SRA- ESS

UP-SRA YIELD ESTIMATION SYSTEM FOR SUGARCANE

Generation and Application of Sugarcane Growth Monitoring Products of the UP-SRA Yield Estimation System for Sugarcane (YESS) Project

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GEO SMART ASIA 2017

SUGARCANE

(Saccharum officinarum)

A species of a tall perennial true grass under the genus Saccharum; main source of sugar in all tropical and subtropical countries of the world.

In the Philippines

a significant industry contributing

USD1.7 billion

annually through raw sugar, molasses & bioethanol production.

providing livelihood to about

58,996 SUGARCANE FARMERS

Can we monitor the growth and health of sugarcane through geospatial products?

Can we help the farmers in obtaining better sugarcane yield?

“YESS”

UP–SRA Yield Estimation System for Sugarcane (YESS)

To generate rapid, realistic and science-based estimate on municipal and farm-level annual cane production

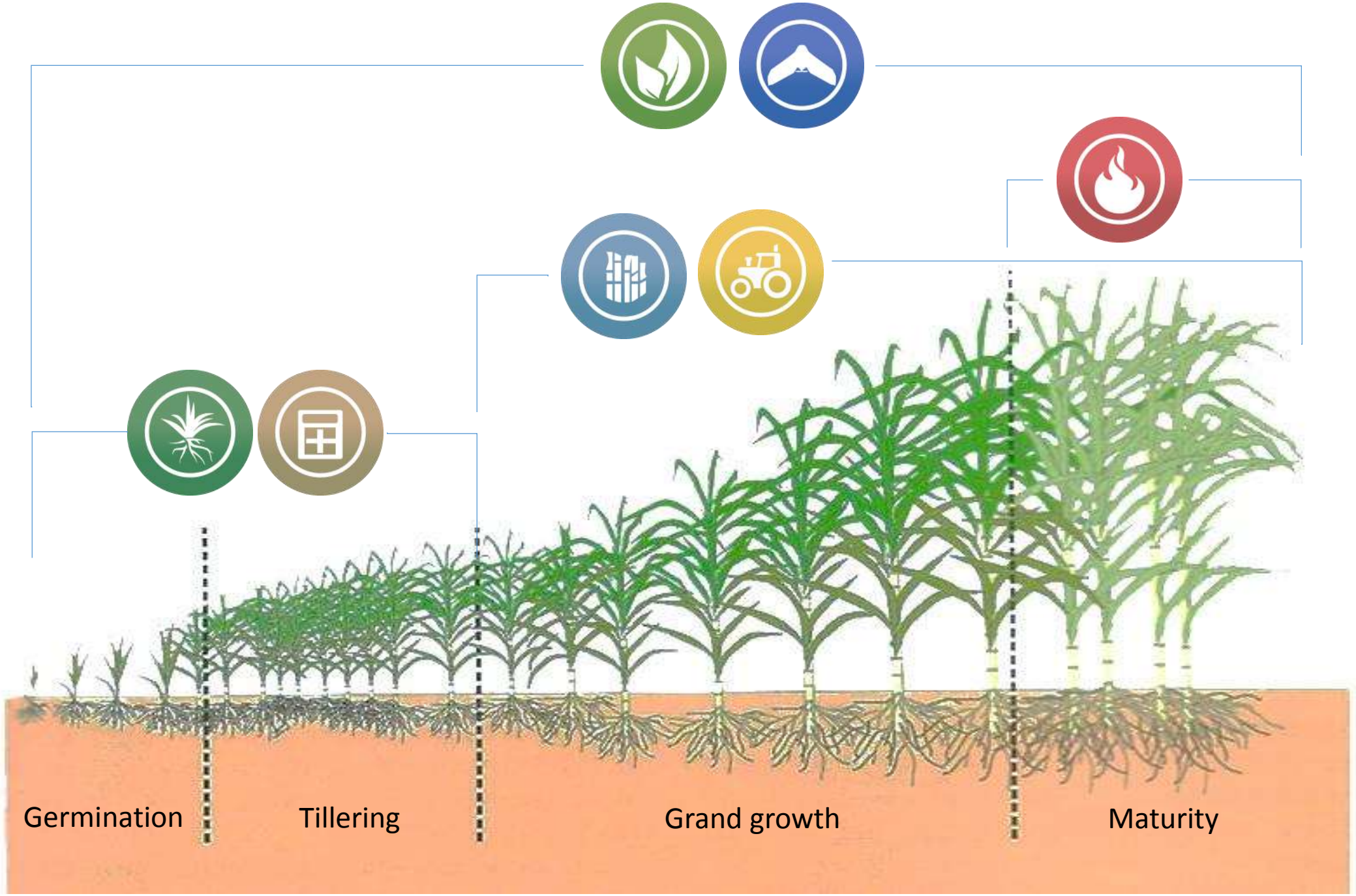
Yield–estimation Products

To generate and automate RS-GIS products for crop growth & health monitoring

Growth Monitoring Products

YESS Growth Monitoring Products

UAV Orthophoto and NDVI Map


Germination
Tillering
Grand growth
Maturity

Landsat and MODIS NDVI Map

Data Source: Landsat, MODIS

Application:

Landsat NDVI - for monitoring the presence and greenness of the sugarcane crop

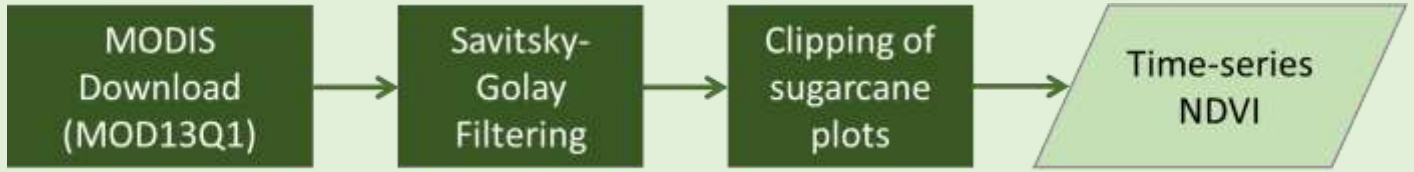
MODIS NDVI - to visualize an extended temporal

Development:

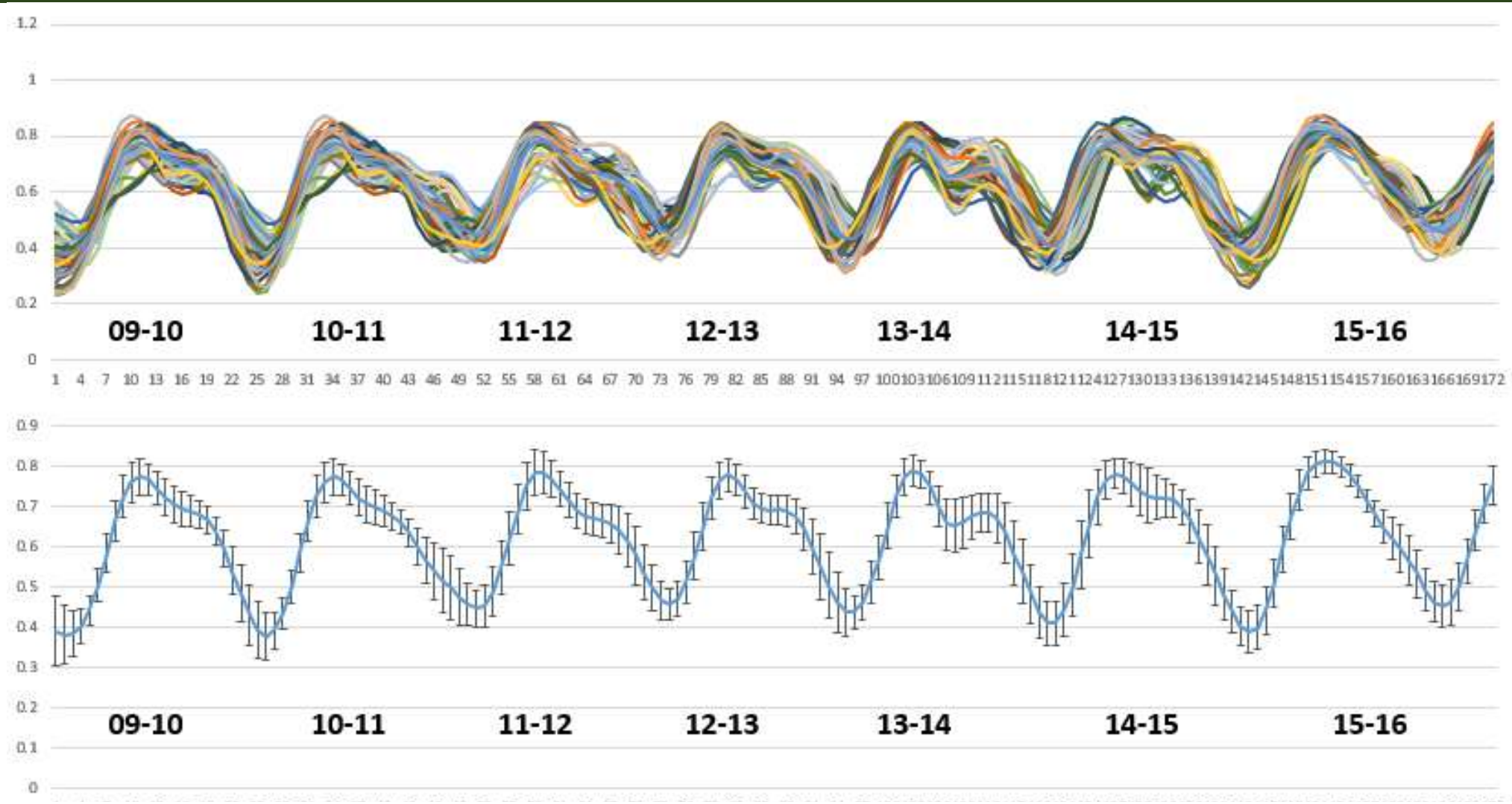
LANDSAT NDVI

$$NDVI = \frac{R_{NIR} - R_{Red}}{R_{NIR} + R_{Red}}$$

MODIS NDVI



Landsat and MODIS NDVI Map



Sample Output:

