**NASA DEVELOP National Program**

**** NASA Marshall Space Flight Center

**Summer 2015**

**Short Title: Thailand Agriculture**

**Subtitle:** Monitoring Food Crop Health and Stress Due to Changing Climate for Enriched Agricultural Land Management

**VPS Title:** (working)

Thailand the right region of rice (komsan,arom,watanyoo)

The right rice is rising in the right realm (chayanit)

Classi-fried Rice (Tim)

**Project Team & Partners**

**Project Team:**

Tim Klug (Project Lead), tim.klug@uah.edu

Komsan Rattanakijsuntorn

Arom Boekfah

Chayanit Choomwattana

Watanyoo Suksa-ngiam

Atipat Wattanuntachai

**Advisors & Mentors:**

Dr. Jeffrey Luvall (NASA at National Space Science and Technology Center)

Dr. Robert Griffin (University of Alabama in Huntsville)

**Partner Organizations**

Royal Thai Embassy, Collaborator/Boundary Organization, POC: Gam Raksaphaeng

SERVIR Mekong, Collaborator/Boundary Organization, POC: Bill Crosson

SERVIR Mekong, Collaborator/Boundary Organization, POC: Peter Cutter

**Project Details**

**Applied Sciences National Applications Addressed:**

Agriculture, Climate

**Study Area:** Northeastern Thailand

**Study Period:** Jan 2000 - Present

**Earth Observations & Parameters**

Landsat 5, Thematic Mapper (TM) - Spectral Vegetation Indices, Land Cover Classifications, NDVI, NDWI, NMDI

Landsat 7, Enhanced Thematic Mapper Plus (ETM+) - Spectral Vegetation Indices, Land Cover Classifications, NDVI, NDWI, NMDI

Landsat 8, Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) - Spectral Vegetation Indices, Land Cover Classifications, NDVI, NDWI, NMDI

Terra, Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) - Digital Elevation Model

TRMM, Precipitation Radar (PR) - Precipitation Data

Global Precipitation Measurement (GPM) - Precipitation Data

Terra/Aqua, Moderate Resolution Imaging Spectroradiometer (MODIS) - Land Surface Temperature MYD11A1 Data

Suomi NPP, Visible Infrared Imaging Radiometer Suite (VIIRS) - Land Surface Temperature

**Ancillary Datasets Utilized**

* USGS National Land Cover Dataset (NLCD) – Soil data
* NOAA National Centers for Environmental Information (NCEI) – Climate Data

**Models Utilized**

* Normalized Difference Vegetation Index
* Normalized Difference Water Index
* Normalized Multi-band Drought Index
* Maximum Entropy Model (MaxEnt)
* Coupled Model Intercomparison Project (CMIP5)

**Software Utilized**

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat ETM+, OLI / TIRS, Terra ASTER, TRMM PR, Suomi NPP VIIRS, and Aqua/Terra MODIS

ENVI - Raster processing/manipulation

Python - Spatial analyst supplement tool for ArcGIS by using arcpy and dnppy library

**Project Overview**

**80-100 Word Objectives Overview**

The economy of northeastern Thailand is vulnerable to the impacts climatic variation due to its reliance on rain-fed rice crops. NASA Earth observations were used to quantify the total production and health of agriculture in these regions over time. Land cover changes over time in prominent rice-growing regions were identified using satellite remote sensing. These changes were compared to trends in local climate, economics, and demographics to create a model for predicting the total yield and value of rice crops in Northeastern Thailand.

**Abstract**

Monitoring climate change is crucial for the Thailand agricultural industry. Climate change results in variations in rainfall patterns which in turn affects the management of crop production. Northeastern Thailand is the area of the country where the majority of rice is grown, but the rice yield per hectare is relatively low. A primary factor is uncertainty the ability to monitor and assess climate change. The research aimed to assess changing climate patterns to improve the understanding of environmental variables, such as precipitation and temperature, to understand risks and impacts of floods, storms, and drought. In addition this project examined relationships between seasonal rainfall patterns and production areas of rice crop. This study used satellite imagery from Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), and Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS). We used precipitation data from Tropical Rainfall Measuring Mission (TRMM) and Global Precipitation Measurement (GPM), land surface temperature data from Moderate Resolution Imaging Spectroradiometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS), and a digital elevation model from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). The images were analyzed by using land cover classifications, Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), and/or Normalized Multi-band Drought Index (NMDI). A better understanding of the changing climate patterns assisted the end-users in initiating the best policies to tackle the challenges of climate change.  In addition, the results of this research contributed to the scientific body of knowledge, in particular earth and agricultural sciences.

**Community Concerns**

* Thailand is the world's largest exporter of rice at 8.5 million metric tons in 2014.
* In the northeastern region of Thailand, the rice crop yield is relatively low compared to other regions in the Mekong area.
* Most of the rice grown in the northeastern region of Thailand is rain-fed which depends heavily on the climate.

**Current Management Practices & Policies**

The Royal Thai Government proposed a rice development strategy focused on developing technologies to increase the production of rice. This was done by breeding a variety of rice that was most resistant to pests and could adapt to environmental changes due to climate, and also by developing techniques that reduce the costs associated with planting and harvesting. In 2014, a USAID and NASA-supported program, SERVIR Mekong, was launched to enhance climate adaptation and landscape management through the applications of geospatial analysis. SERVIR Mekong will help governments and communities to improve agriculture risk management in the Lower Mekong countries, including Thailand.

**Decision Support Tools & Benefits**

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| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Land Cover Classification | Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI & TIRS | Indicates areas where land cover has changed in the study area |
| Normalized Differenced Vegetation/Water Index Catalog | Landsat 5 TM, Landsat 7 ETM+ , Landsat 8 OLI & TIRS, Terra ASTER, TRMM PR, Aqua/Terra MODIS, Suomi NPP VIIRS | Indicates areas of healthy vegetation and photosynthesis and moisture content in soil |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)