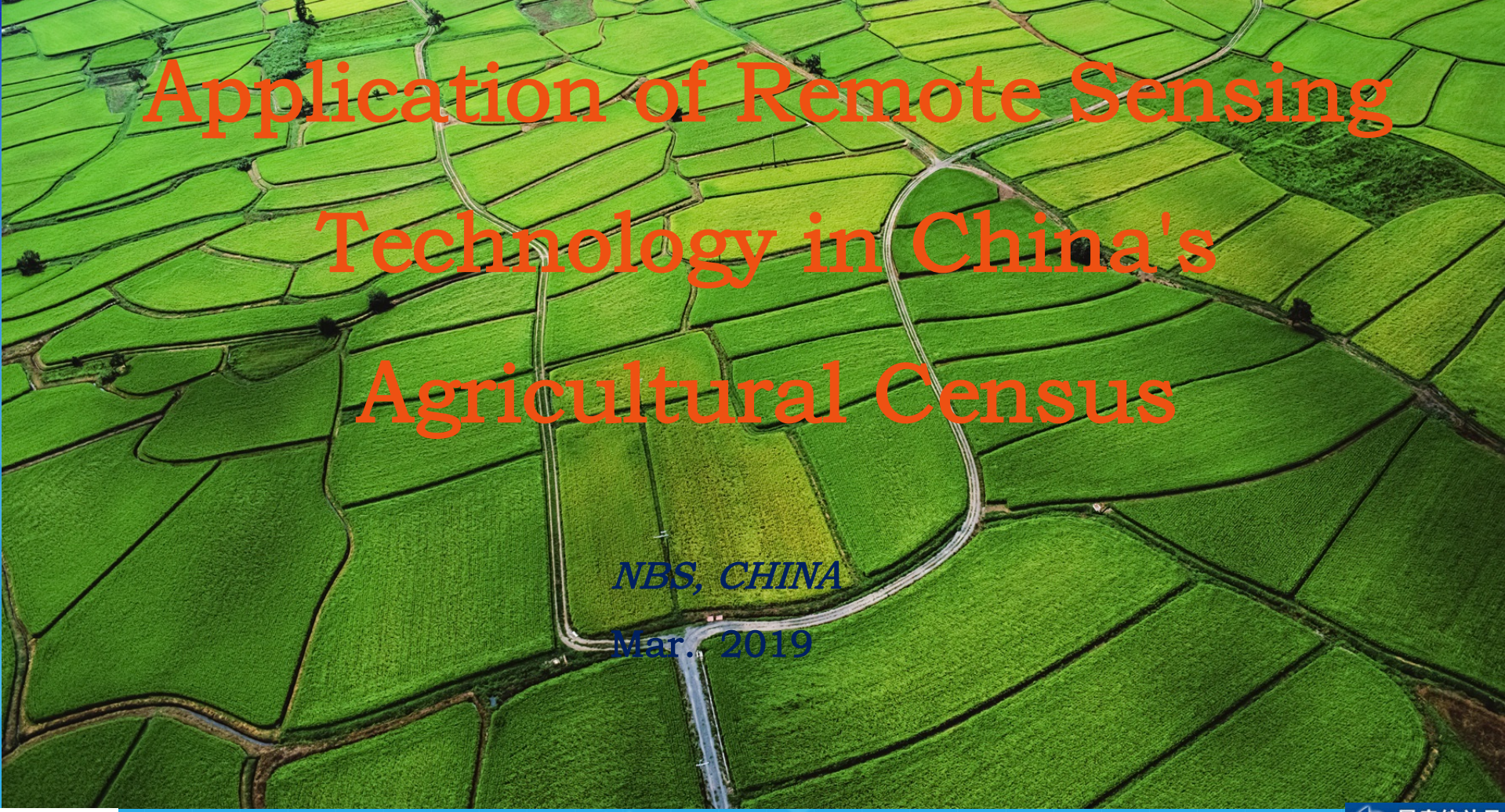
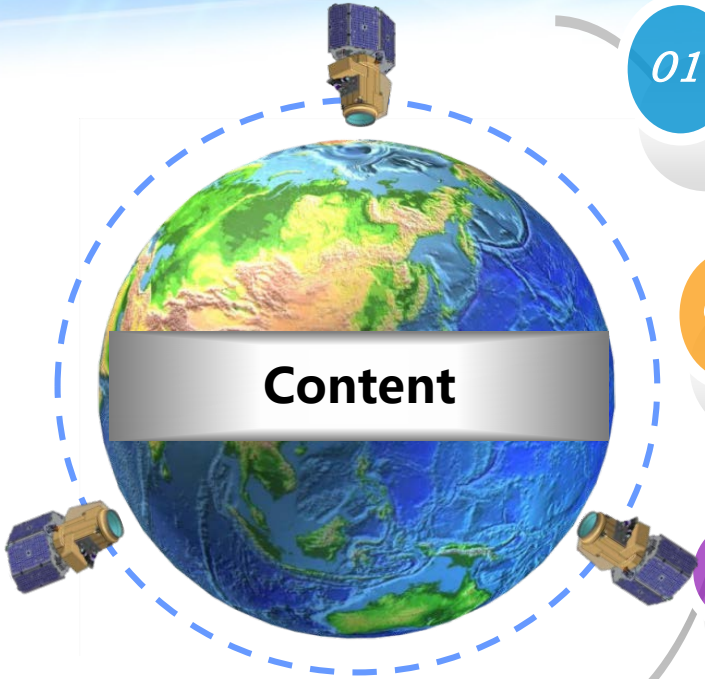


Application of Remote Sensing Technology in China's Agricultural Census

NBS, CHINA

Mar., 2019



1.Major achievements in the application of remote sensing technology

1.1 For the first time, the cultivated land for statistical investigation was established.

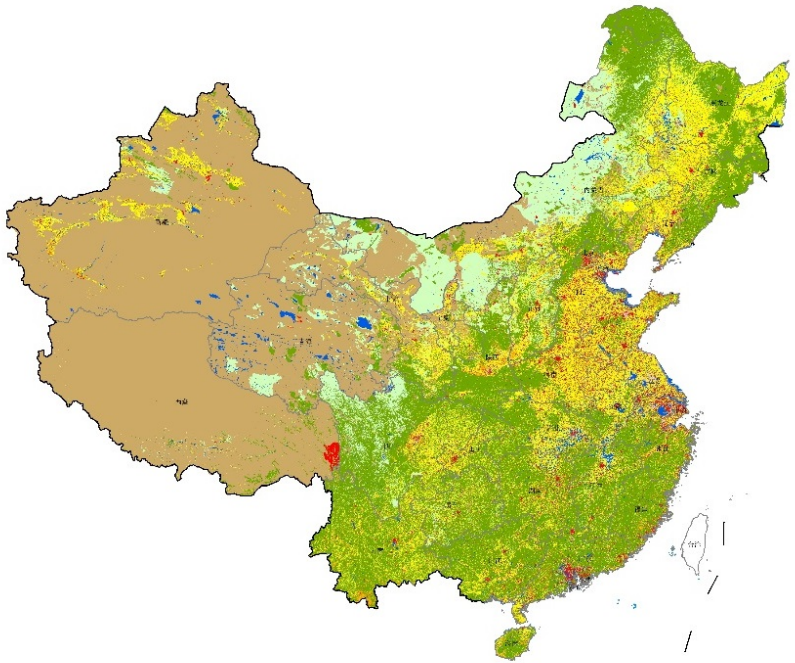
The survey has covered 35 million arable land plots in crop growing areas in 31 provinces (autonomous regions and municipalities directly under the central government, except Hong Kong, Macao and Taiwan).

