Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences

CropWatch Introduction and Crop Area Estimation

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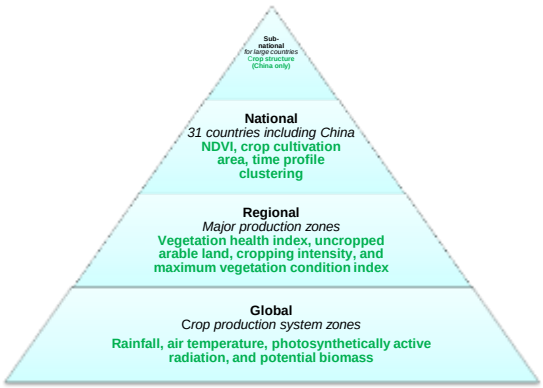
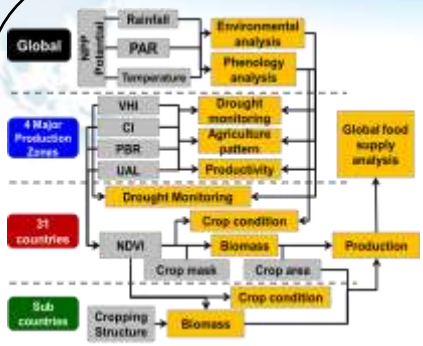
CropWatch

- **4 scales**
  - Global (60 CPSZs)
  - 6 MPZs
  - 31 key countries
  - Subcountris
- **3 temporal resolution**
  - 15 Days: NDVI, Crop condition
  - Growing season：Area, Yield, Production
  - Year：EI, CI, UAL, PBR
- **3 spatial resolution**
  - 0.25°（Global)
  - 1km (4 MPZ, 31 countries, Sub countries)
  - 30m (China)

CropWatch hierarchical structure



Methodology

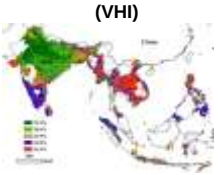


Environmental Index (EI)

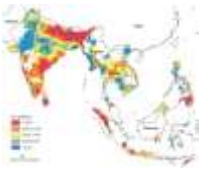
Cropping Intensity (CI)

Uncropped Arable Land ratio (UAL)

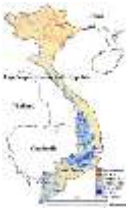
Vegetation Health Index (VHI)



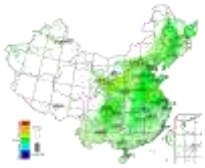
Potential Biomass Ratio (PBR)



NDVI departure

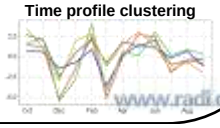


Drought Index



Growth process analysis

Time profile clustering



Validation

CropWatch global validation sites

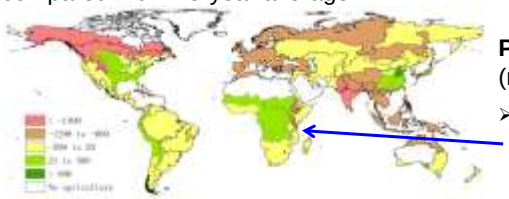
GVG, field data sampling

GVG, Agri-info Sampling System

1 Global Environment analysis

Accumulated PAR (W/m^2) for October 2012-September 2013, compared with five-year average

Radiation

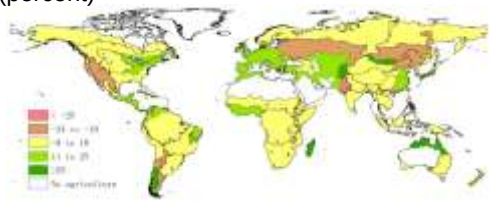


PAR directly relates to both **rainfall** (negatively) and **temperature** (positively)

- In Africa, **the broader Sahel** which is a water-stressed region benefited from favorable PAR conditions—consistent with the observation that PAR and rainfall are negatively related.

