



**SMARTAGRI**  
**—CAMBODIA—**

## **SmartAgriCambodia: Advancing Sustainable Agriculture in Battambang**

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## **Annual Report on the Creation of Digital Maps on Selected Agricultural Fields in Battambang Province**

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## 1. INTRODUCTION

This annual report summarises the activities, methodological approach, and main results of digital map creation on selected agricultural fields in Battambang Province in 2025. The activities were carried out within development and research-application initiatives focused on the implementation of precision and smart agriculture principles in Cambodia, in cooperation with the National University of Battambang (NUBB) and other local partners.

The objectives of the mapping activities were to:

- verify the applicability of satellite and UAV data under local conditions,
- create the first reference digital map outputs for selected crops,
- strengthen the professional capacities of local staff in working with geospatial data,
- prepare background data for targeted (variable-rate) interventions in crop production.

## 2. CHARACTERISTICS OF THE MAPPED LOCATIONS AND CROPS

In 2025, digital mapping was conducted on selected agricultural fields in Battambang Province, with the key site being the Experimental and Demonstration Agricultural Area of the National University of Battambang (NUBB), covering approximately 20 ha. These fields primarily served educational, demonstration, and pilot application purposes.

In 2025, the Experimental and Demonstration Agricultural Area of NUBB was designed and used as a pilot and reference site for digital mapping and testing precision agriculture principles, with the ambition to gradually transfer verified methodologies to other agricultural fields and cooperatives across the entire Battambang Province.

The focus was placed primarily on the following crops and crop types:

- rice (paddy fields),
- cassava,
- maize,
- orchards (mango, longan).

The selected locations represent typical growing conditions of the region, including variations in soil properties, water regime, and farming practices. In addition to the NUBB research field, the mapped locations also included fields of the agricultural cooperatives Teuk Chhit Kaksekor Kea MeanChey, Rokar Mean Rith, Tasey Samaki, Mean Rattanak Mondoul, and Bour Samaky Mean Chey, which

served as complementary demonstration and validation sites to verify the transferability of the applied methodologies.

### 3. DATA SOURCES AND METHODOLOGY

#### 3.1 Data Sources

A DJI Phantom unmanned aerial vehicle equipped with a multispectral camera was used for imaging the selected fields, enabling the acquisition of highly detailed RGB and multispectral images suitable for subsequent crop condition analysis.

Digital map creation was based on combined data sources:

- satellite imagery (Copernicus Programme – Sentinel-2),
- UAV data acquired using multicopters equipped with multispectral and thermal cameras with RTK correction,
- vector data (field boundaries, reference layers).

Satellite data were primarily used for broader spatial context and temporal comparisons, while UAV imagery enabled detailed analysis of crop variability at the field and orchard levels.

#### 3.2 Data Processing

Data processing was performed using open-source and freely available software tools, in particular:

- SNAP (ESA),
- QGIS,
- specialized tools for photogrammetric processing of UAV data.

The main processing steps included:

- data preprocessing and georeferencing,
- generation of orthophotos,
- calculation of spectral and vegetation indices,
- creation of thematic maps and their cartographic finalisation.

#### 3.3 Vegetation and Stress Indices Used

In 2025, the following indices were primarily derived:

- NDVI – assessment of crop vitality and biomass,
- GNDVI – indication of chlorophyll content,
- NDRE and CIR – crop health and nitrogen status,
- SAVI – minimisation of soil background influence,
- CWSI – assessment of water stress (for selected UAV missions with a thermal camera).

## 4. MAIN MAPPING RESULTS

### 4.1 Rice

For rice fields, digital maps were used to identify:

- spatial variability in crop vitality,
- areas without vegetation cover (tracks caused by agricultural machinery),
- zones with reduced growth potentially related to water or nutrient stress.

Based on a combination of RGB imagery and vegetation index maps (especially NDVI and GNDVI), it was possible to evaluate in detail the heterogeneity of rice stands within individual fields. The results showed that even relatively small areas exhibit significant differences in crop vitality, which may have a direct impact on final yields.

Identified zones with reduced vitality represent potential areas with insufficient water availability, uneven fertilisation, or mechanical damage to the crop. This information provides an important basis for targeted field inspections and subsequent agronomic measures, particularly in the optimisation of irrigation and fertiliser application.

The map outputs also enabled clear identification of agricultural machinery traffic routes and associated non-productive areas. Based on these data, optimisation of traffic routes can be proposed in order to minimise crop damage and increase the overall production efficiency of rice fields.