1. Major achievements in the application of remote sensing technology

1.2 It is the first time to establish the foundation of sampling survey on the spot.

A total of 22,000 sampling census areas were established in 30 provinces (autonomous regions and municipalities directly under the central government, except Tibet, Hong Kong, Macao and Taiwan), and more than 100,000 samples were used.

全国农作物种植及其相关地类空间分布图



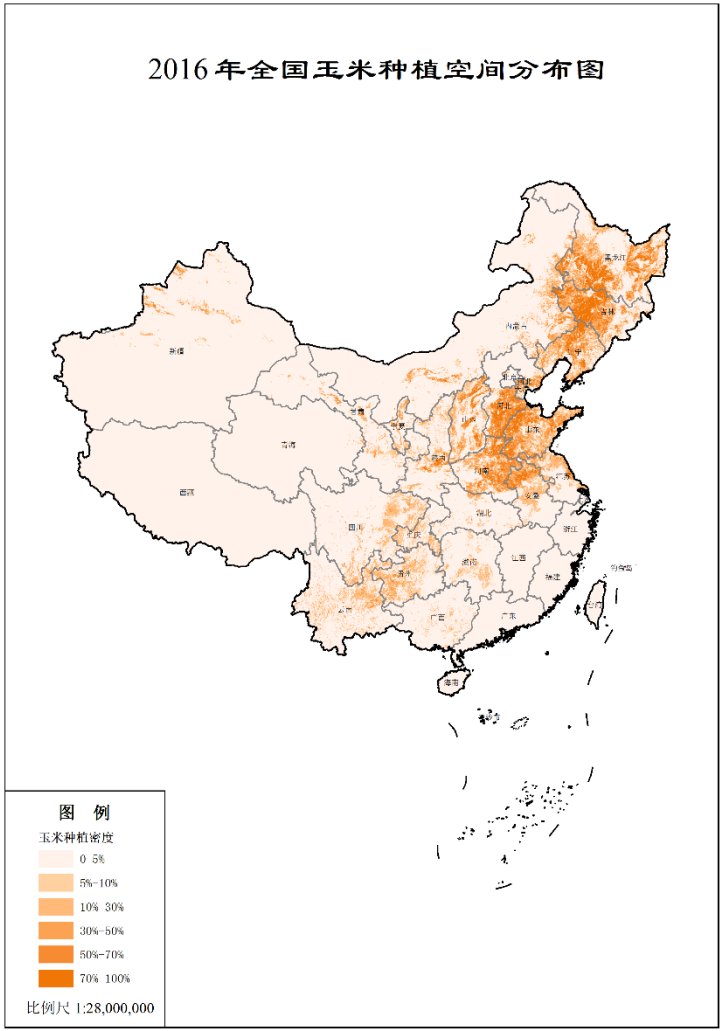
全国农作物面积遥感抽中普查区分布

1. Major achievements in the application of remote sensing technology

1.3 Find out the spatial distribution of major crops in China.

The distribution of major crops in 30 provinces (autonomous regions and municipalities directly under the central government, except Tibet, Hong Kong, Macao and Taiwan) was measured.

1.4 The area measurements were published as census results.


2016年全国玉米种植空间分布图
图 例
玉米种植密度
0 5%
5%-10%
10% 30%
30%-50%
50%-70%
70% 100%
比例尺 1:28,000,000

2. The historical background of remote sensing measurement

2.1 Challenges

The household survey

① The stability of the respondents declined

② Dishonest and inaccurate answers

③ The structure of agriculture is changing

2.2 Solusions

Remote sensing and ground survey

① Survey subjects are stable and immovable

② What you see is what you get

③ Macro changes are reflected quickly

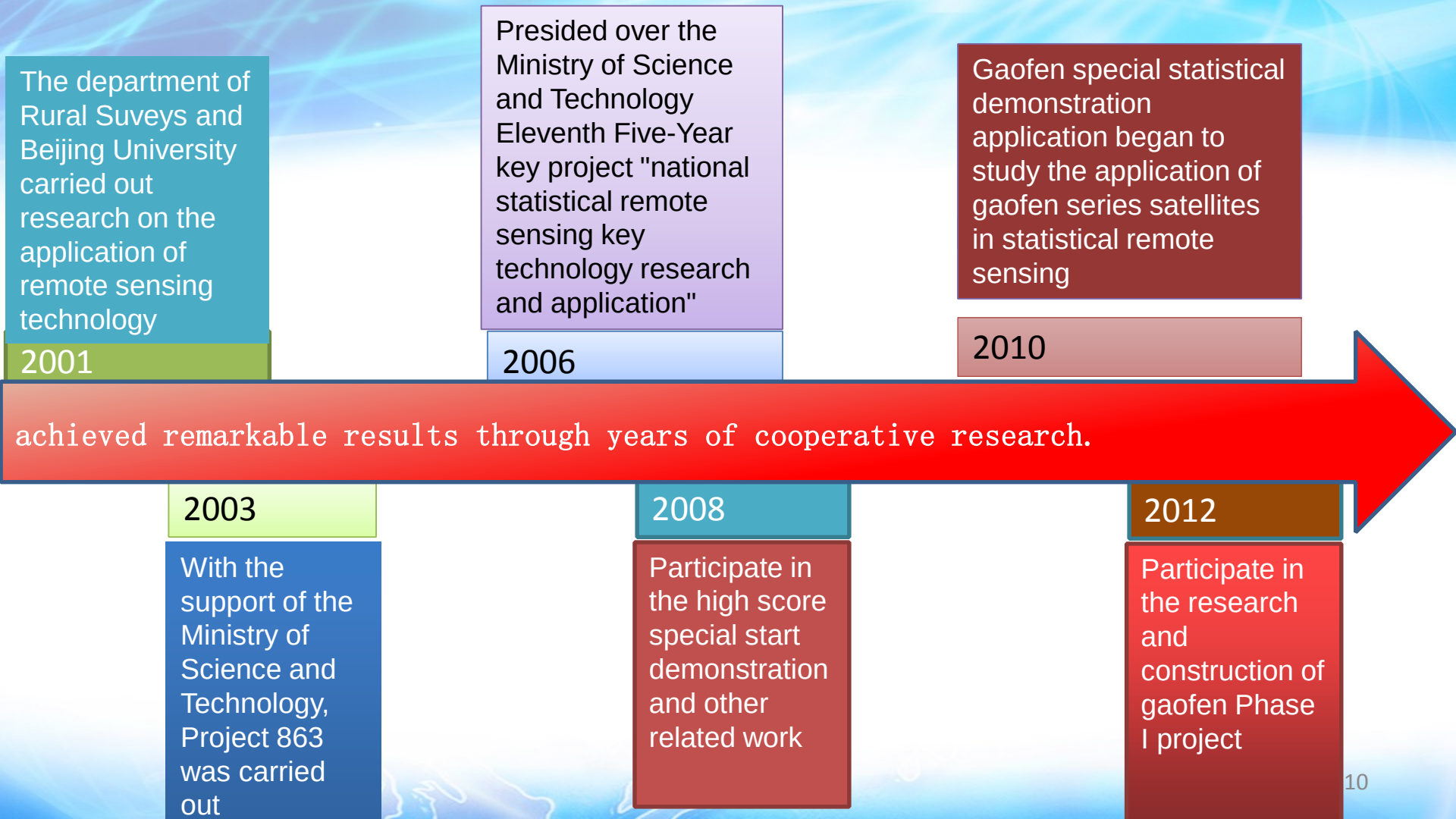
2. The historical background of remote sensing measurement

