Earth Observation Technologies for Crop Monitoring and Promote Collaborations among GEOGLAM/JECAM/Asia-RiCE 2018

Promote Rice Production using SAR and Space Based technologies in Cambodia

17-20 September 2018
Taiwan Agriculture Research Institute (TARI), Taichung, Taiwan.

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Department of Planning and Statistics (DPS/MAFF)
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Introduction

- Land Area: 181.035 km².
- Population: 15.8 million
- Population growth rate: 1.54%
- 80% of population is living in rural area with 72.8 engaged in agriculture.
- Households engaged in agricultural activities in the country totaled to 2.6 million.
- Household Agriculture: 2.1 million.
The global economy improved 3.7% in 2017 and 3.9% in 2018 and 2019

ASEAN 5.3% 2017 (201.3% and 2019 5.3%)

China’s 6.8% growth in 2017 (6.6% in 2018 and 6.4% in 2019)

The growth of agriculture is related to climate change (rainfall, drought, flood)

Agriculture helped the economy during the 2008 and 2009 crisis
Total Value Added of Agricultural Sector’s Increasing Every Year

**Gross Value Added for Agriculture, 1998-2017**  
(In Billion Riels)

**Gross Value Added Change (%)**

- Total Value Added of Agricultural Sector’s Increasing Every Year
- 1998: 5,213  
- 1999: 5,058  
- 2000: 5,224  
- 2001: 6,301  
- 2002: 8,972  
- 2003: 10,406  
- 2004: 13,745  
- 2005: 14,420  
- 2006: 15,999  
- 2007: 19,470  
- 2008: 20,101  
- 2009: 20,986  
- 2010: 6,07  
- 2011: 13.44  
- 2012: 25.52  
- 2013: 13.49  
- 2014: 0.49  
- 2015: 0.24  
- 2016: 3.00  
- 2017: 4.40
Share (%) Agriculture in GDP Decreased

Share (%) of Agriculture in GDP, 2013-2017

Composition of Sub-Sector in Agriculture 2017

Fisheries 23.5%
Forestry 7%
Crops 59%
Livestock & Poultry 11%

Source: Ministry of Planning (MoP) 2017
Declined labor force in agriculture

Mechanization will be replaced labor
**Policy for Agriculture Development**

**Overall Policy Goal**

«Promote agricultural growth to around 5% per annum through enhancement of agriculture productivity, diversification, and commercialization; of livestock and aquaculture farming by taking into account the consideration of sustainable forestry and fisheries protection and resource management.»

**Policy Objectives**

- **Policy Objective 1:**
  - Objective-1: “Enhancement of inclusive agricultural growth by promoting agricultural modernization, research and extension to increase productivity, diversification, competitiveness, and agri-business”

- **Policy Objective 2:**
  - Objective-2: “Promotion of Sustainable Agricultural Land Use, Forestry & Fisheries Resources Management and Development”
RICE Production

- Rice is the most important crop in terms of production and significance to Cambodian population and occupies around 90% of the total available cultivated land;
- There is potential for expanding fragrant rice cultivation provided that farmers receive adequate returns.
# Agricultural Information and Statistics Data

## Achievement In Rice Production from 2013 to 2017

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Cultivated Area (Ha)</td>
<td>3,052,420</td>
<td>3,055,507</td>
<td>3,051,412</td>
<td>3,118,160</td>
<td>3,206,523</td>
<td>2.83%</td>
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<td>Harvested Area (Ha)</td>
<td>2,968,967</td>
<td>3,028,836</td>
<td>3,025,630</td>
<td>3,099,769</td>
<td>3,189,485</td>
<td>2.89%</td>
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<tr>
<td>Yield (T/Ha)</td>
<td>3.163</td>
<td>3.079</td>
<td>3.085</td>
<td>3.211</td>
<td>3.298</td>
<td>2.71%</td>
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<tr>
<td>Production (MT)</td>
<td>9,389,961</td>
<td>9,324,416</td>
<td>9,335,284</td>
<td>9,952,270</td>
<td>10,518,339</td>
<td>5.69%</td>
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<tr>
<td>Rice Surplus (MT)</td>
<td>3,090,452</td>
<td>3,013,783</td>
<td>2,975,809</td>
<td>3,275,089</td>
<td>3,558,612</td>
<td>8.66%</td>
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<tr>
<td>Paddy Surplus (MT)</td>
<td>4,828,832</td>
<td>4,709,036</td>
<td>4,649,702</td>
<td>5,117,327</td>
<td>5,560,331</td>
<td>8.66%</td>
</tr>
</tbody>
</table>
Data Processing Field Validation
Data Processing Field Validation

