**Global Cropland Area Database (GCAD30) through Landsat and MODIS Data Fusion for the Years 2010 and 1990 and Its Dynamics Over Four Decades using AVHRR and MODIS**

**Project Summary:** Monitoring global croplands (GCs) is imperative for ensuring sustainable water and food security to the people of the world in the Twenty-first Century. However, the currently available cropland products suffer from major limitations such as: (1) Absence of precise spatial location of the cropped areas; (b) Coarse resolution nature of the map products with significant uncertainties in areas, locations, and detail; (b) Uncertainties in differentiating irrigated areas from rainfed areas; (c) Absence of crop types and cropping intensities; and (e) Absence of a dedicated web\data portal for the dissemination of cropland products.

Therefore, our project aims to close these gaps through a Global Cropland Area Database at nominal 30m (**GCAD30**) with **4 distinct products**:

1. Cropland extent\area,

2. Crop types with focus on 8 crops that occupy 70% of the global cropland areas,

3. Irrigated *versus* rainfed, and

4. Cropping intensities: single, double, triple, and continuous cropping.

The project will disseminate these data and products through the USGS Powell Center Global Croplands Working Group web portal (<https://my-beta.usgs.gov/wggc/>) which will also include web mapping for user interaction, feedback, and improvements.

**First**, the above 4 products will be generated for GCAD for nominal year 2010 (**GCAD2010**) based on Landsat 30m Global Land Survey 2010 (GLS2010) fused with Moderate Resolution Imaging Spectroradiometer (MODIS) 250m NDVI monthly maximum value composites (MVC) of 2009-2011 data, and suite of secondary data (e.g., long-term precipitation, temperature, GDEM elevation). GCAD30 will be produced using **three mature cropland mapping algorithms (CMAs)**:

1. Spectral matching techniques (**SMT**; <http://www.iwmigiam.org>; Thenkabail et al., 2009a, b, 2007);

2. A cropland classification algorithm (**ACCA**) that is rule-based: (Thenkabail et al., 2012; e.g.,

<http://www.sciencebase.gov/catalog/folder/4f79f1b7e4b0009bd827f548>); and

3. Hierarchical segmentation (**HSeg**) algorithm: (Tilton et al., 2012a,b; <http://science.gsfc.nasa.gov/606.3/TILTON/>).

The **SMTs** will be preferred for parts of the world with large volumes of field-plot and other geo-specific map data (section 12.1). **ACCA** will be applied in regions with sparse or unreliable field-plot data, but where numerous other sources of data (see section 7.1) and\or large volume of training data generated from HSeg (Tilton et al., 2012a,b) exist. Further, **HSeg** will be used in conjunction with SMTs and ACCAs to help improve classification accuracies and generate training data over highly fragmented croplands.

**Second**, the same 4 products will be generated for **GCAD1990** which will combine GLS1990, AVHRR 1989-1991, secondary climate and topographic data and national statistical data. **Third**, **GCAD four decades** will characterize the global cropland dynamics from the 1980s to present based on AVHRR 8 km (1982-2000) and MODIS 250m (2001-2017) continuous monthly time-series. **Fourth**, all the products will be extensively evaluated for **accuracies, errors, and uncertainties** using data such as: (i) 25% of ~20,000+ *in-situ* data, (ii) thousand+ globally well distributed very high resolution (sub-meter to 5 meter) Commercial Imagery Derived Requirement (CIDR)Database of USGS, available free of cost to the project through the National Geospatial Intelligence Agency (<https://warp.nga.mil/>), (iii) our ongoing collaborative work over large areas (e.g., rice map of Asia; Figure 7), and (iv) maps from national systems (e.g., USDA cropland data layer; see letters of support from global partners).

**GCAD30 will make significant contributions** to Earth System Data Records (ESDRs), Group on Earth Observations (GEO) Agriculture and Water Societal Beneficial Areas (GEO Ag. SBAs), GEO Global Agricultural Monitoring Initiative (GEO GLAM), and the recent “Big Data” initiative by the White House. The project has the support of **USGS Working Group on Global Croplands** (<http://powellcenter.usgs.gov/current_projects.php#GlobalCroplandsAbstract>).