2.3 Opportunities (the Third National Agricultural Census)

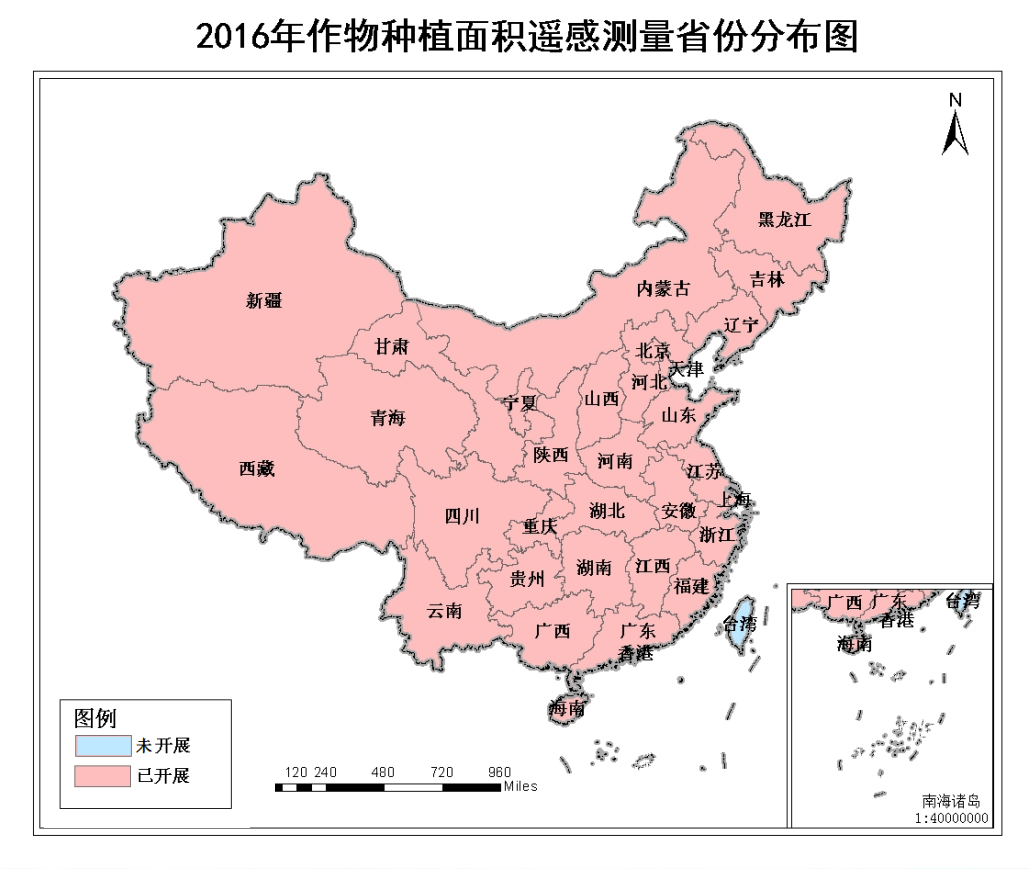
- Funding for remote sensing survey is guaranteed.
  A large proportion of the funds for remote sensing of crop area are included in the general survey.

- A large number of investigators were deployed.
  More than 50,000 field investigators.

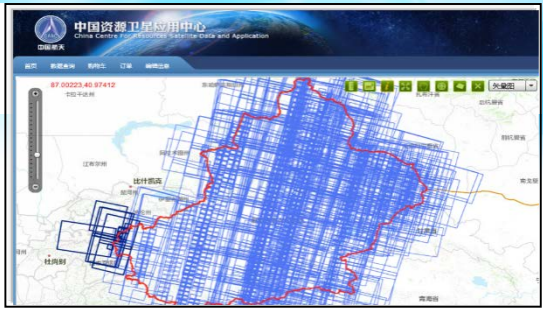
- Technical support is guaranteed.


The department of Rural Suveys and Beijing University carried out research on the application of remote sensing technology
2001
Presided over the Ministry of Science and Technology Eleventh Five-Year key project "national statistical remote sensing key technology research and application"
2006
Gaofen special statistical demonstration application began to study the application of gaofen series satellites in statistical remote sensing
2010
achieved remarkable results through years of cooperative research.
2003
With the support of the Ministry of Science and Technology, Project 863 was carried out
2008
Participate in the high score special start demonstration and other related work
2012
Participate in the research and construction of gaofen Phase I project

We carried out trials of regional applications for many years

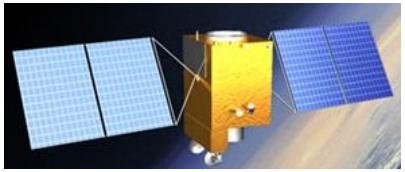


2. The historical background of remote sensing



- Remote sensing image data is guaranteed

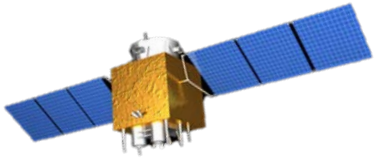
Sub-meter level remote sensing image data