1- Application Used
- MapScape 5.4.1
- QGIS
- Rice YES
- Oryza Crop Modelling
- ArcMap

2- Dataset
- Sentinel-1A &1B
- Landsat8, Sentinel 2

3- Methodology

- Seasonal Area
- Start of Season date
- Leaf Area Index
- Flood damage

- Crop calendar
- Crop practices

- Meteo data
- Soil data
- Phenological data
- Management data

- Rice YES & Oryza Crop modelling
- Rice yield processing

- Earth Observation data

- Leaf Area Index in situ point data

- Validation

- Yield estimation

- Production

- Main and Backup Acquisition plan

- Satellite acquisition programming

Data

Modelling

Products
Data Processing Field Validation

4- SAR Data Selection
- Extract data
- Imagery in time serials

5- SAR Intensity data generation
- Imported files (-gr) for both VH & VV
- Digital Elevation Model (DEM)
- Vector file (Admin boundary)
Rice Cultivated Area

- The following input files required
  - SAR intensity file both VH & VV
  - Landsat 8
  - File (_lia)
  - DEM
  - Input mask file

- 14 Provinces and 38 districts

<table>
<thead>
<tr>
<th>No</th>
<th>Province</th>
<th>Sample Dist</th>
<th>EW</th>
<th>MW-1</th>
<th>MW-2</th>
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<tr>
<td>1</td>
<td>Battambang</td>
<td>Thma Koul</td>
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<td>Bavel</td>
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<td>5</td>
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<td>Chong Kai</td>
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</tbody>
</table>

TOTAL 38 700 550 550
Data Processing Field Validation

Main Wet Season 2017

Dry Season 2017

Starting of Season (SoS) MWS

Starting of Season (SoS)
Flood Map Processing

- Generate color composite
  - 20170728
  - 20170821
  - 20170902

- General Flood Map
Data Collection

➢ Using Smartphone
The RIICE smartphone is equipped with a digital camera, GPS, barcode scanner, and leaf area index measurement application.

➢ Form Surveys
1- Metadata Field Boundary
2- Metadata Pre Season
3- Monitoring
4- Metadata Tillering
5- Metadata Harvest
6- Damage Assessment
7- Rice-Non-Rice Validation

➢ Sending Data to GeoODK Server
Mini-training

- Verify INAHOR estimation using 2017 data in Battambang Province
  - Although some misdetection of maize planted areas was found in northwestern part, most of rice planted areas could be correctly detected.
- Check if the proposed validation framework works operationally in order
  - DPS staff properly validated rice planted area statistics with INAHOR estimation values based on the framework. However, criteria for selecting candidate districts for recheck were loose. Discussion for their modification was made.

**Dataset B: Battambang (2017)**

Rice planting area by INAHOR (T1 = automatic value, T2 = mean - 0.5*sigma)

**Verification team in DPS**
- Team establishment with a specialist as the team leader
- Prepare a new post of INAHOR operation specialist
- Budget the expenses related to the management of verification team
- Hold a conference for local officials verification

**Validation of reported value from local office using INAHOR result and functions**
- Re-report directive to local office
- Re-survey by local office (look-around, re-interview)
- Correction of reported value
Field Validation
## Rice map accuracy assessment

<table>
<thead>
<tr>
<th>Actual class from survey</th>
<th>Predicted class from the map</th>
<th>Rice</th>
<th>Non-Rice</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>974</td>
<td>75</td>
<td></td>
<td>92.9%</td>
</tr>
<tr>
<td>Non-Rice</td>
<td>0</td>
<td>7</td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>Reliability</td>
<td>100.0%</td>
<td>8.5%</td>
<td></td>
<td>92.9%</td>
</tr>
</tbody>
</table>

Confusion matrix computations from the "Accuracy Data" worksheet
Thank you for your kind attention