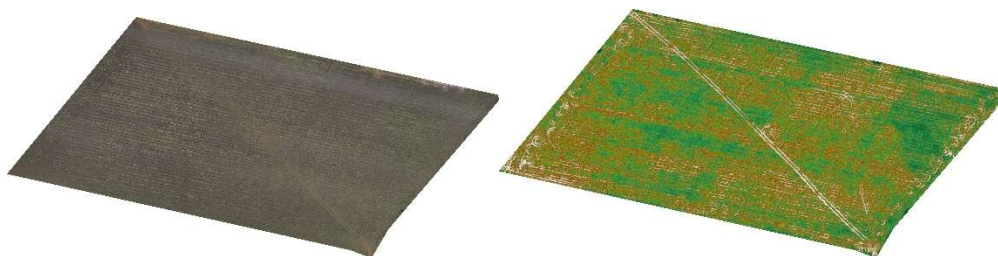


Fig. 1 Map layers: Rice (GNDVI and RGB)

### 4.2 Cassava

Vitality maps (RGB and GNDVI) revealed significant heterogeneity in cassava stands, including areas without vegetation and zones with lower plant density. The identified problem areas provide a suitable basis for:

- variable-rate fertilisation,
- targeted plant protection,
- optimisation of water management.

The mapping results confirmed the high sensitivity of cassava stands to spatial differences in soil and moisture conditions. Digital maps enabled early identification of stress zones with potentially reduced yield potential and provided a foundation for targeted agronomic interventions.

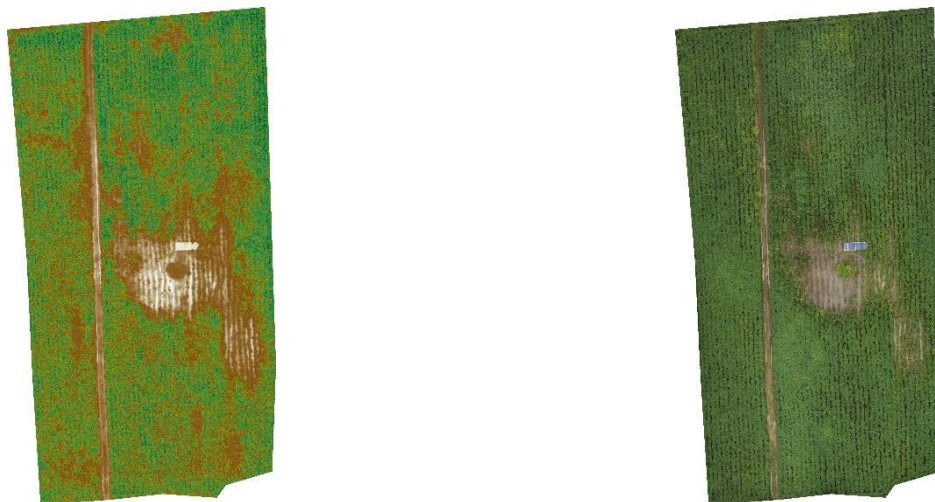


Fig. 2 Map layers: Cassava (GNDVI and RGB)

### 4.3 Orchards (Mango, Longan)

In orchards, digital maps enabled:

- assessment of the size and shape of individual tree crowns,
- identification of weakened or stressed trees,
- detection of areas with increased water accumulation.

This information is particularly important for monitoring irrigation system functionality and planning targeted field interventions. The results confirmed the high potential of UAV data for early identification of orchards with reduced vitality and uneven irrigation performance, providing an effective basis for targeted field inspections and optimised orchard management.

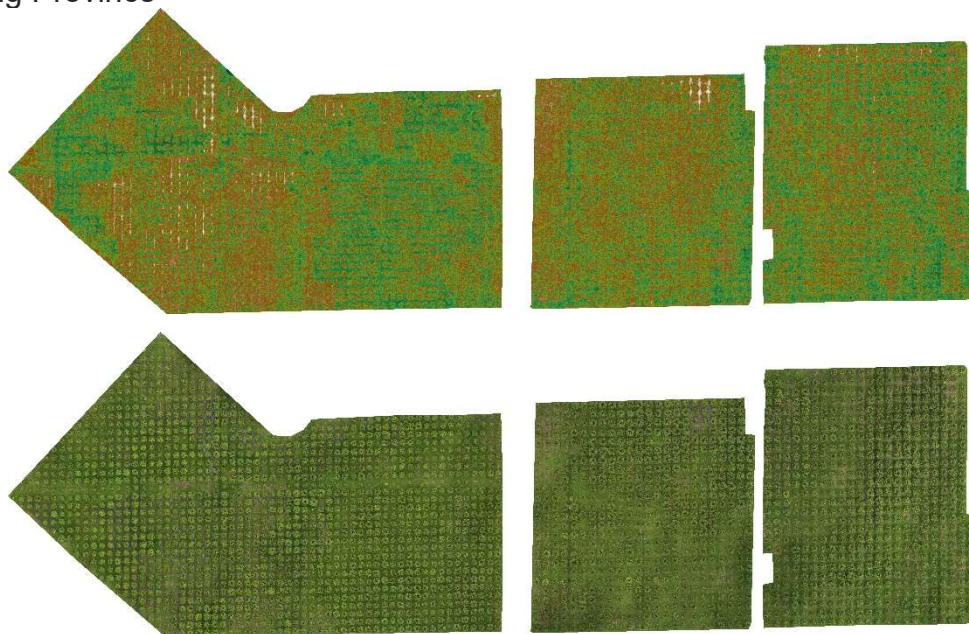


Fig. 3 Map layers: Mango (GNDVI and RGB)