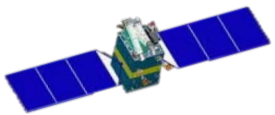
GAOFEN 2

BEIJING 2

Meter level remote sensing image data

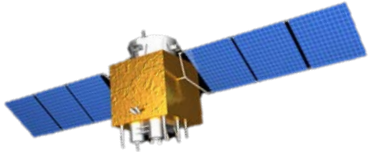


GAOFEN 12m/8m

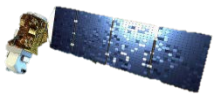


RESOURCE 3 TIANHUI 1

Medium resolution remote sensing image data



GAOFEN1 16m

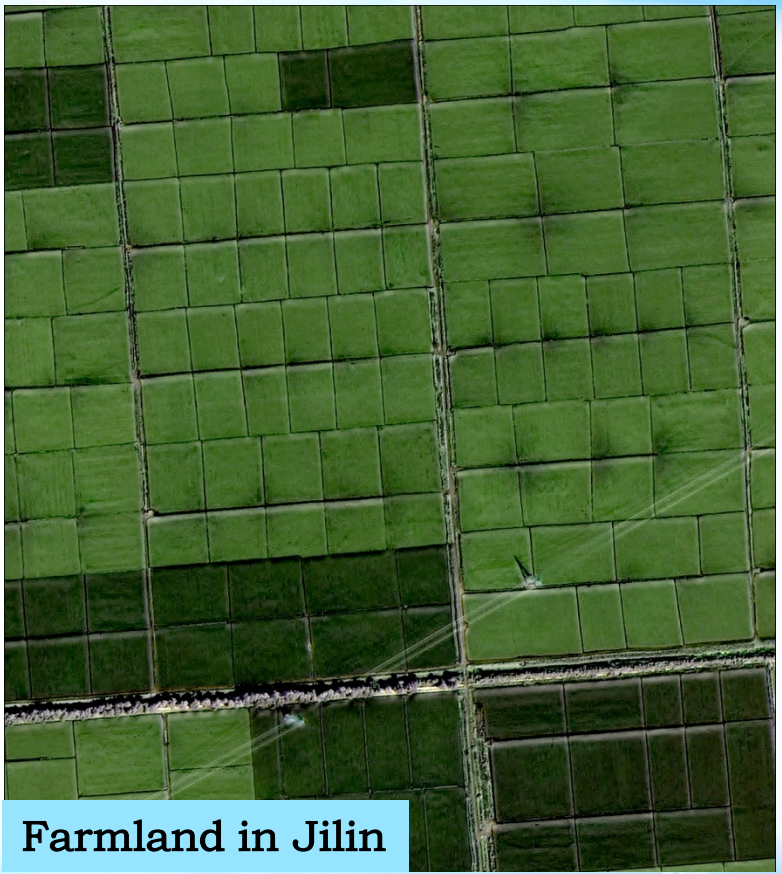


Landsat8

Others

Gaofen-2 satellite image data

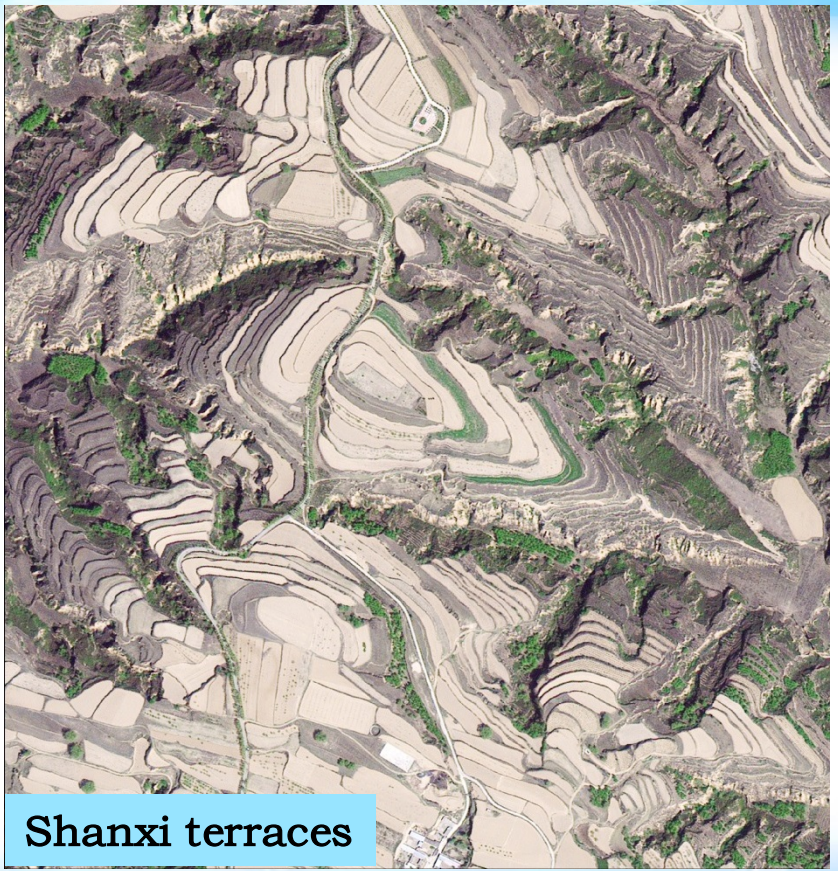
Irrigation farmland in Inner Mongolia



Farmland in Jilin

Beijing II satellite image data

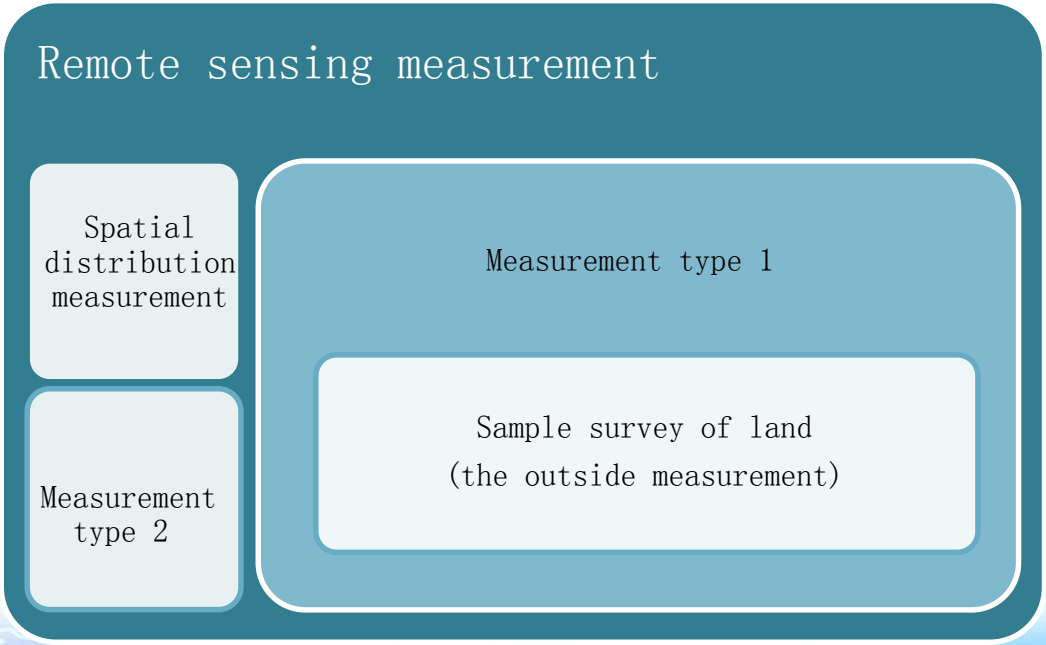
Hunan rape flower



Shanxi terraces

3.1 Remote sensing measurement design

Ground sampling survey + remote sensing measurement



3.2 Work Organization

Under the unified coordination of the NBS, the remote sensing survey of major crops shall be organized and carried out by the Survey Offices of NBS. The third-party data quality audit unit shall provide professional data quality audit services.

The Survey Offices at the county level shall undertake the field investigation of remote sensing surveying of crop areas in key counties to ensure the successful completion of the tasks of remote sensing survey.

3.Design, organization and implementation of remote sensing measurement

(Ⅰ)Basic data preparation — NBS

(Ⅱ)Measurement of spatial distribution of major crops
(Ⅲ)Measurement type 1
(Ⅳ)Measurement type 2
— Survey Offices (partly by NBS)

(Ⅴ)Field survey — Provincial, municipal and county survey systems

(Ⅵ)provincial, key county measurement results
(Ⅶ)Post enumeration survey
(Ⅷ)Precision evaluation of measurement results
(Ⅸ)Archive and display results
— NBS, Survey Offices at provincal level

3.3 Implement

- Field survey

(Ⅰ)Respondent

Field investigation was conducted to obtain the information of ground features in each natural plot of the quadrate land (every complete natural plot intersecting with the quadrate) in each sampling village, including plots for planting crops and all plots covering other ground features (buildings, rivers, woodlands, etc.). Fill in the “field survey form for remote sensing of crop area” and take photos of ground objects as required.

