy analyzer

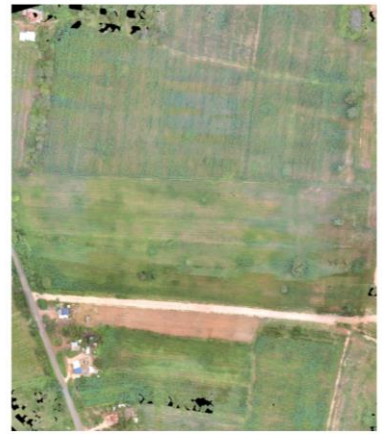
Estimated leaf area index estimated from different vegetation indices







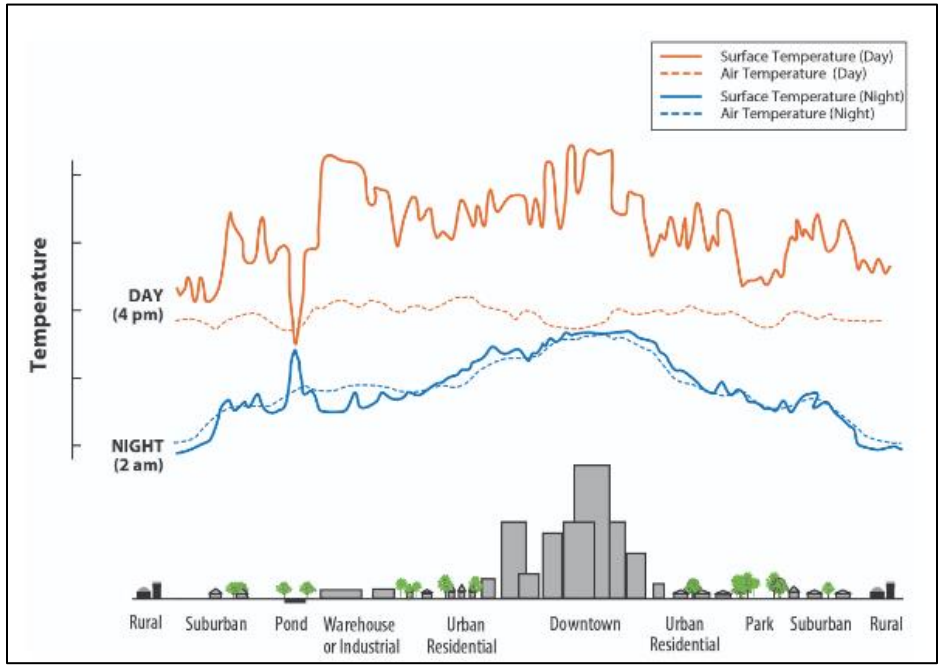




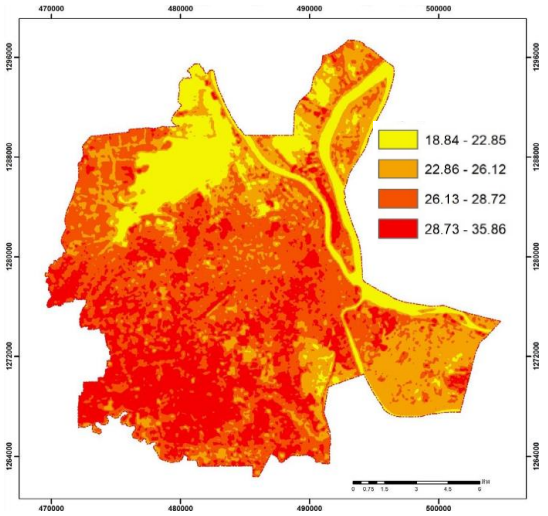
(Source: Pengkheang Mol, 2024)

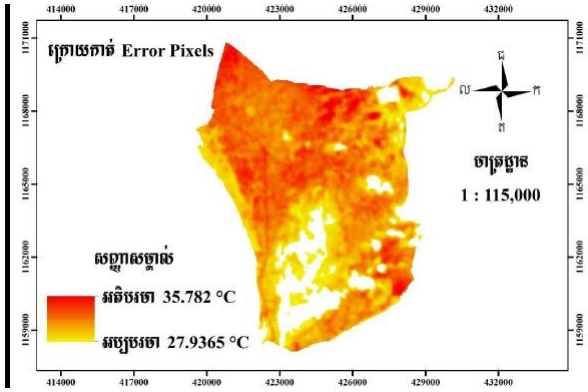
Urban planning/environment

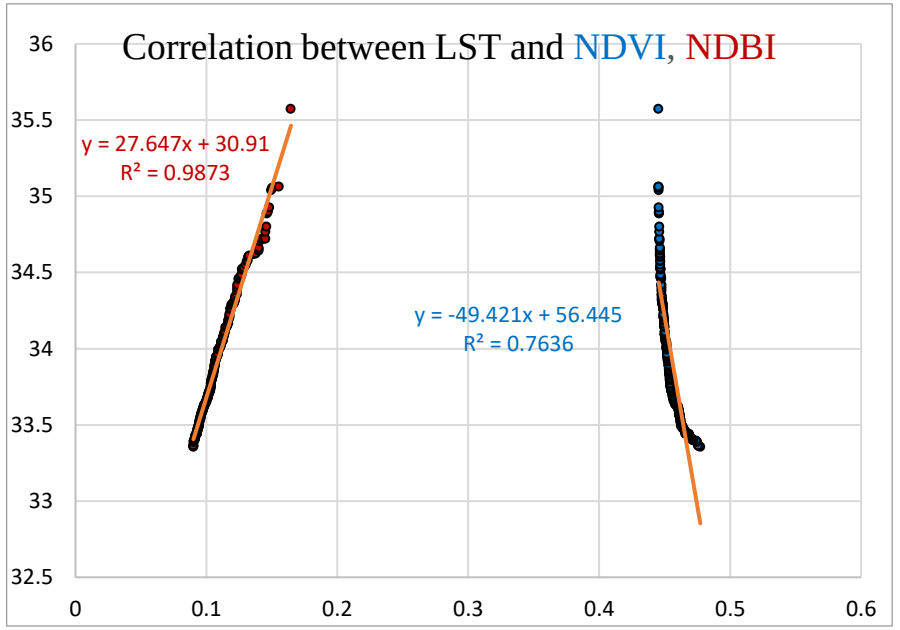
- Use remote sensing to monitor land surface temperatures in cities and municipalities in Cambodia
- Investigate the impacts of urbanization on surface urban heat island



(Source: US EPA)







(Source: Sovan Hang, 2021 & Kungly Roeun, 2023)

Thank you for your attentions!