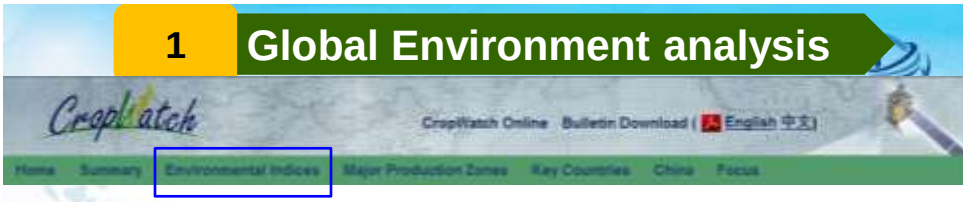
Accumulated rainfall index anomaly, April to September 2013 (percent)

Rainfall



- Unusually **wet summer** conditions occurred in the region of Mongolia, Pamir and surroundings
- **Wet winter** months occurred in Madagascar, North Australia and south-west South America.
- **A negative departure** from the recent mean occurred in the area from Punjab to Gujarat.

1 Global Environment analysis



2013 **Temperature accumulation** above 5° C, departure from the five-year average

Temperature

- most of the northern hemisphere experienced average conditions, with some areas undergoing below average conditions over the period from October 2012 to September 2013.
- The southern hemisphere was generally warmer than the last five years.

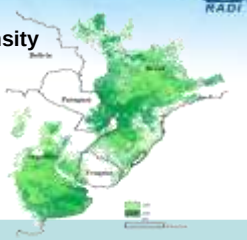
Global **temperature** trends

Global temperature trends are in line with the current apparent "global warming slow-down"

- Eastern African Highlands, parts of western Asia, some areas in South America show significant increasing temperatures (blue).
- Marked decreasing trends (red) affect parts of the western United States and Mexico, South Africa, and Taiwan.

2 Cropland use intensity

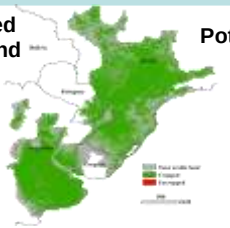
Cropping Intensity (CI)



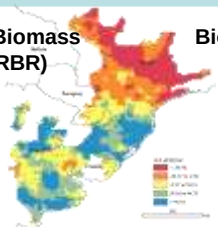
South American MPZ: prospects for the current wheat crops are favorable.

- CI presented a significantly increasing trend, up 8.3 percent over the recent medium term, most of the increase being achieved over the last five years.
- UAL was very low this season (0.14%), further decreasing over the already very low values of the recent past (0.25%).
- PBR also showed a decreasing trend- with marked and significant decreases in southwest Mato Grosso - indicating a somewhat reduced efficiency of farming systems in the MPZ.

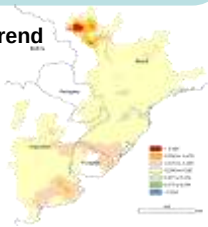
Uncropped Arable Land (UAL)



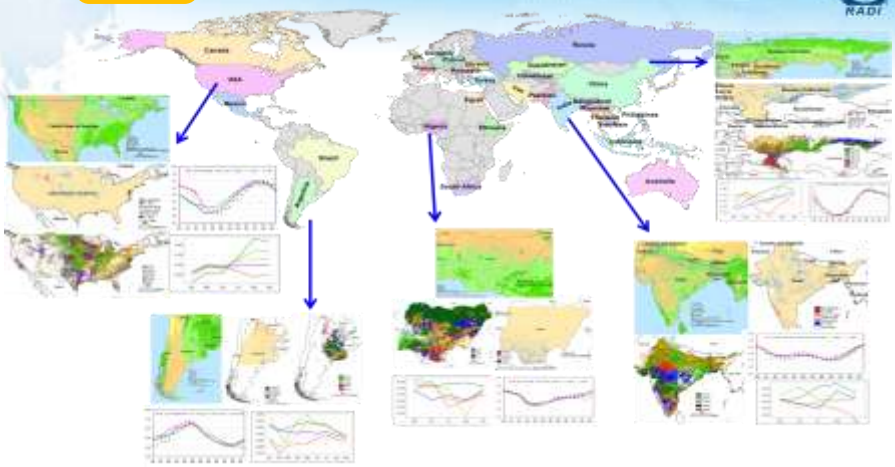
Potential Biomass Ratio (RBR)