3.Design, organization and implementation of remote sensing measurement

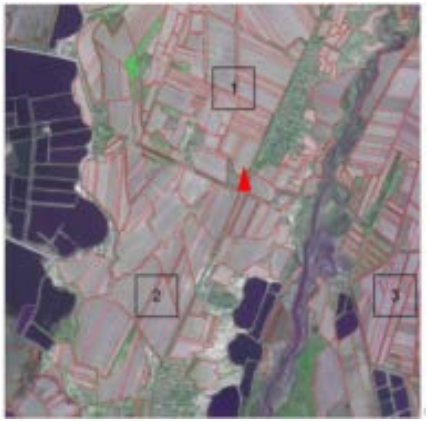
(Ⅱ)Preparation

PDA	Field survey forms	Car	Other equipment
 PDA  电源线、备用电池等其他设备	 调查图表	 车辆	 皮尺  蓝、黑签字笔 黄色彩笔

3.Design, organization and implementation of remote sensing measurement

(Ⅲ)Field survey

Site plot search

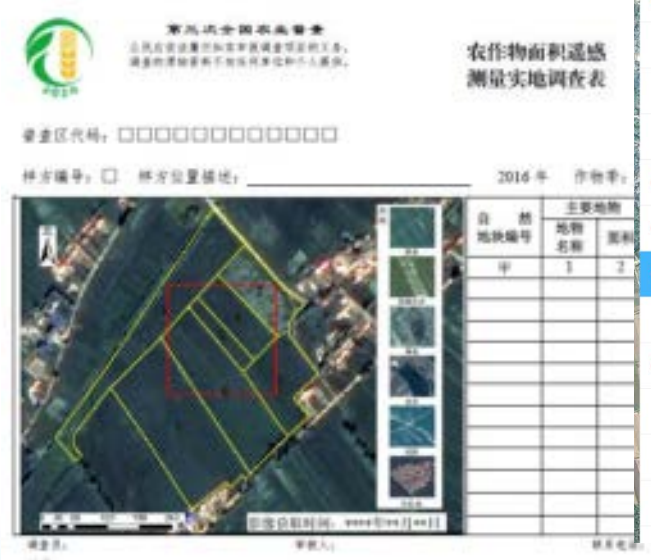


Navigate to plot using PDA

Combined with the surrounding landscape pattern,verify proper plot location

3.Design, organization and implementation of remote sensing measurement

Fill in the crop information



- Survey times of crops including autumn and winter sowing, spring sowing and summer sowing
- Interplanting (interplanting refers to that the second crop has been planted when the main crop is not harvested, and the intercrossing of the growth cycle does not exceed 1/3 of the time, but the main crop is basically covered)
- intercropping
- including ground objects occupying a small proportion or in a small area
- Other odds and ends
- Plots with more than three land features (only two are filled in the table, PDA supports more than three crops)

3.Design, organization and implementation of remote sensing measurement

Main feature types

一级分类	代码	二级分类	别名（通俗用名）
100 农作物	120	棉花	
	121	花生	
	122	油菜籽	油菜花，冬油菜籽
	123	芝麻	
	124	胡麻籽	
	125	向日葵籽	葵花子、瓜子、油葵
	126	其他油料	
	127	黄红麻	
	128	兰麻	
	129	大麻（线麻）	
	130	亚麻	
	131	其他麻类	
	132	甘蔗	
	133	甜菜	
	134	烤烟	
	135	其他烟叶	
	136	药材	
	137	蔬菜（含菜用瓜）	
	138	番茄	西红柿
	139	食用菌	

3.Design, organization and implementation of remote sensing measurement

Photo the plot

Use the investigation of special software programs to take the picture of the main types of objects

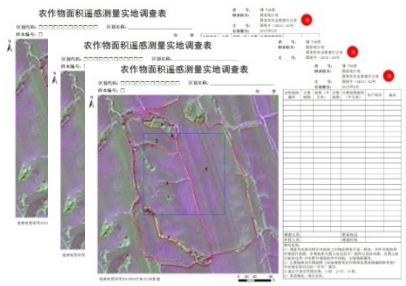
• Take at least 3 photos for each sample square, one of the main ones take at least one photo.

• Each natural plot is not over 1, a kind of square is not more than 10.