#### 4.4 Maize

In maize fields, zones with reduced vitality and differences in row spacing were identified. These findings can serve as feedback for agricultural machinery calibration and planning of variable-rate inputs.

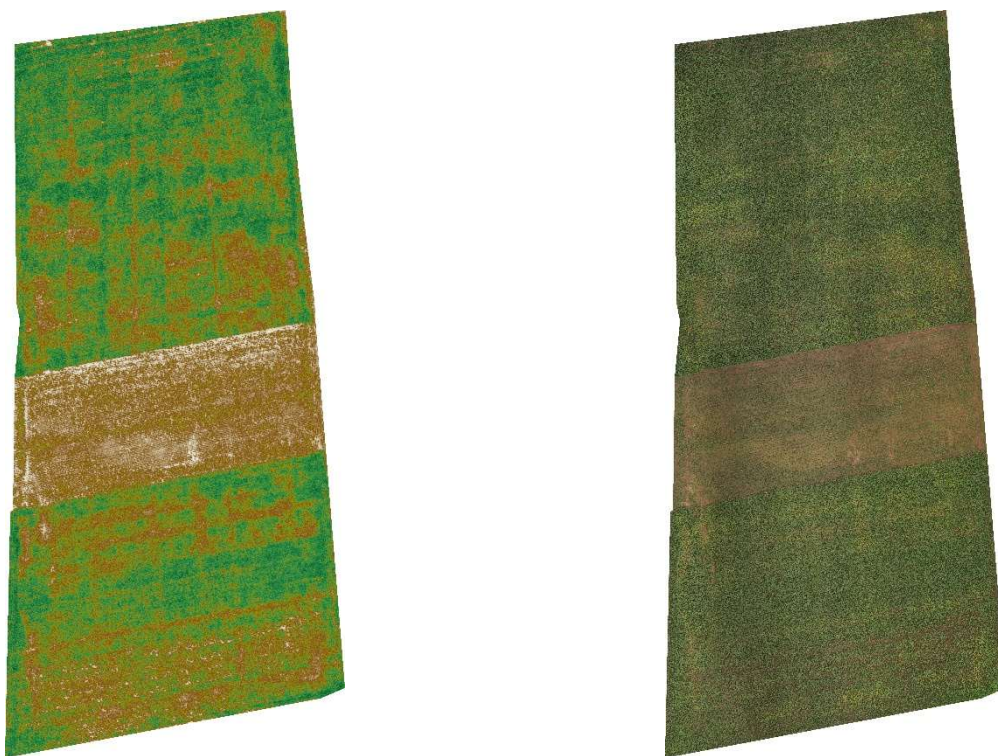


Fig. 4 Map layers: Maize (GNDVI and RGB)

Using a combination of RGB imagery and GNDVI maps, zones with reduced vitality and uneven crop establishment were identified in maize stands, providing direct support for the localisation of stress areas and the design of targeted (variable-rate) interventions, particularly in fertilisation, irrigation, and machinery setup.

## 5. BENEFITS FOR PRACTICE AND EDUCATION

The mapping activities in 2025 delivered significant practical and educational benefits:

- creation of the first reference digital maps for selected crops in the region,
- verification of data processing methodologies under local conditions,
- practical training of NUBB technical and academic staff,
- increased awareness of precision agriculture possibilities among local partners.

Digital maps serve not only as an analytical tool but also as demonstration material for further training and development activities.

## 6. PLANS AND OUTLOOK FOR THE COMING YEARS

In the coming years, the following activities are planned:

- expansion of mapping to additional fields and agricultural cooperatives in Battambang Province,
- systematic monitoring of selected fields throughout the entire growing season,
- linking map outputs with application maps for variable-rate fertilisation and irrigation,
- establishment of a central data repository for data sharing and long-term archiving,
- deeper integration of UAV and satellite data into decision-making processes of local farmers and institutions.

This annual report confirms that digital mapping represents a key tool for the gradual implementation of smart agriculture principles under Cambodian conditions and provides a solid foundation for further development in Battambang Province.