MODIS NDVI time series (7 years) in Tarlac Mill District

Classified Planted and Ratoon Cane Map

Data Source: MODIS 16 days composite & MODIS 8 days composite

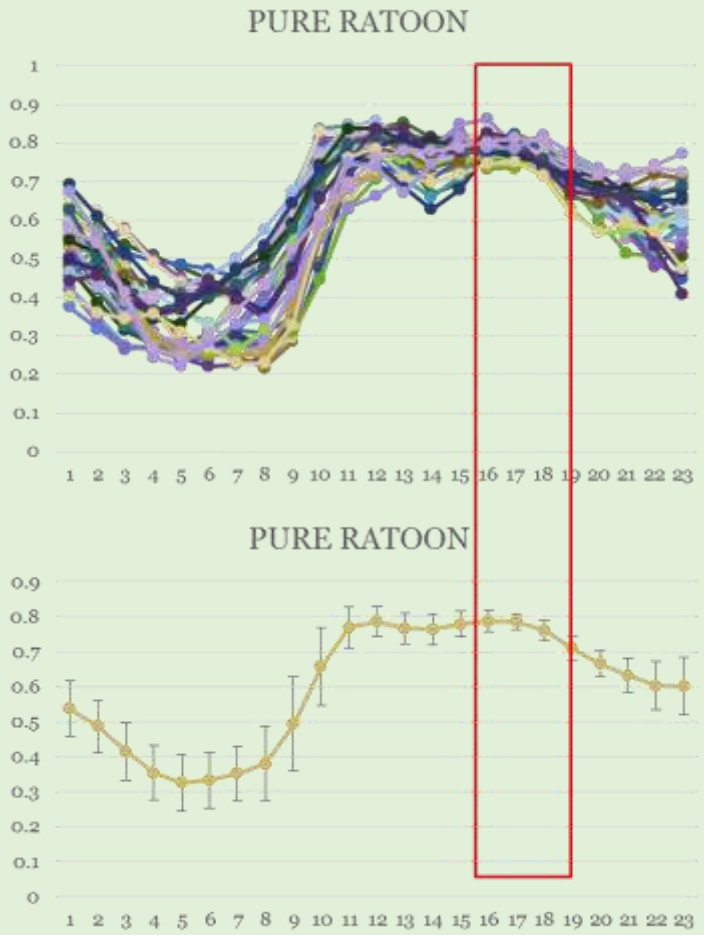
Application:

Useful in determining the crop type (whether a cane is planted or a ratoon) which has an effect on total yield production

Planted Cane

Ratoon Cane

Development:



Plant canes have higher standard deviation during the grand growth stage as highlighted

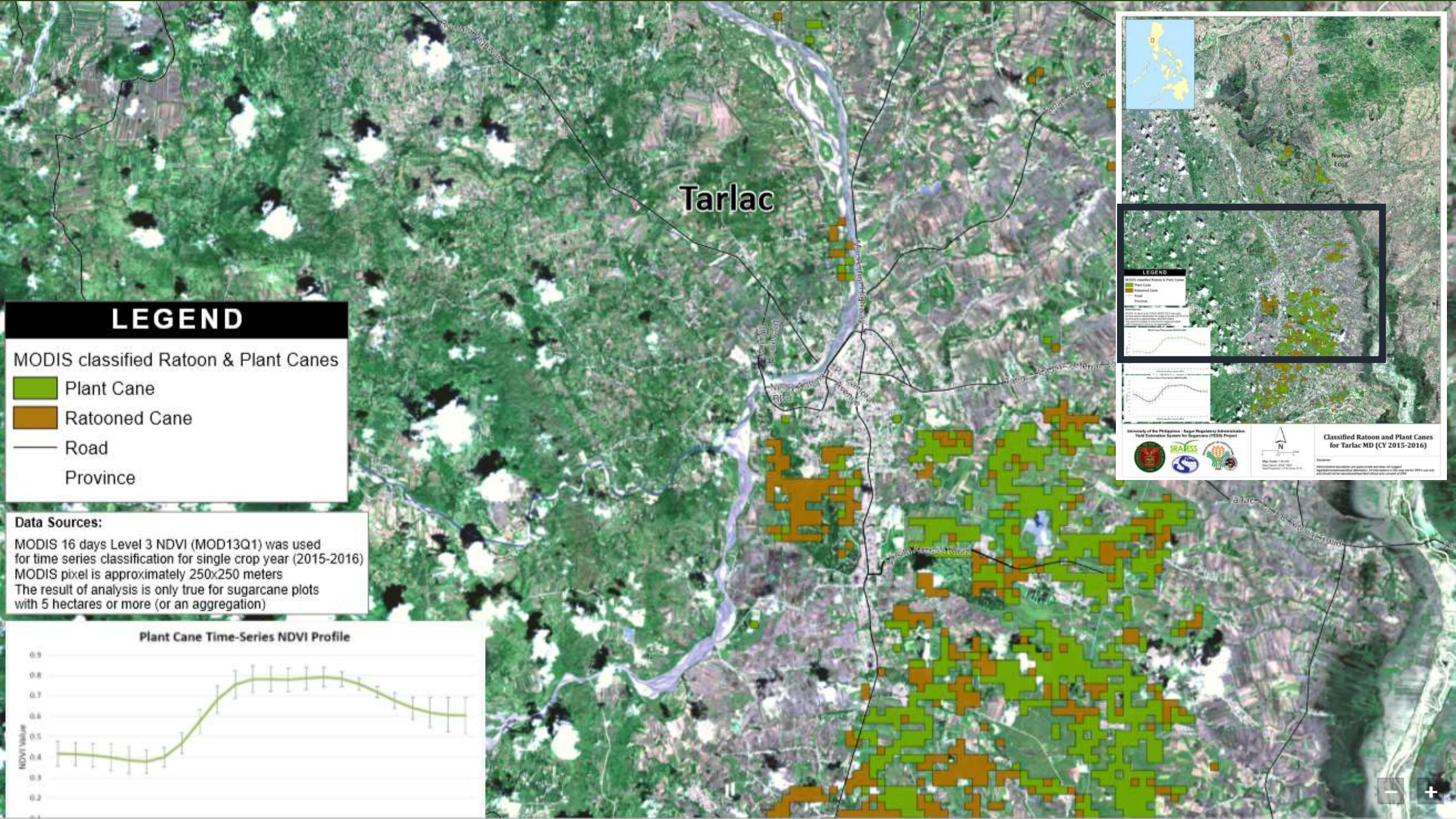
Standard deviation of ratoon crops during the establishment period is more constant

↓

temporal spectral differences

↓

Image classification

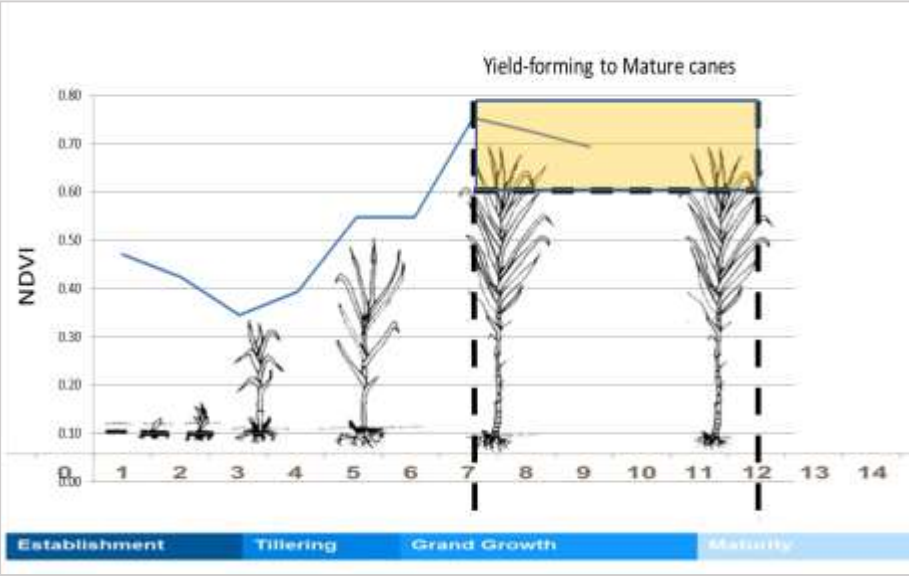

Tarlac
LEGEND
MODIS classified Ratoon & Plant Canes
Plant Cane
Ratooned Cane
Road
Province
Data Sources:
MODIS 16 days Level 3 NDVI (MOD13Q1) was used for time series classification for single crop year (2015-2016)
MODIS pixel is approximately 250x250 meters
The result of analysis is only true for sugarcane plots with 5 hectares or more (or an aggregation)
Plant Cane Time-Series NDVI Profile
NDVI Value
Nueva Ecija
Classified Ratoon and Plant Canes for Tarlac MD (CY 2015-2016)

Yield-forming to Mature Cane Map

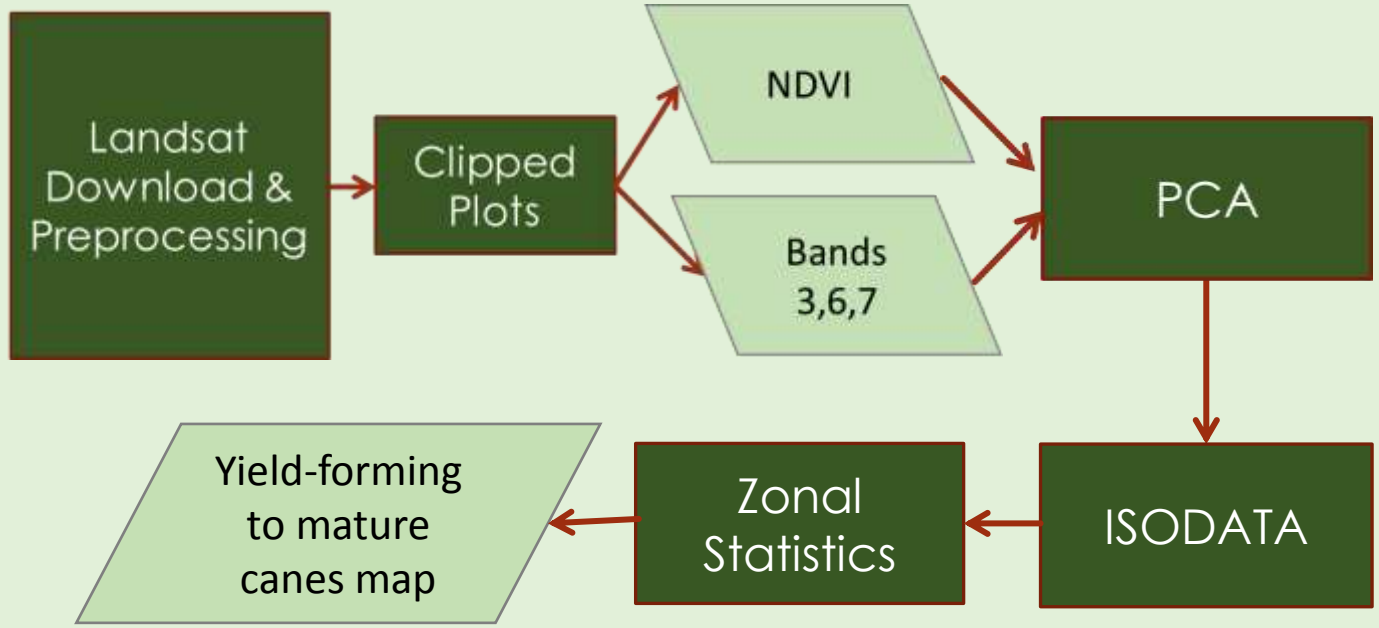
Data Source: Landsat

Application:

Can be used to compute the total area of harvestable canes; determining the remaining standing canes when generated during the harvest period

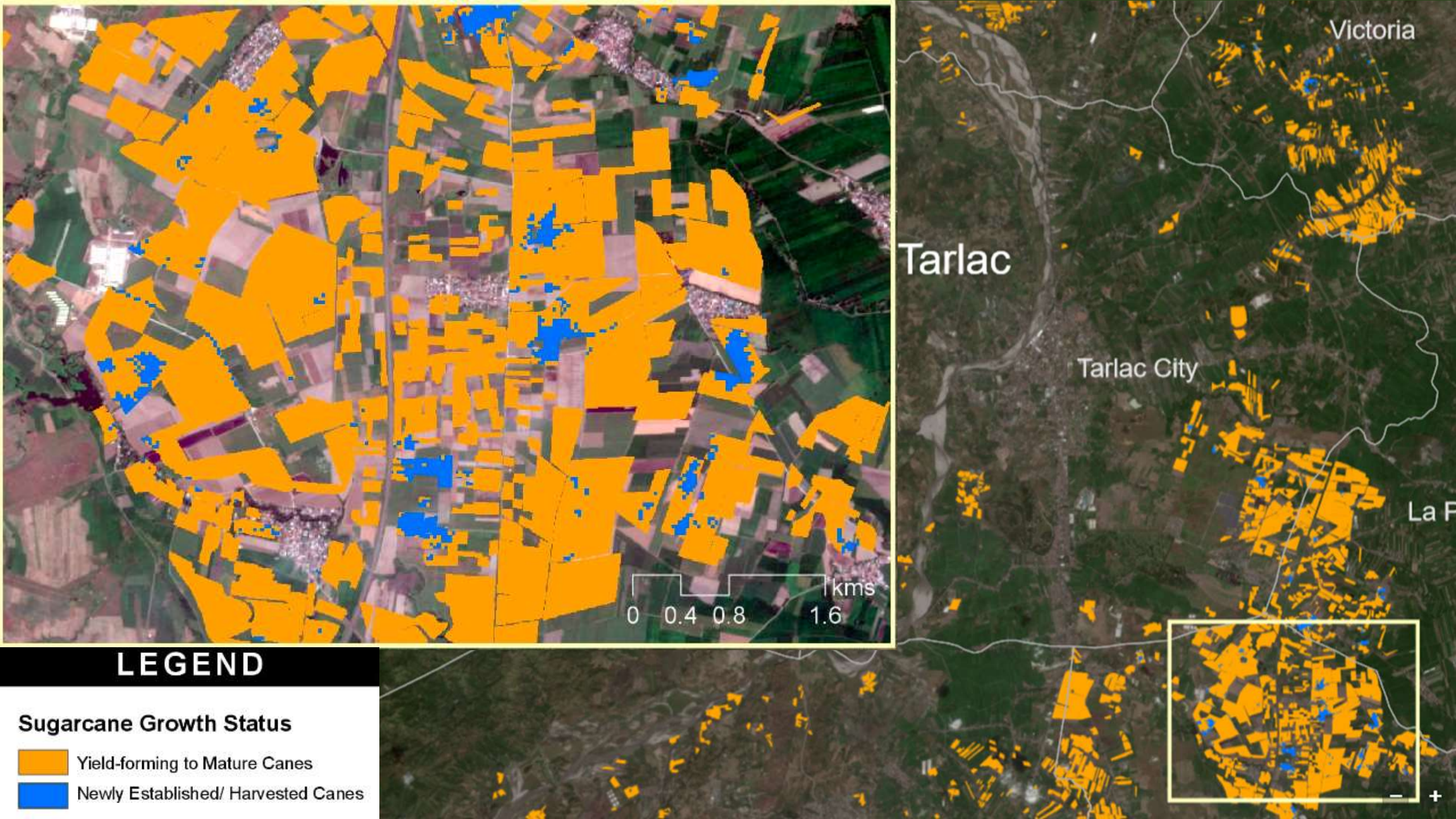


Development:



NDVI: Bands used are B5 and B4 (L8). This index is an indicator of plant health or growth *(Rahman et al, 2004).*

SWIR BANDS: When combined with B5 (NIR), bands 6 & 7 can provide better estimation of vegetation water content *(Ceccato et al, 2002)*


Victoria
Tarlac
Tarlac City
La P
0 0.4 0.8 1.6
kms
LEGEND
Sugarcane Growth Status
Yield-forming to Mature Canes
Newly Established/ Harvested Canes

Sugarcane Area Estimate

Data Source: Sentinel 1 (SAR), SRA Sugarcane Shapefile

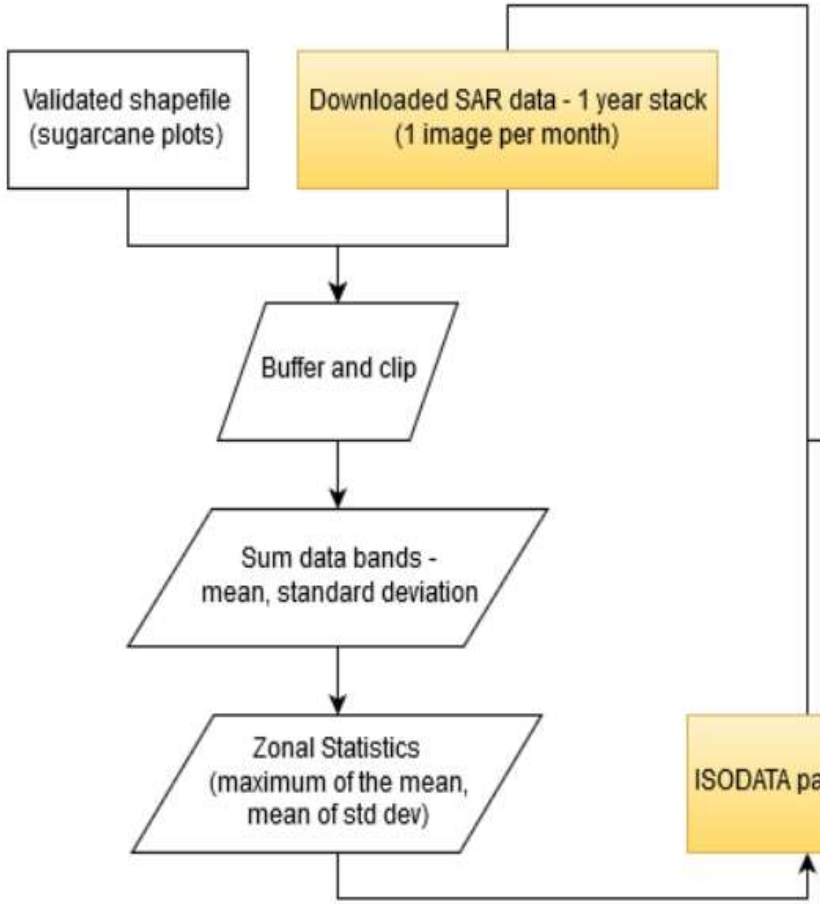
Application:

Can be used in determining the total area planted with sugarcane within a mill district, municipality or a specified farm location

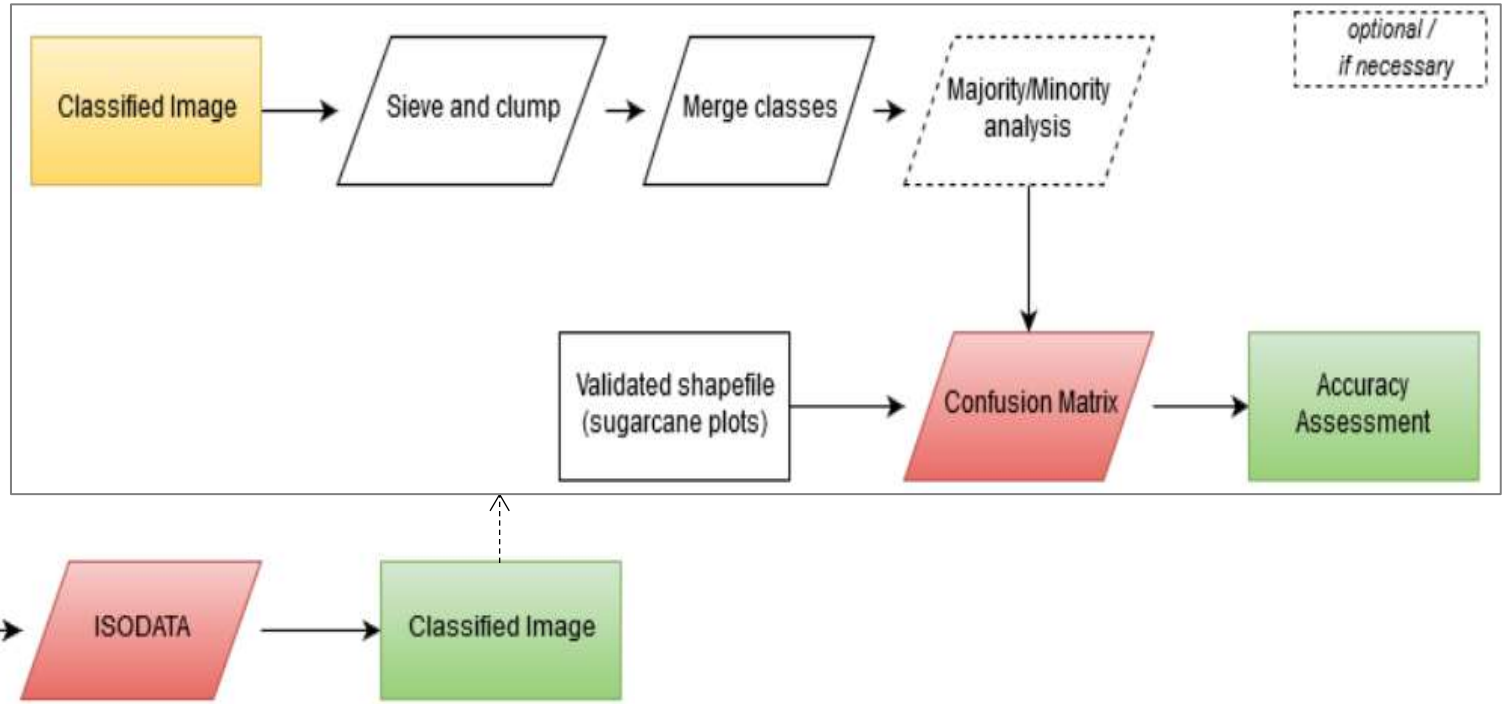
Sugarcane Area Estimate

Development:

Classification Process

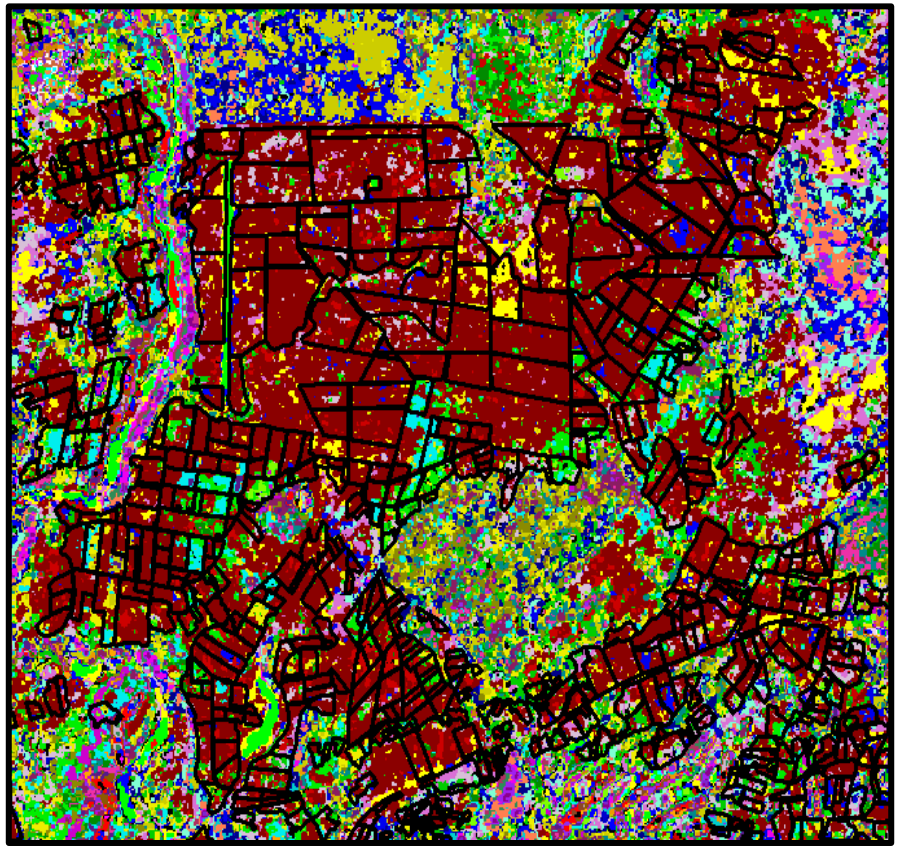


Post Processing (Data Cleaning)



Sugarcane Area Estimate

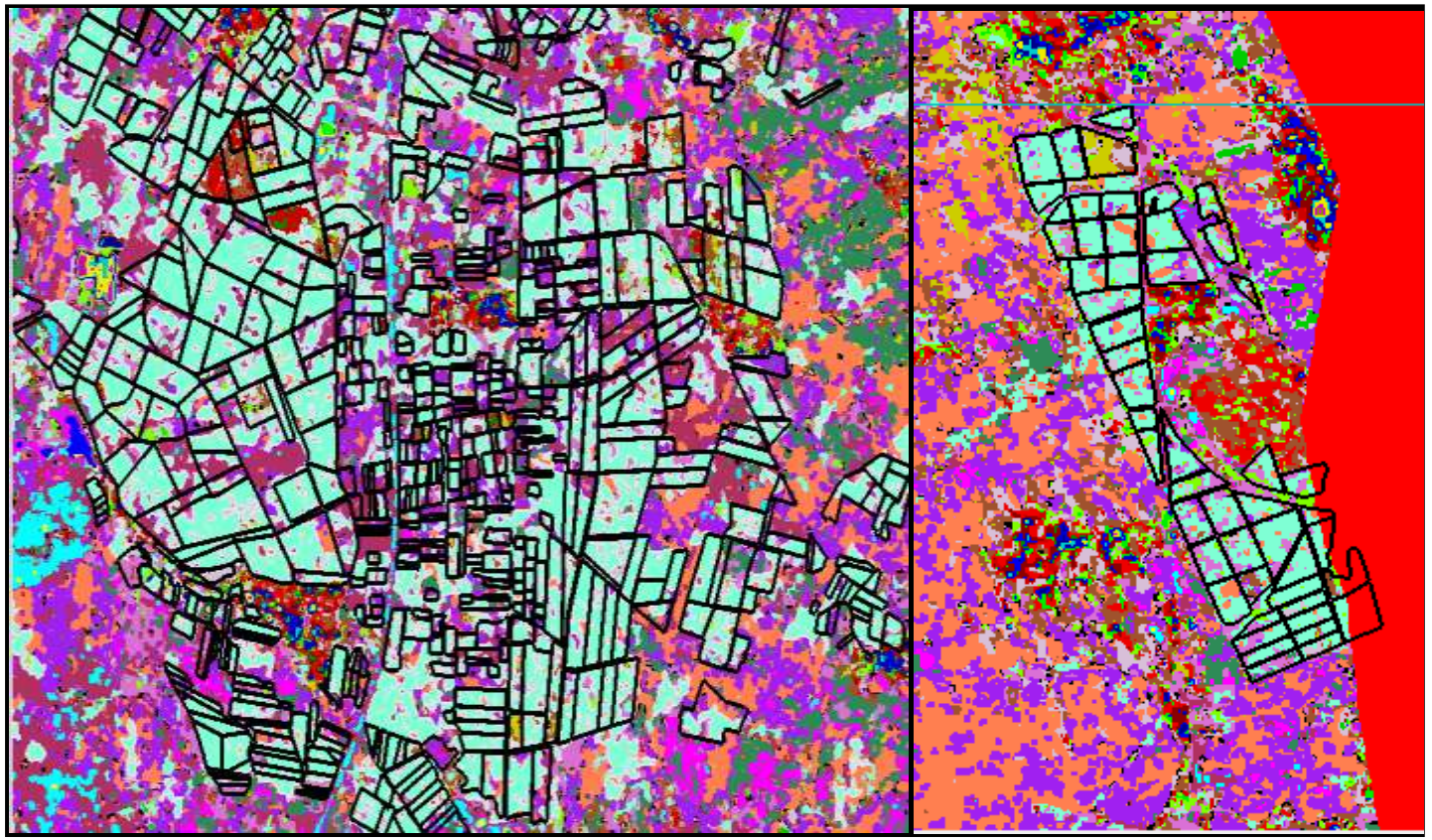
Sample Output: Tarlac and Bukidnon Classified Sugarcane Area