Biomass Trend



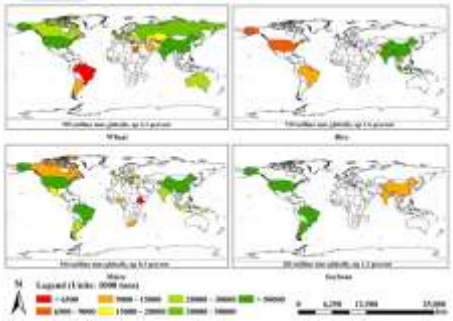
3 Crop Condition analysis



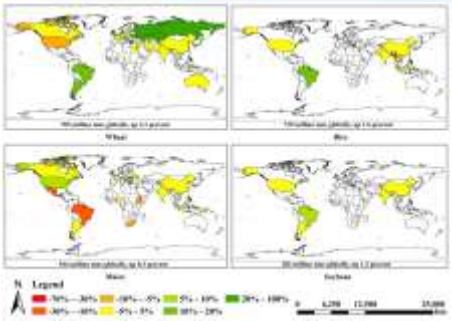
For each country, 5 maps and graphs are provided showing (a) the average NDVI background; (b) Crop condition map compared with the average of the previous 5 years; (c) Crop condition development profile; (d) Spatial NDVI patterns of the latest or ongoing season; and (e) NDVI profiles associated with the spatial patterns

4 Crop Production estimates

2013 Production



Production Changes vs 2012 (△%)



The CropWatch estimate for the 2013 production of main crops is as follows:

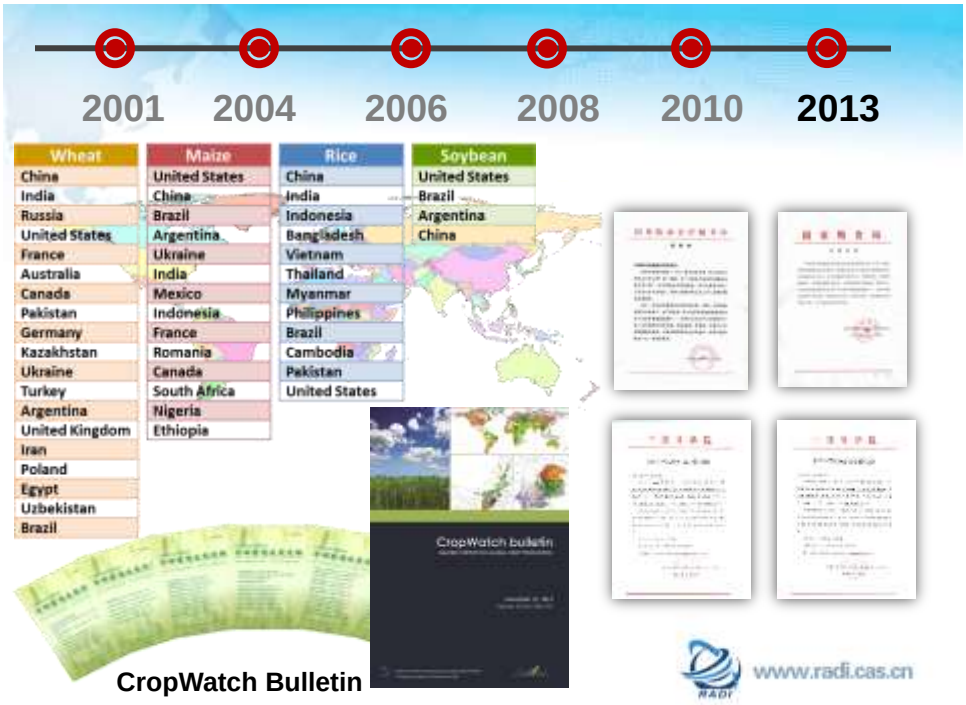
- wheat, 705 million tons, up 4.1% over preliminary 2012 FAOSTAT estimates;
- rice as paddy, 739 million tons, up 1.6%;
- maize, 944 million tons, up 0.3%;
- soybean, 282 million tons, an increase of 1.2% compared with 2012