Take pictures

3.Design, organization and implementation of remote sensing measurement

(Ⅳ)Results

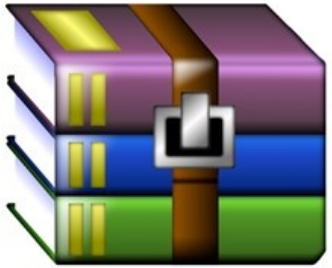


Paper survey chart photos

Software for survey

Field photos

Electronic recording table

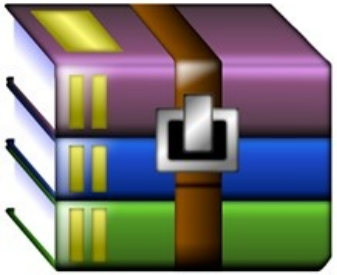


XXcityXXcounty field results.rar

Packing

3.Design, organization and implementation of remote sensing measurement

(V)Report

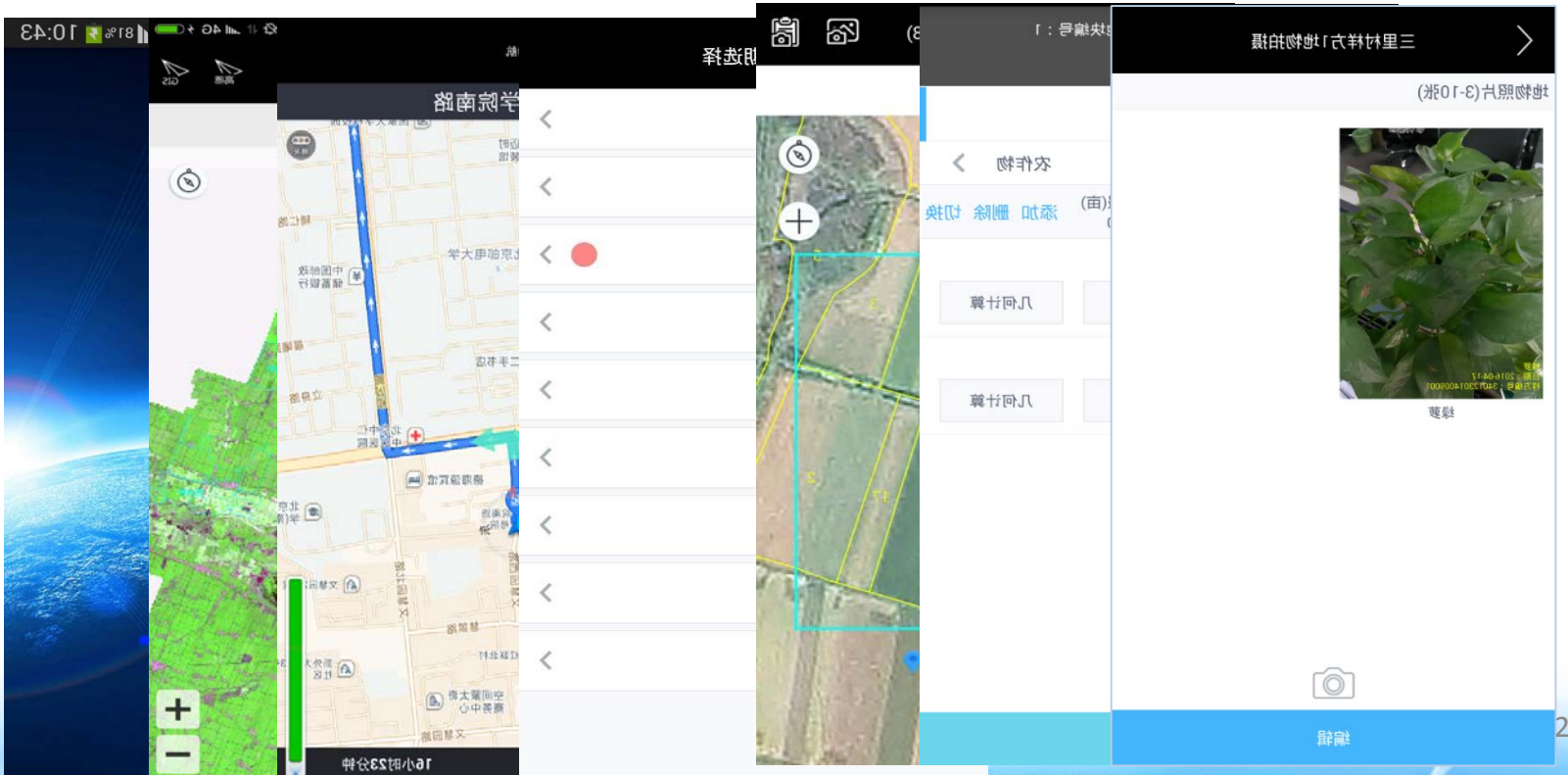


XXcityXXcounty field results.rar

Report content

3.Design, organization and implementation of remote sensing measurement

Field survey of software operations

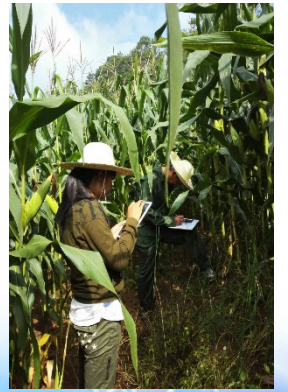








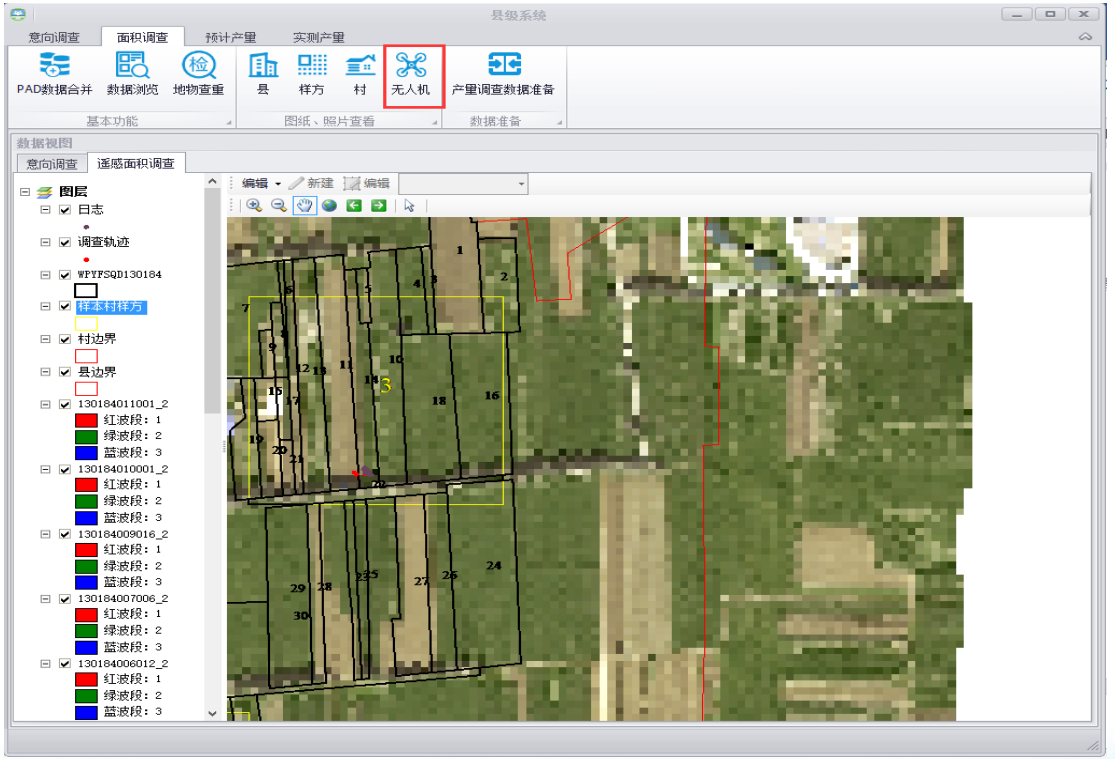





Field survey

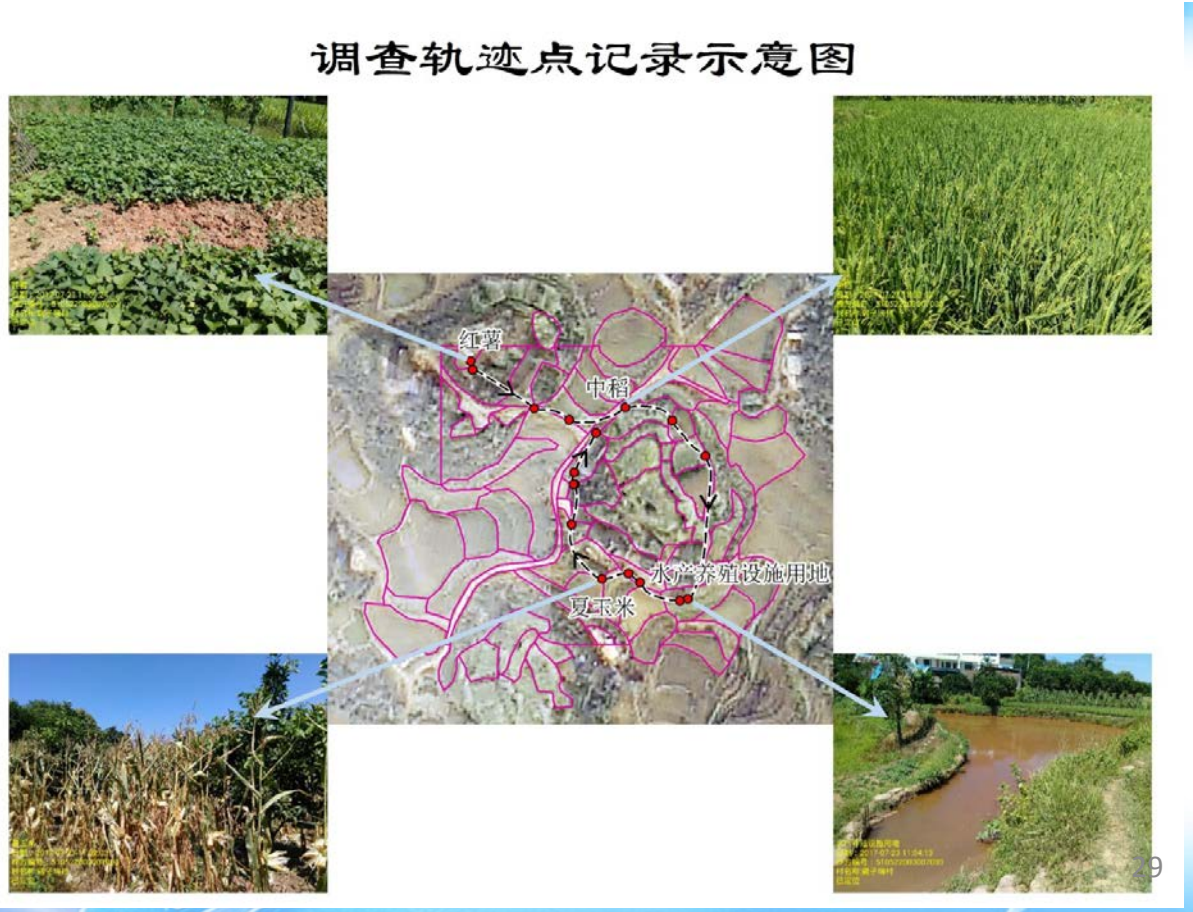
3.Design, organization and implementation of remote sensing measurement