Classified Sugarcane in Bukidnon MD

Computed Area: **62,313 Ha**

Accuracy: 87%



Classified Sugarcane in Tarlac MD

Computed Area: **10,219.00 Ha**

Accuracy: 78%

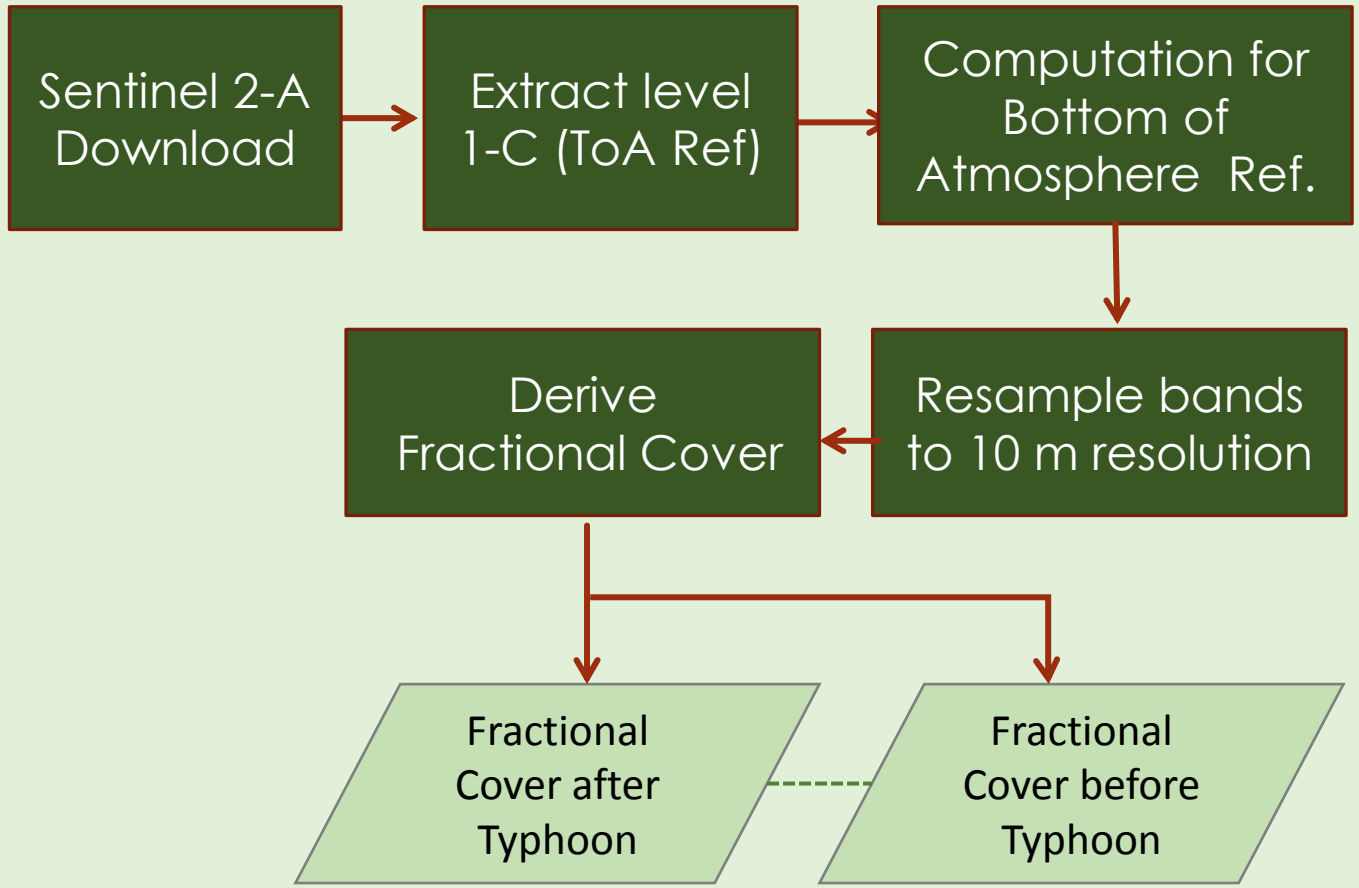
Cane Canopy Damage Map

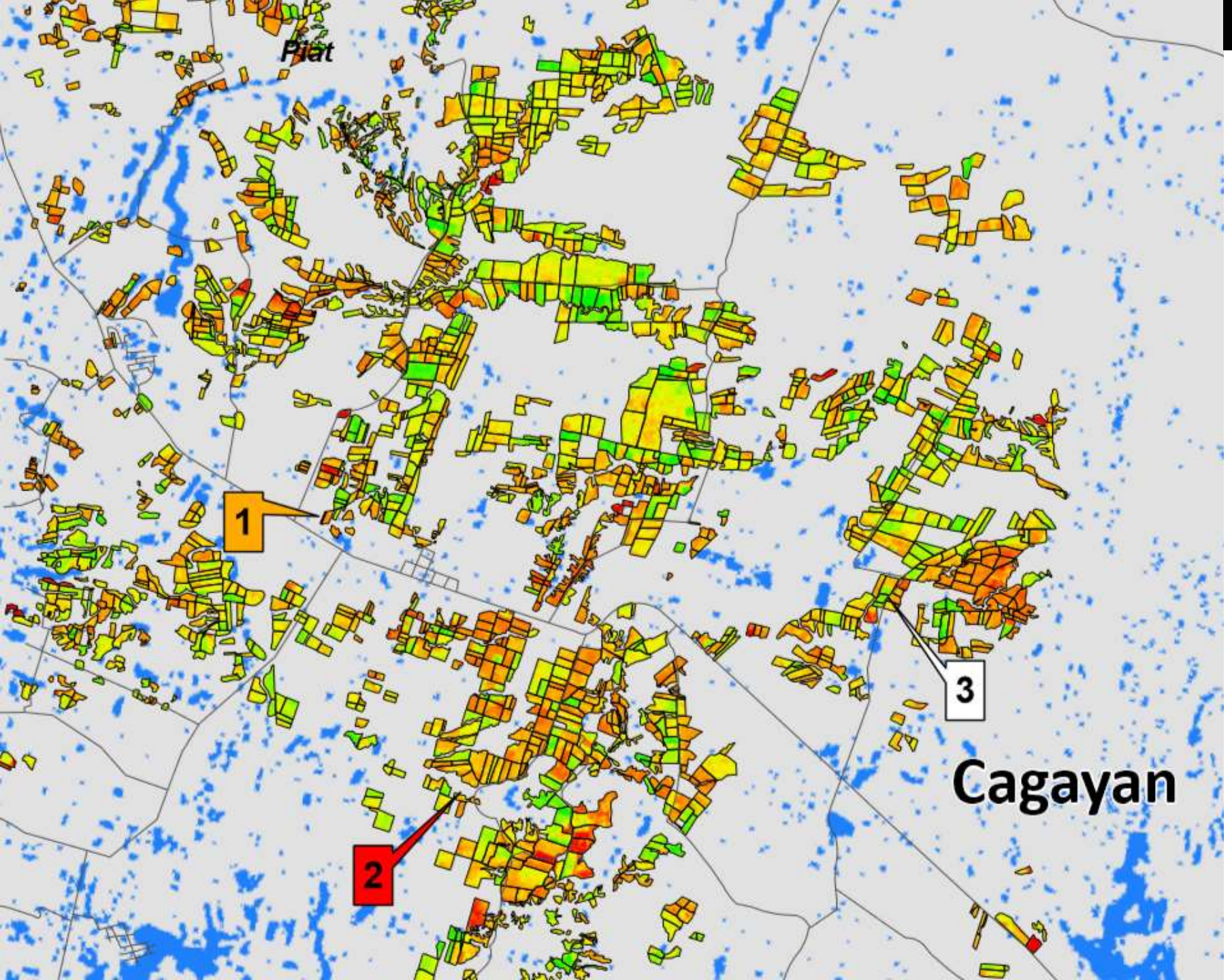
Data Source: Sentinel 2

Application:

Detect areas with low, moderate or high canopy damage in terms of crop fractional cover.

Development:



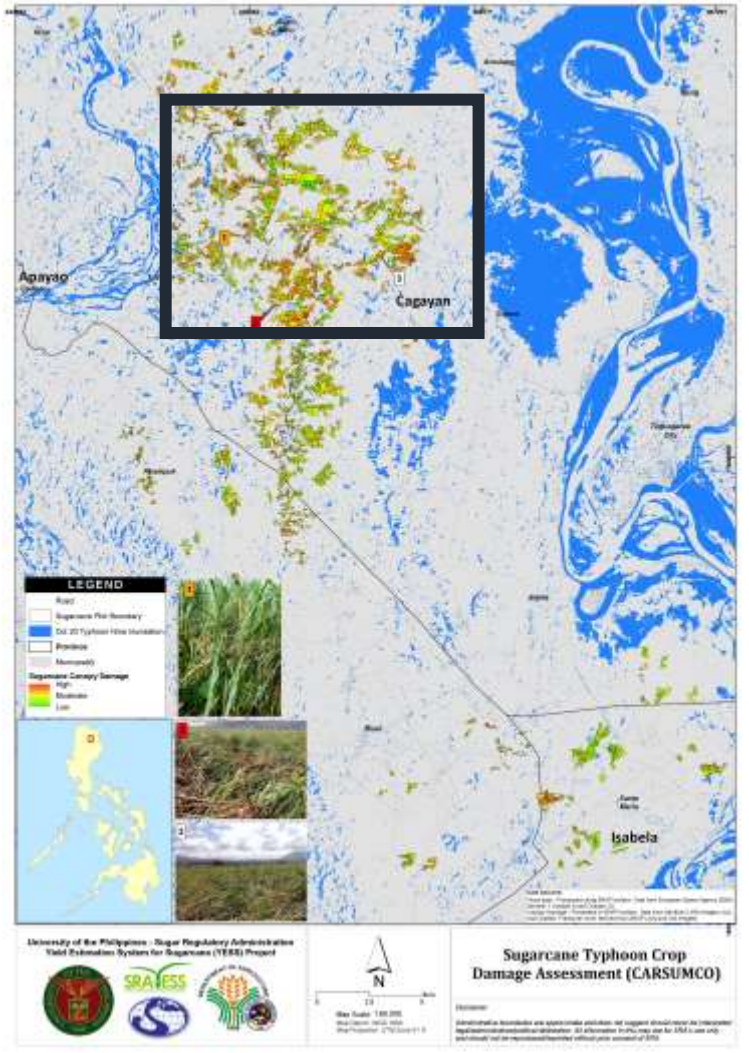


LEGEND

Sugarcane Canopy Damage

- High
- Moderate
- Low

Oct 20 Typhoon Nina Inundation



Burned Cane Map

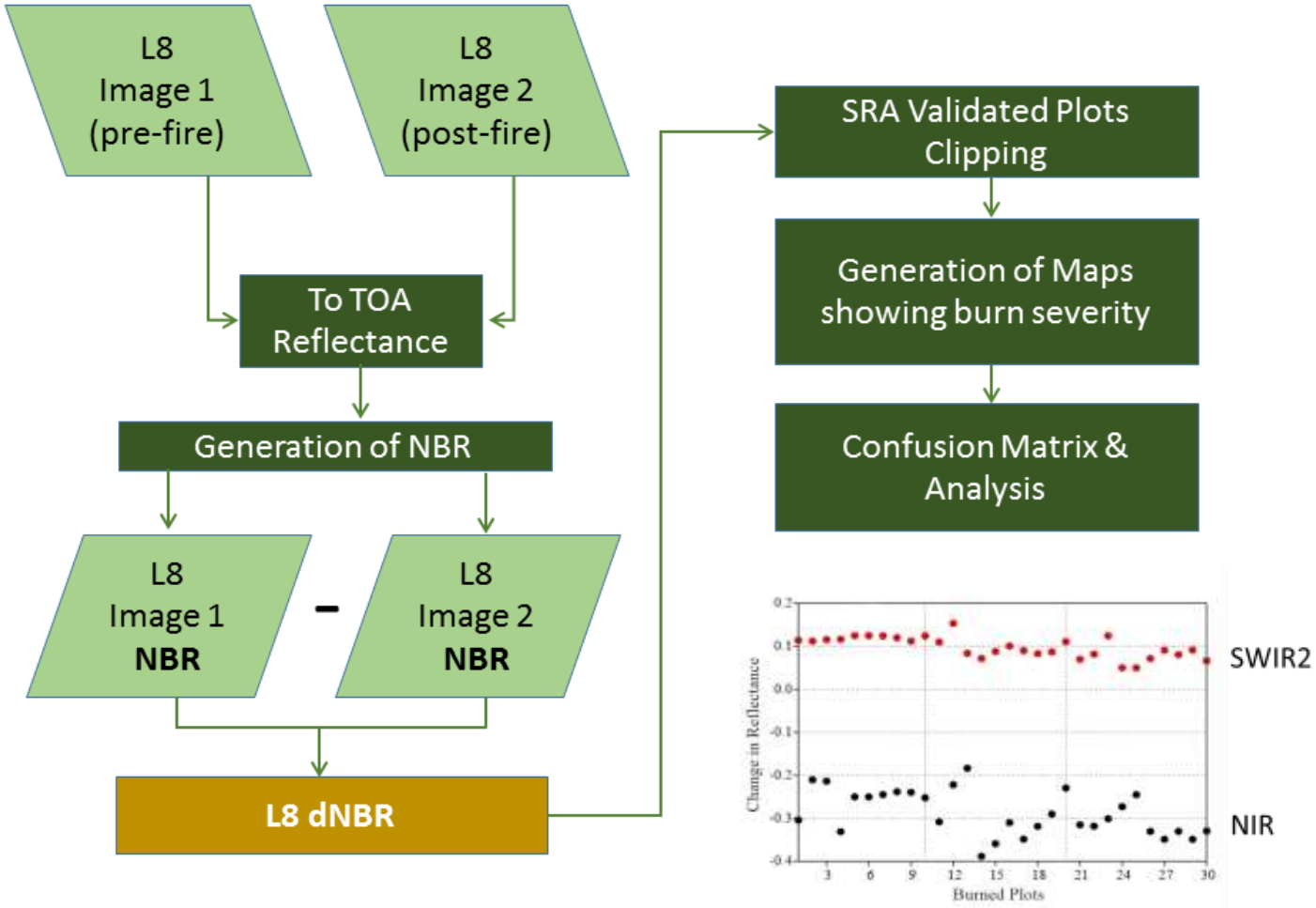
Data Source: Landsat

Application:

Burned cane maps highlight the burned area and burn severity of each sugarcane pixels.