For the 30 major producers and exporting countries:

- increases are more modest for wheat (+2.3%) and for rice (+0.8%)
- exceed the rest of the world for maize (+1.7%) and for soybean (+1.6%)

Release on Website

http://www.cropwatch.com.cn/



Clients of CropWatch

The monitoring result was delivered to:

- **State Council: E-government**
- **Ministry of Agriculture**
- **State Grain Administration**
- **State Development and Reform Commission**
- **Office of State Flood Control and Drought Relief Headquarters**
- **Ministry of Civil Affairs**
- **National Bureau of Statistics of China**
- **National Disaster Reduction Center of China**
- **Etc.**

Customization and technical services

Chinagrain® web
Information Center of MWR
Disaster relief center of MCA
5 provinces (Jilin, Hebei, Anhui, Chongqing, Heilongjiang)—supported by MWR

CropWatch ® Features

- **Remote sensing data are main data used**
- **Independent without using statistic data**
- **Automatic processing, only 3 full time staff**
- **Validation and uncertainty analysis carried out since 2001.**
- **Quality control schemas had been introduced**
- **Continuous operation from 1998**
- **Crucial information services to the central government**

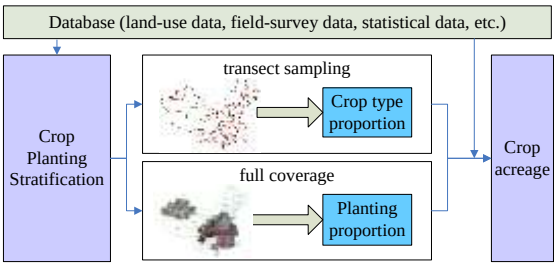
Crop Area Estimation In CropWatch

Complex Agricultural Landscapes

One important factor is the limited classification accuracy of crop types based on remote sensing data.

- Left is the Heilongjiang Province in Northeastern China;
- middle is the Shanxi Province in Northern China, at the
- right is Chongqing in Southwestern China

Crop Planting and Type Proportion(CPTP) Method



Acreage = area_arable * R1 * R2

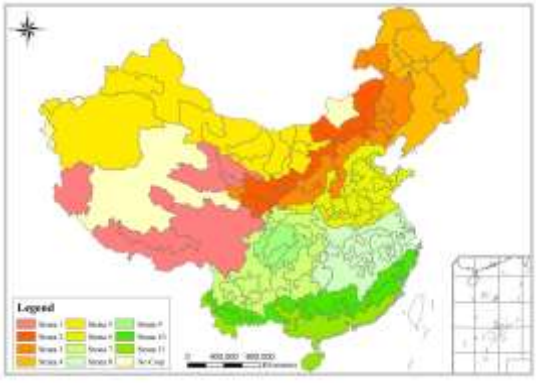
Where: Acreage: crop acreage
area_arable: area of arable land
R1: planted proportion on arable land
R2: percentage of certain crop type on planted arable land