Unmanned aerial vehicle



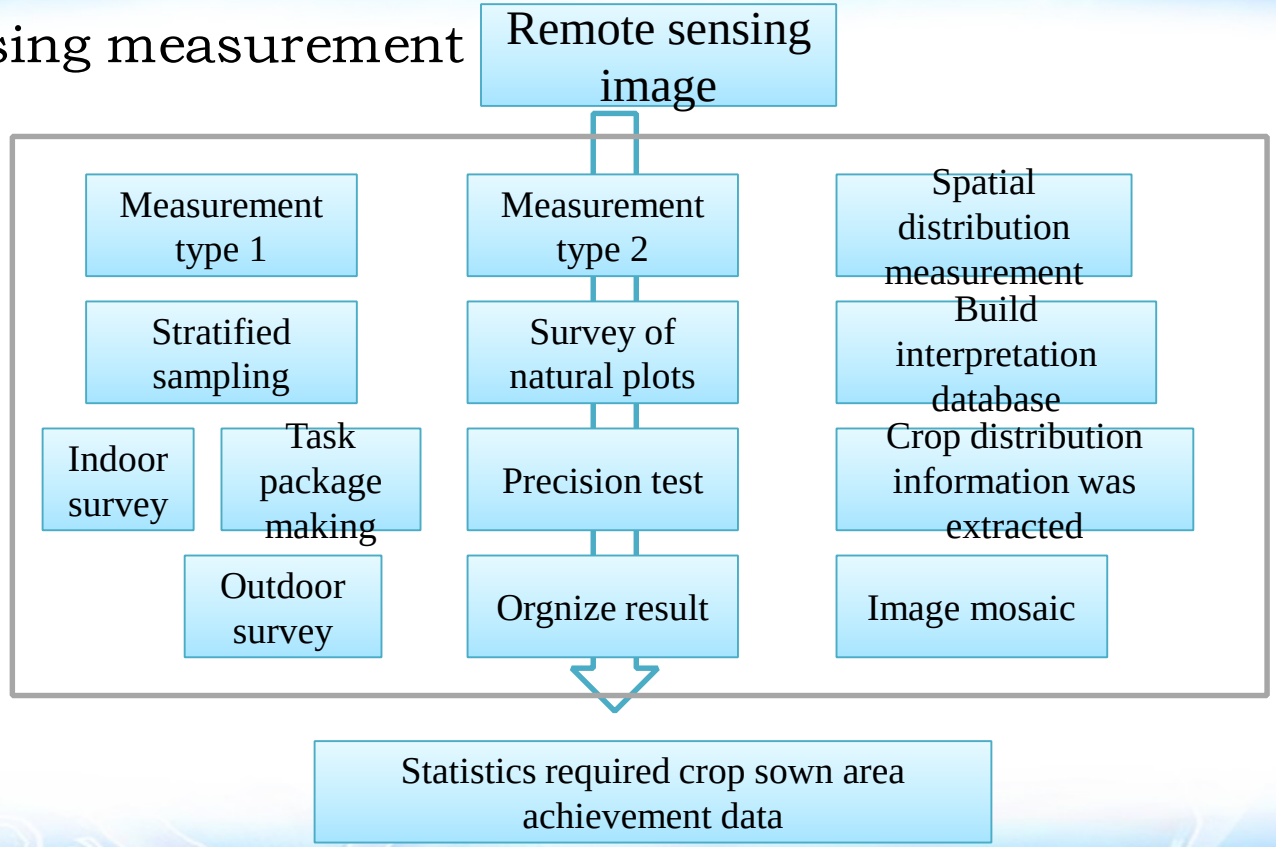
3.Design, organization and implementation of remote sensing measurement

(Ⅵ)Post survey



3.Design, organization and implementation of remote sensing measurement

- Remote sensing measurement



3.Design, organization and implementation of remote sensing measurement

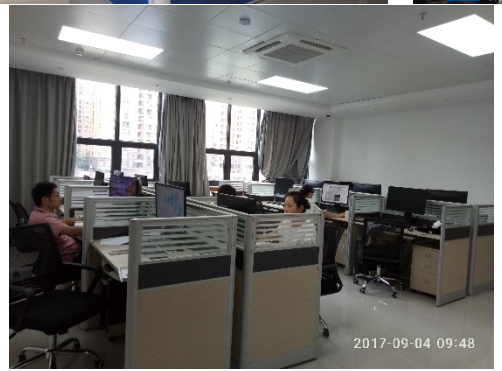
- Hardware and software construction

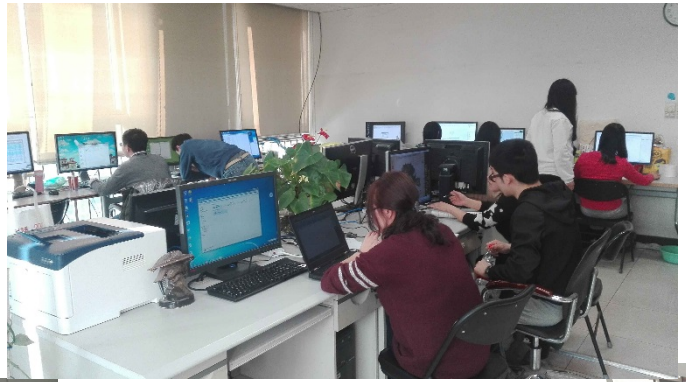
Indoor work

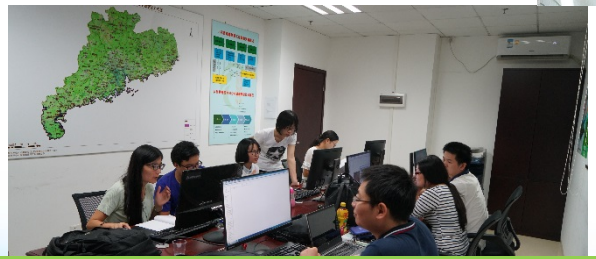
High-performance graphics workstation
Disk array
switches
The server
Professional remote sensing geographic information software

Outdoor work

Field PDA
Drones (more than 400)
Survey vehicle (22 sets)
Field research APP
Remote sensing measurement software system







Construction of national remote sensing studio

3.Design, organization and implementation of remote sensing measurement

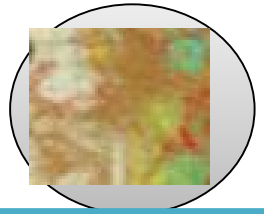
- Conduct measurement

Type 1/Type 2 measurement		Spatial distribution measurement
Identification subject - person: 1.Plot boundaries and cropplanting boundaries according to image display features. 2.Distinguish the ground objects on the plots drawn and assign values to their attributes.	identification	Identification subject - machine: 1.Spatial geographic information of all plots. 2.The machine is trained to automatically identify the crop distribution in the image by establishing the interpretation database.