Information on burned cane extent is significant in yield estimation models to calculate total sugar lost during harvest.

Development:



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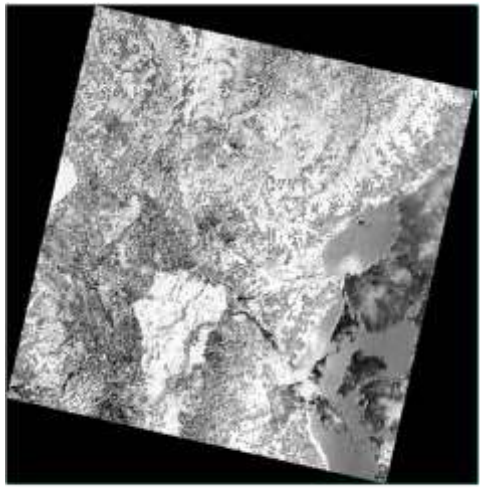


IMAGE 2: MARCH 16 2016

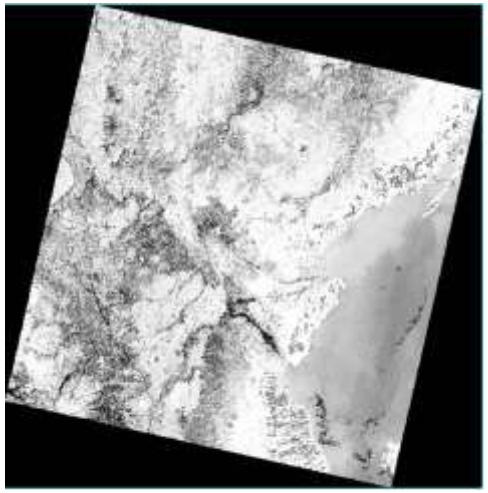
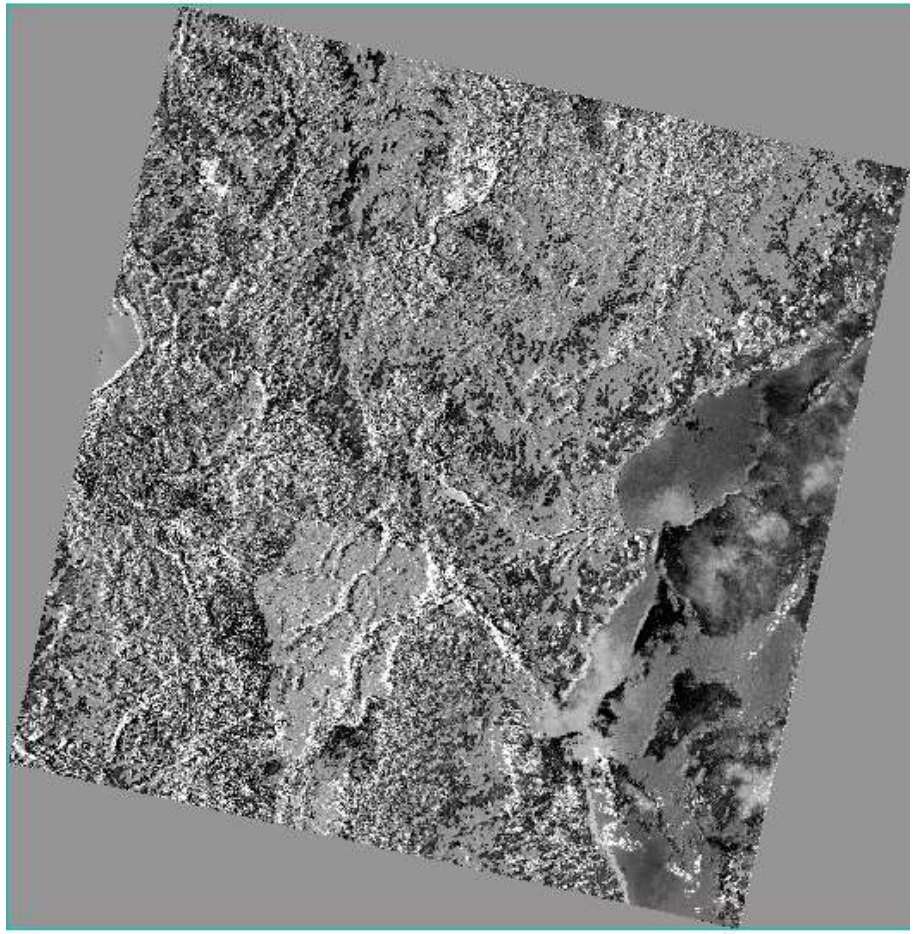
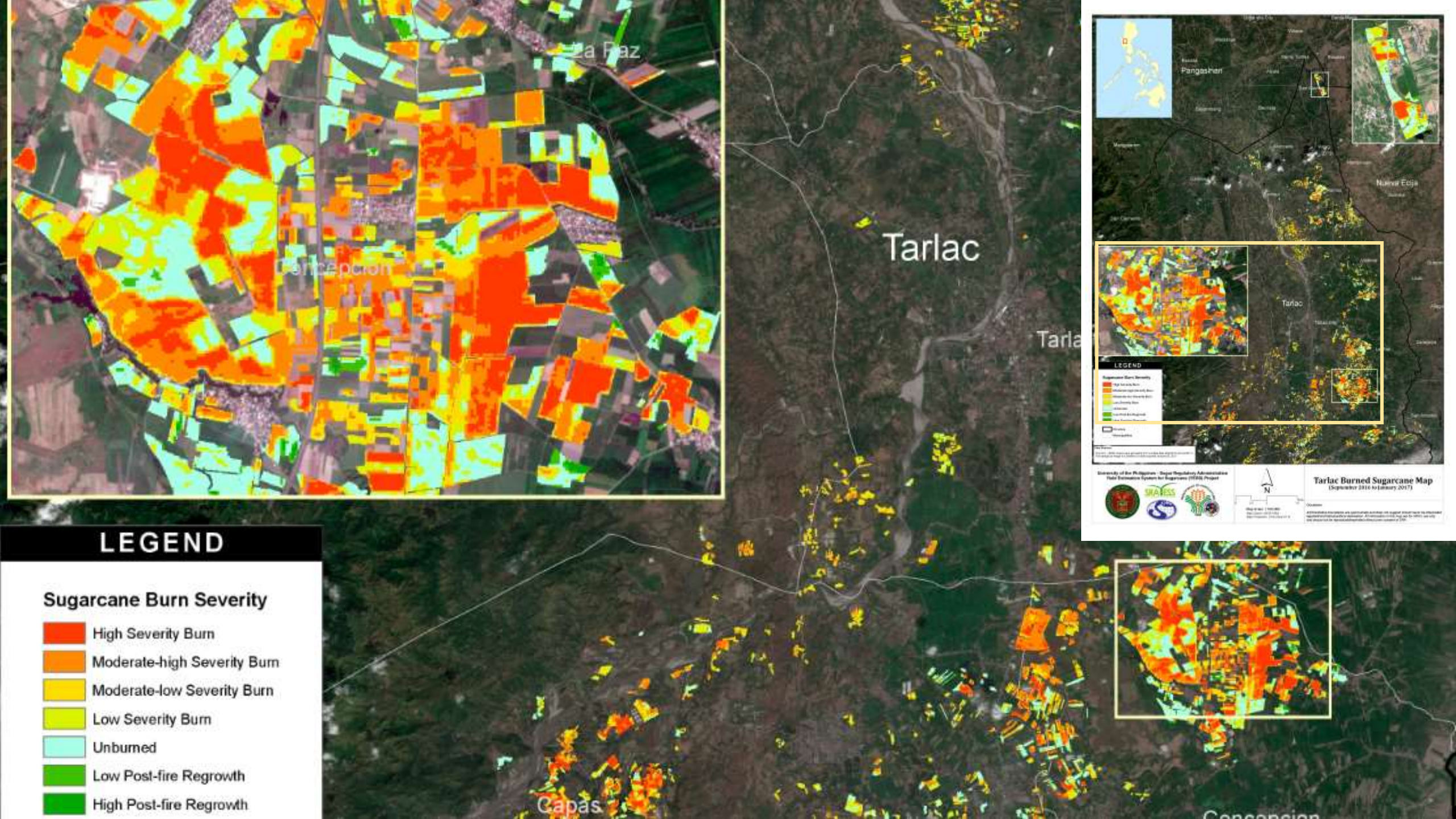


IMAGE 1: FEB 13 2016



dNBR (FEB-MARCH 2016)


Tarlac
Capas
Concepcion
Pangasinan
Nueva Ecija
LEGEND
Sugarcane Burn Severity
High Severity Burn
Moderate-high Severity Burn
Moderate-low Severity Burn
Low Severity Burn
Unburned
Low Post-fire Regrowth
High Post-fire Regrowth
Tarlac Burned Sugarcane Map