Stratification

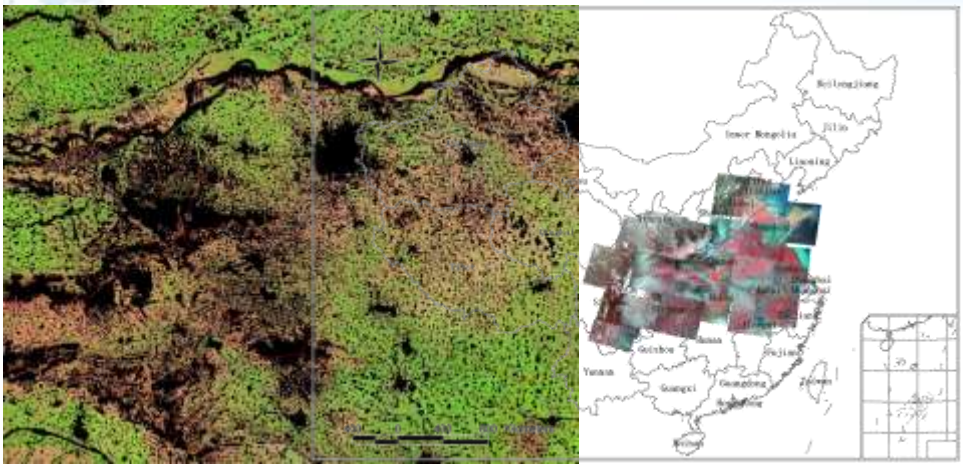
First : climate zoning
- **11 areas**

Second: Planting Structure
- **44 regions**

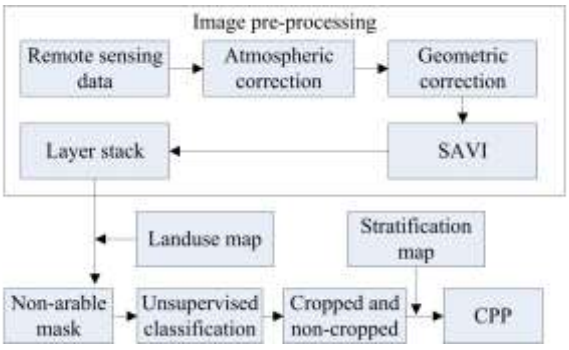
Third: Farming density
- **102 polygons**



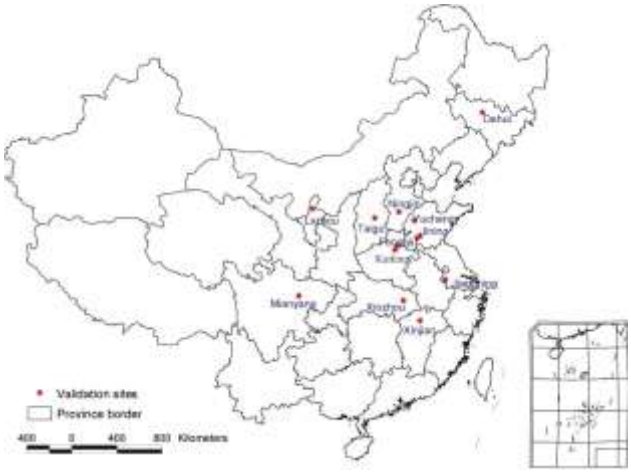
Crop planting proportion estimation—winter wheat, 2010



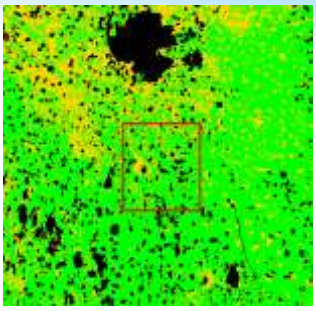
Crop Planting Proportion Extraction

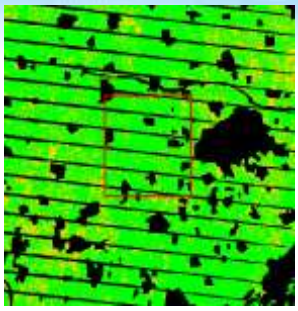


Validation Sites



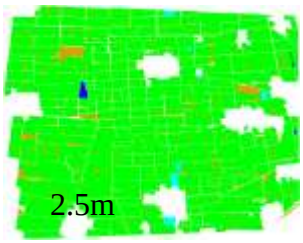
Crop planting proportion estimation—validation

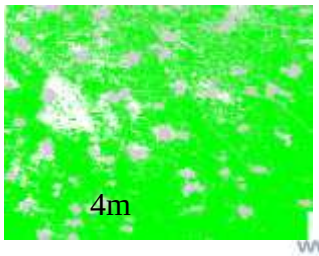




(A) Taigu fall-harvest crop area in 2003

(B) Kaifeng Summer-harvest crop area in 2001



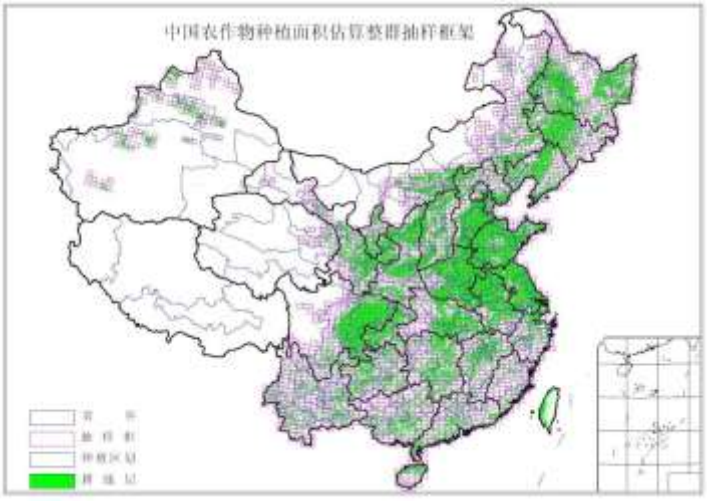


Crop planting proportion estimation—validation

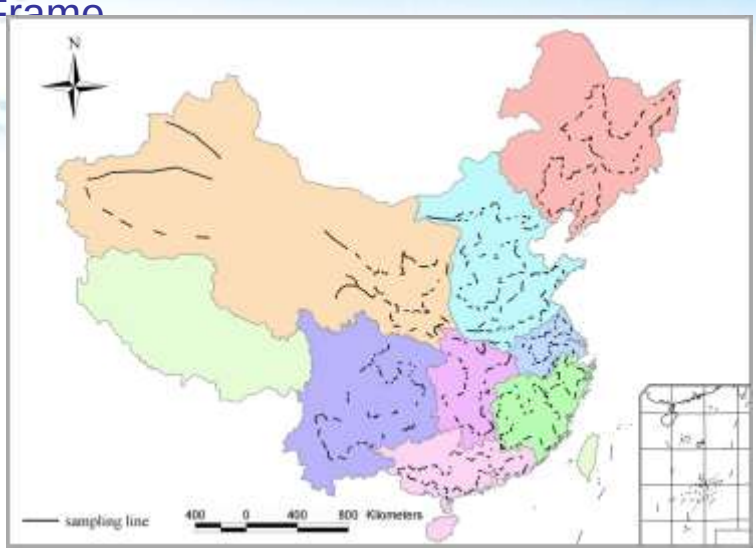
Crop proportion accuracy assessment for the two test area

Items	kaifeng	Taigu
Planting area with Landsat TM	101272	25062
Arable land from landuse map (1:100000)	142613	28214
Planting proportion from Landsat TM	0.7101	0.8883
Planting area with IKONOS/Quickbird	122052	23508
Arable land from IKONOS/Quickbird	169880	27067
Planting proportion from IKONOS/Quickbird	0.7185	0.8685
Error	-0.43%	2.28%