UAV Orthophoto and NDVI Map

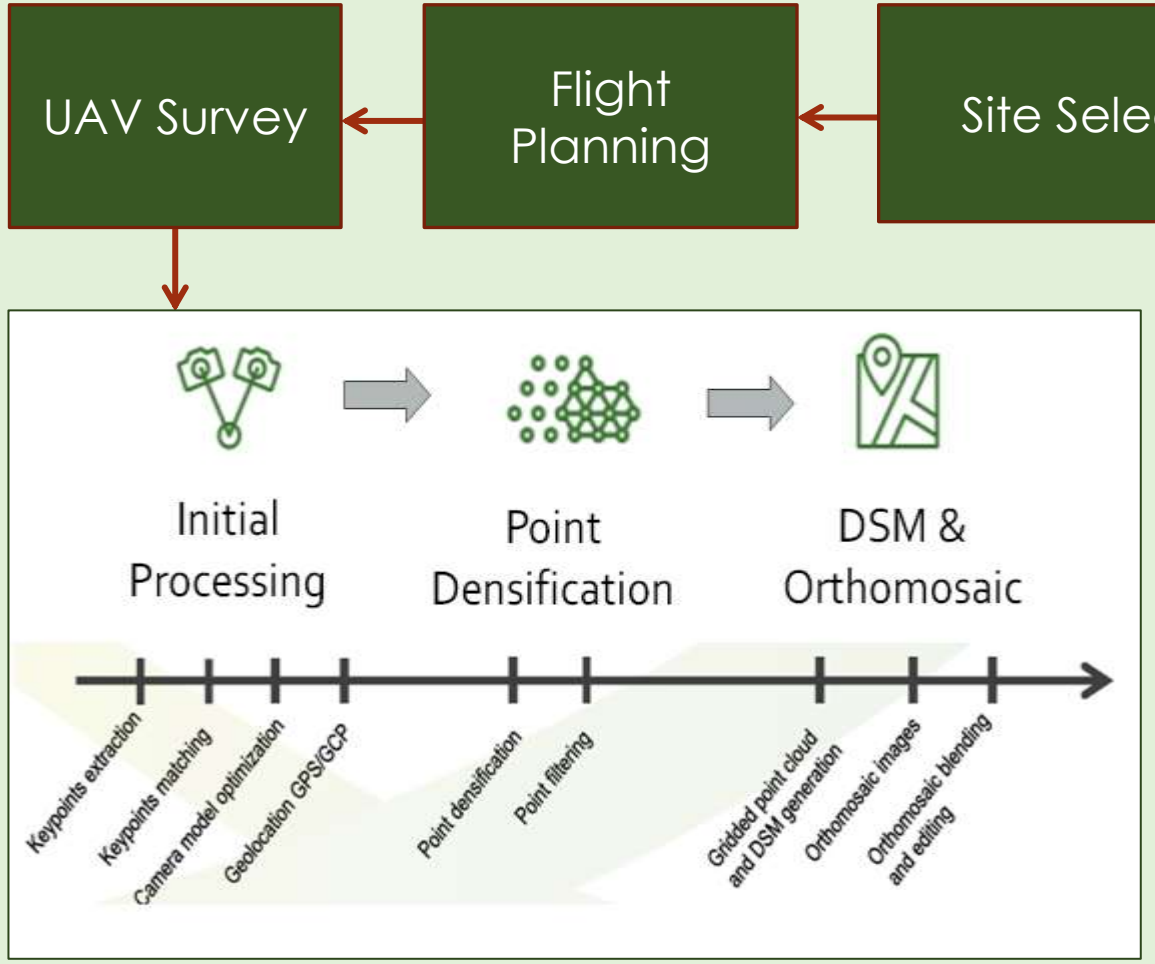
Data Source: Survey-grade UAV

Application:

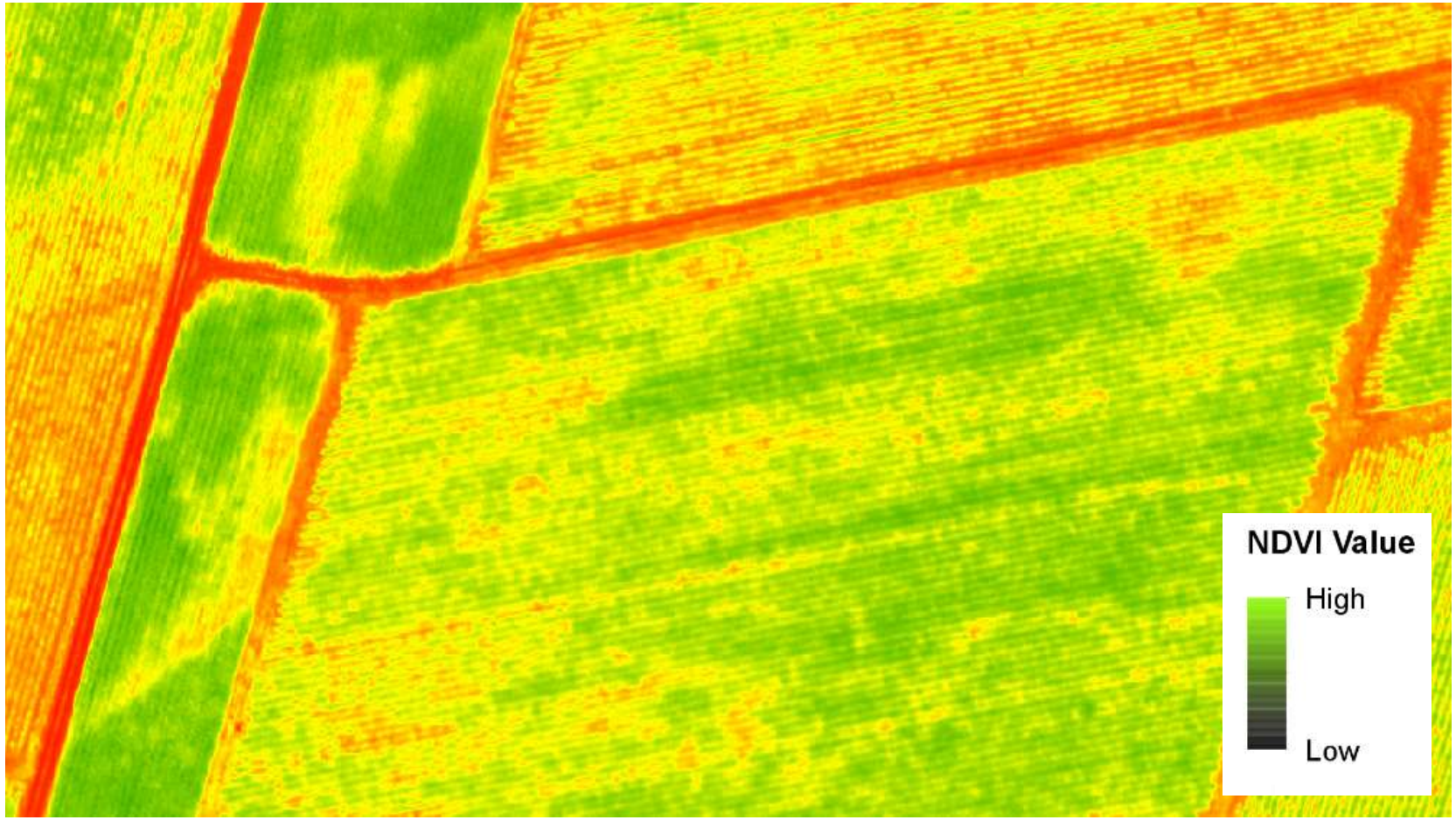
- useful for monitoring growth status of canes in smaller plots

- for field validation of other products, e.g. burned cane areas and typhoon-damaged canes

Development:



Sample Output:
3D Model, Sugar Mill and Sugarcane Field, Bukidnon



UAV NDVI, Tarlac MD

Orthophoto with Burned canes

Orthophoto with damaged canes

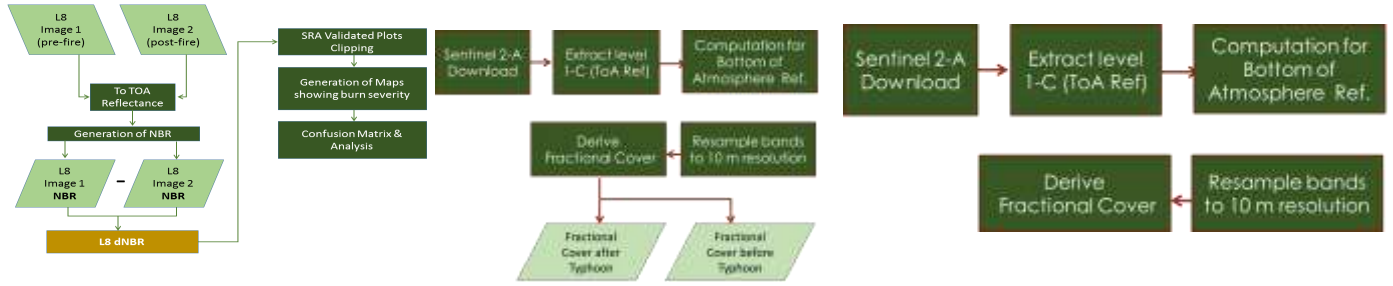
Products: From SRA-YESS to SRA-WebGIS

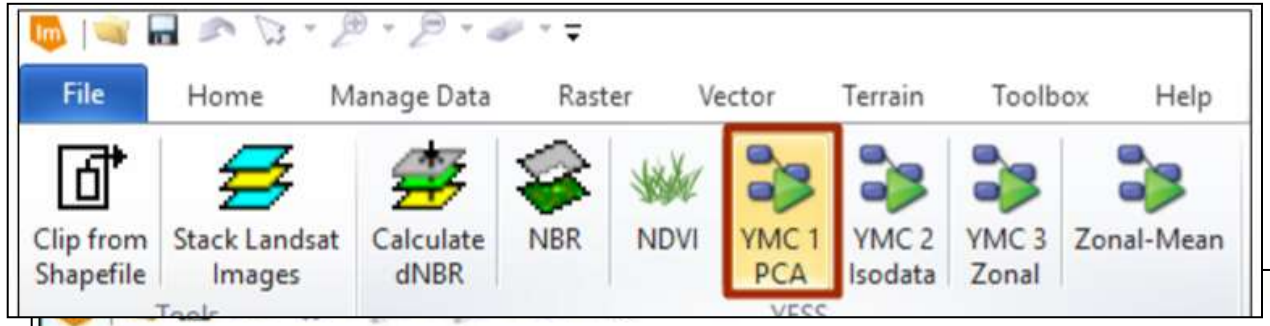
PRODUCT WORKFLOWS

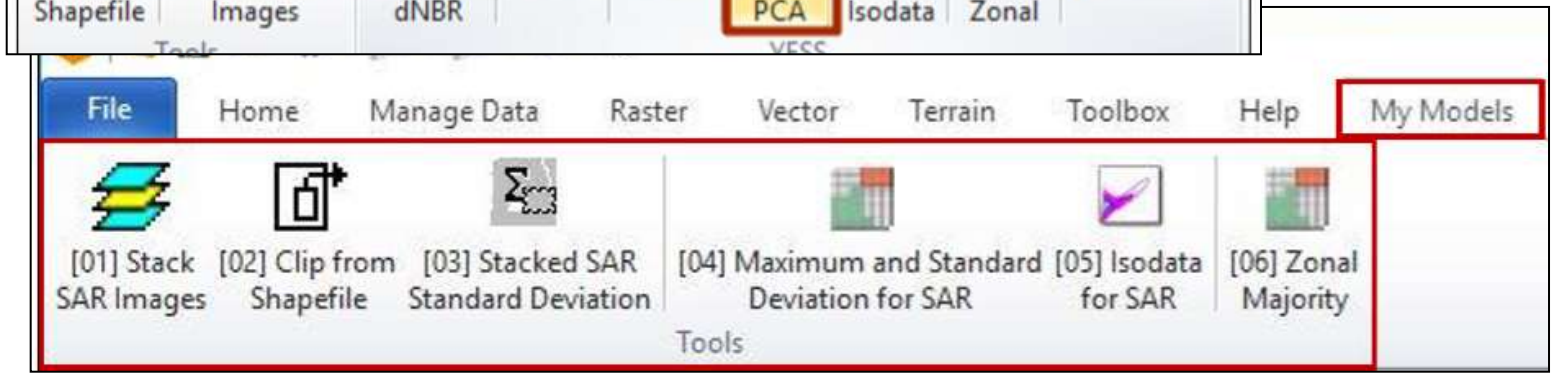
AUTOMATION IN ERDAS IMAGINE
(Ready to use models)