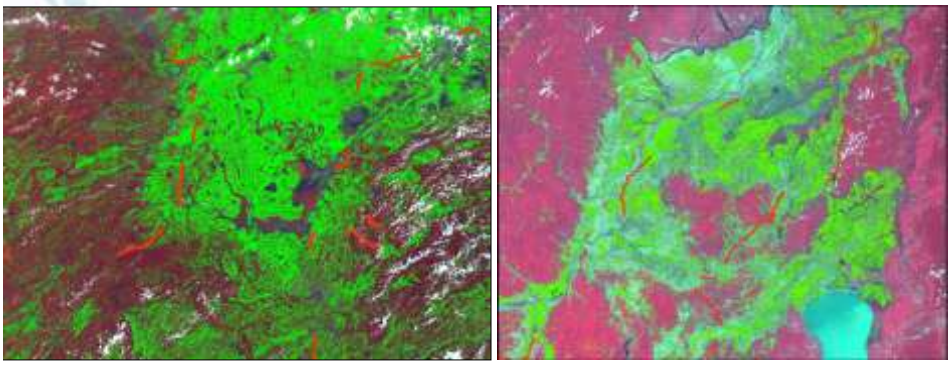
Regional sampling frame



Crop Types Proporation Sampling Frame



Sampling Segments



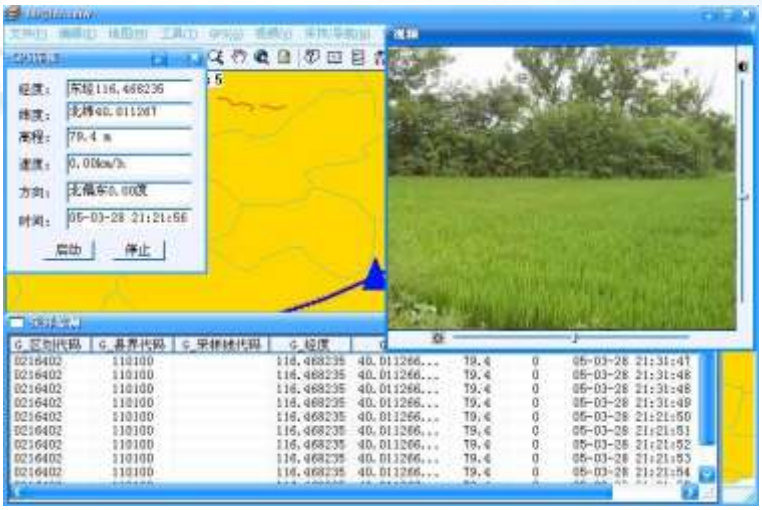
Background : IRS P6 image
Green region : planted area of arble land
Red line : GVG sampling line

GVG field sampling system

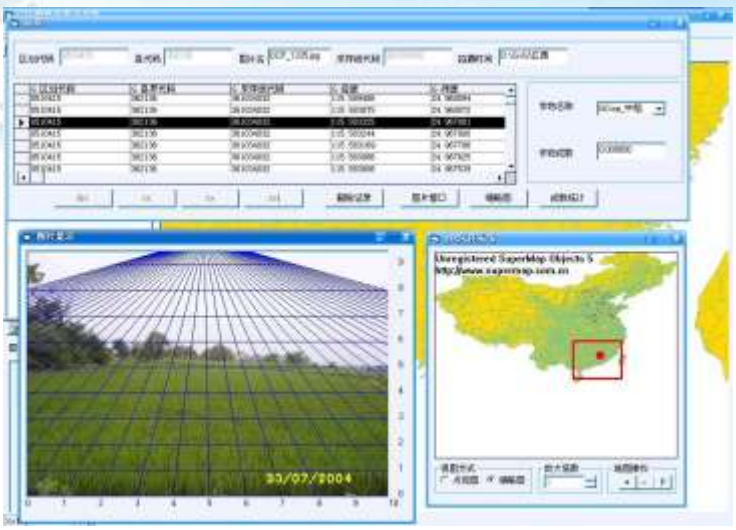
For acquiring the real-time crop types proportion

GVG field sampling system--Hardware System

GVG field sampling system--Sampling

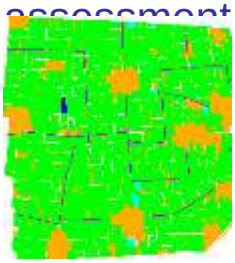


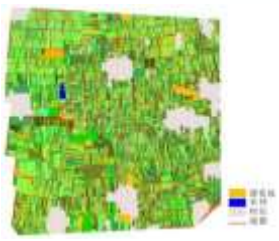
GVG field sampling system--Interpretation



GVG field sampling system--Crop Type Proportion Calculation

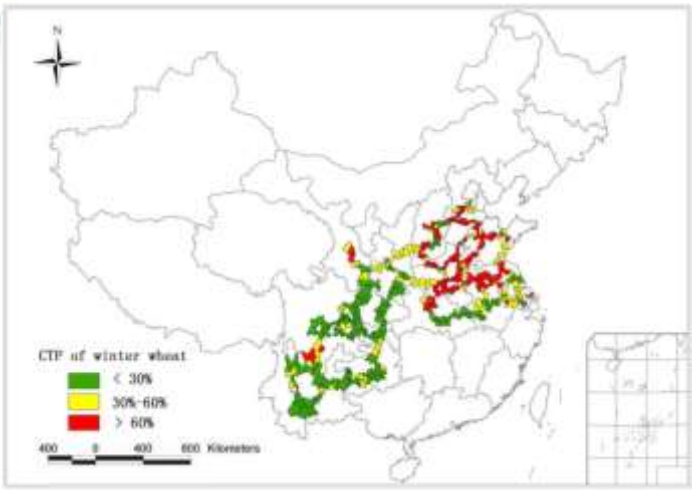
Crop type proportion accuracy assessment





Crops	GVG(%)	Field mapping (%)	Error(%)
Corn	31.24	30.24	3.31
Vegetable	20.61	19.29	6.84
Soya Bean	19.86	19.29	2.95
Idle land	4.24	4.14	2.42
Durra	3.28	3.11	5.47
Sun flower	2.11	1.86	13.44

Sampling line for 2010 Winter Wheat



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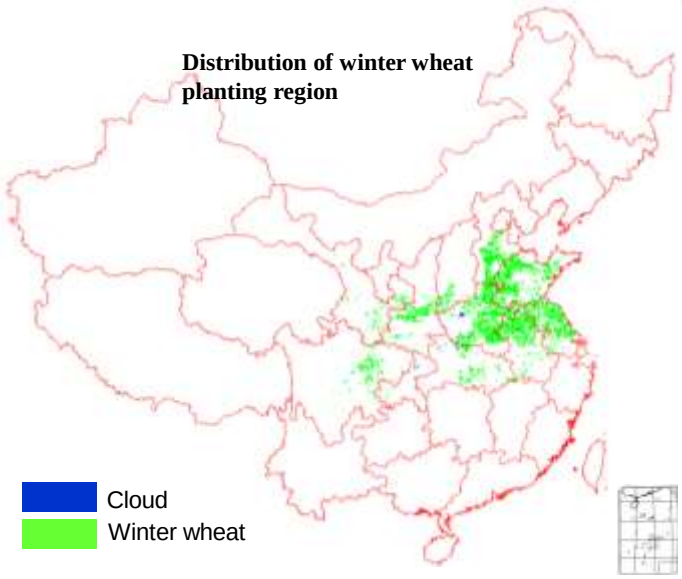
Recent results

Distribution of winter wheat planting region



Winter wheat acreage of China and each province

Units: Area: 1000ha

Region	2011	2012	%
全国	24,349.59	24,454.62	0.43
河北省	2,302.66	2,305.18	0.11
山西省	635.32	641.66	1.00
江苏省	1,949.19	1,951.21	0.10
安徽省	2,258.06	2,269.29	0.50
山东省	4,270.61	4,298.18	0.65
河南省	5,395.34	5,426.43	0.58
湖北省	769.86	778.73	1.15
重庆市	447.88	443.74	-0.92
四川省	1,686.58	1,678.69	-0.47
陕西省	730.31	747.54	2.36
甘肃省	606.96	602.92	-0.67

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CPTP Method

- RE of crop acreage estimation will be 4.09%.
- The method makes fully use of the benefits of remote sensing.
  - CPP is obtained by segmenting cropped and non-cropped areas
  - CTP is acquired by ground survey with the GVG instrument and transect sampling.
- The method meets the time requirement of operational dominant crop acreage estimation at large areas.
- The method is also affordable.
- This method can be used both for large areas as well as for smaller regions.
- But the method can only be used inside country.

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Thanks!

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