OUTPUT → GEODATABASE

SRA-WEBGIS







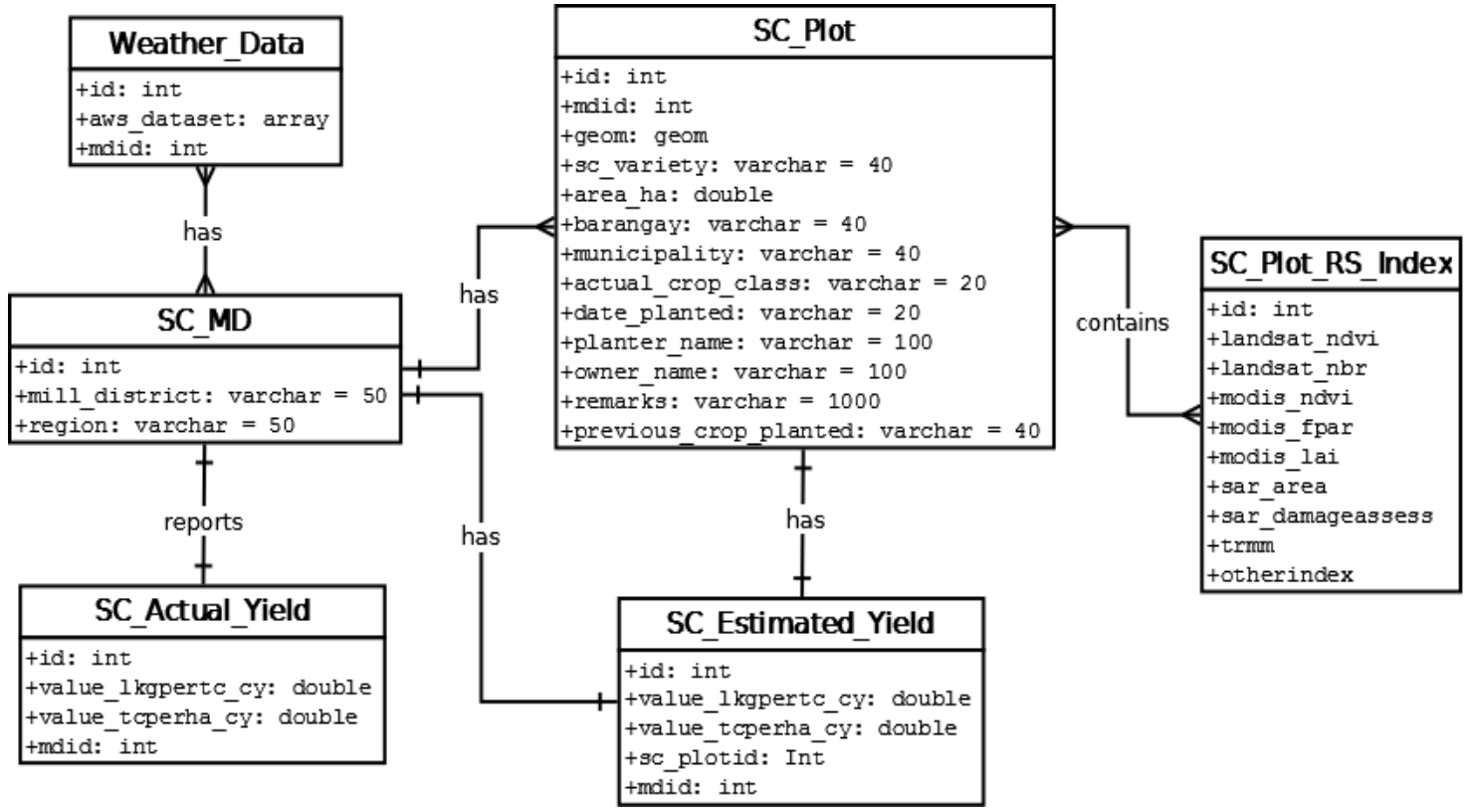
Products: From SRA-YESS to SRA-WebGIS

PRODUCT WORKFLOWS

AUTOMATION IN ERDAS IMAGINE
(Ready to use models)

OUTPUT → GEODATABASE

SRA-WEBGIS



Products: From SRA-YESS to SRA-WebGIS

PRODUCT WORKFLOWS

↓

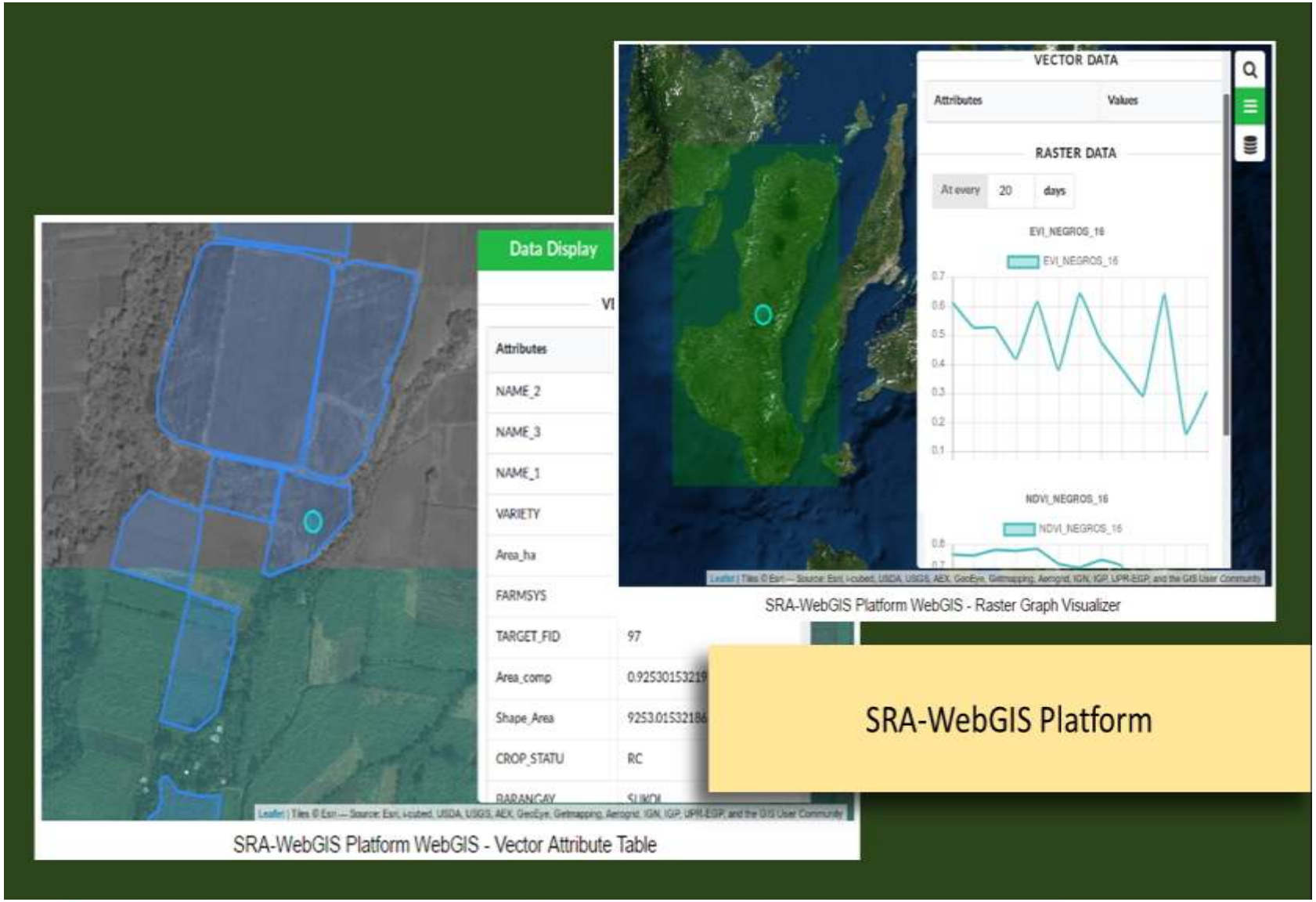
AUTOMATION IN ERDAS IMAGINE
(Ready to use models)

↓

OUTPUT → GEODATABASE

↓

SRA-WEBGIS



SUMMARY

Aside from the plot-level yield estimate, **different growth monitoring geospatial products were developed** for the YESS Project through a collaboration between experts, stakeholders and farmers.

Significance of the products:

FARMERS can now use the different RS-based products for monitoring their sugarcane plantation. This is vital for making management decisions such as application of fertilizers and determining the right harvest schedule.

Sugar Regulatory Administration (SRA) can utilize these products for drawing decisions and for intervention and support to farmers and mill districts with poor sugarcane growth and low estimated production.

ACKNOWLEDGEMENTS

SUGAR REGULATORY ADMINISTRATION
Department of Agriculture
Philippine Sugar Center Building, Quezon City, Philippines

DEPARTMENT OF GEODETIC ENGINEERING
University of the Philippines - Diliman

GEOSMART ASIA 2017
Geospatial Media and Communications