3.Design, organization and implementation of remote sensing measurement

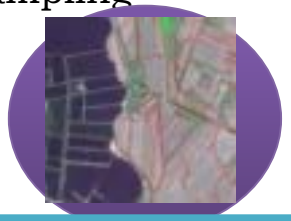
- Spatial distribution measurement

Multi-resolution remote sensing image efficient utilization method based on statistical sampling



Medium resolution data

- Large area observation
- Fast data processing
- Most of the free
- Low resolution is difficult to meet the needs of business investigation



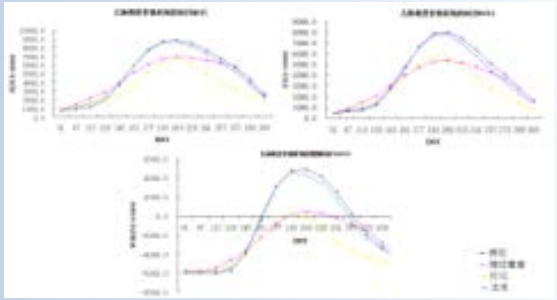
High resolution data

- It is difficult to achieve a large area of full coverage in a short period
- Data processing is time-consuming and laborious
- Higher purchase cost
- High resolution can meet the needs of business investigation

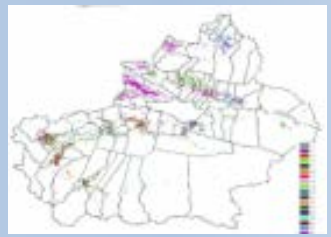
3.Design, organization and implementation of remote sensing measurement

Survey plot

Planting area division



Database of major crop samples



results

Example: cotton measurement in Xinjiang

3.Design, organization and implementation of remote sensing measurement

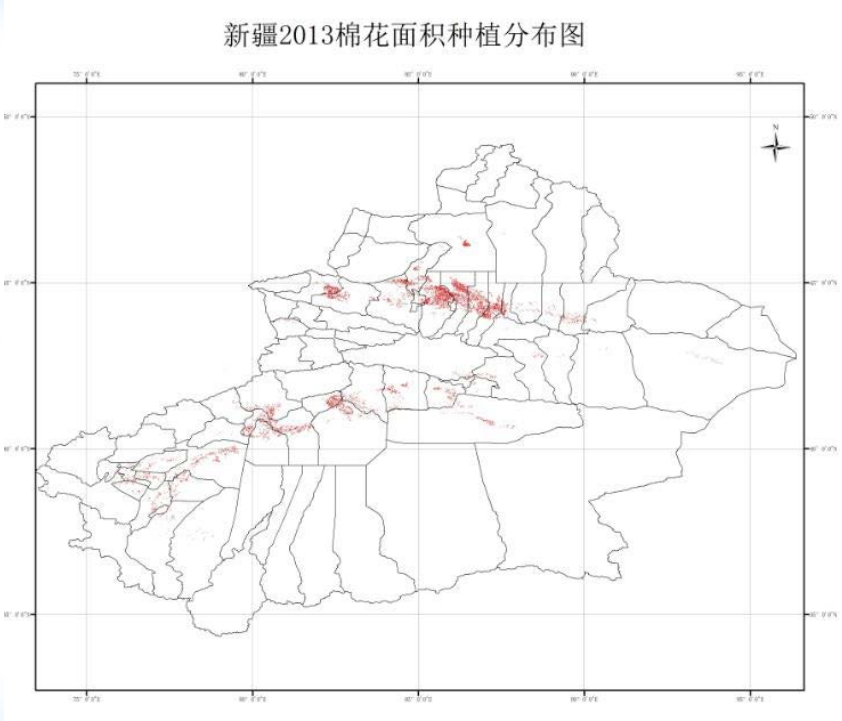


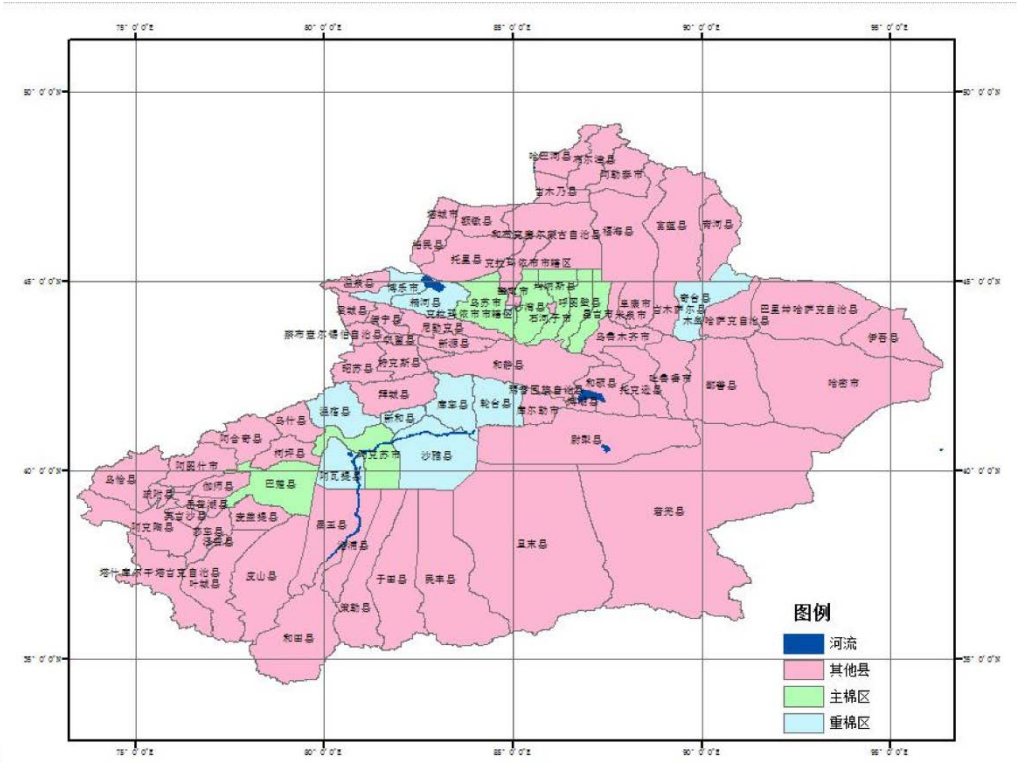
表 5-1 2013 年遥感估算新疆各县棉花面积情况

县名	面积（亩）	全县百分比
乌鲁木齐市	101668	0.51%
米泉市	300562	1.51%
克拉玛依市市辖区	533787	2.68%
克拉玛依市市辖区	0	0.00%
吐鲁番市	21241	0.11%
鄯善县	12577	0.06%
托克逊县	76549	0.38%
哈密市	0	0.00%
巴里坤哈萨克自治县	0	0.00%
伊吾县	0	0.00%

In 2013, cotton area was extracted from the collected 90-scene remote sensing data by using the remote sensing extraction method of middle-resolution cotton in Xinjiang.

3.Design, organization and implementation of remote sensing measurement

Cotton planting area proportion (%) of the whole province's planting area	Cotton regional ization
More than 4 % (Pale blue)	import planting area
2-4% (green)	normal planting area
0.1%-2% (pink)	less planting area



3.Design, organization and implementation of remote sensing measurement

- Measurement type 1

A. number of measurements

The three crop seasons of autumn and winter sowing, spring sowing and summer sowing were measured.

B. Requirements for image spatial resolution and phase timing

0.5-1m for the basic image, and about 2m for the current situation of 2-3 phases of each measurement season (in the current season).

C. measure crop types

Wheat, corn, rice, soybean, cotton and important provincial crops.

3.Design, organization and implementation of remote sensing measurement

- Measurement type 1

D. Measurement accuracy requirements

Area accuracy: better than 98%.

Ground object type accuracy: better than 98%.

3.Design, organization and implementation of remote sensing measurement

- Measurement type 1

Crop interpretation markers are established

水稻

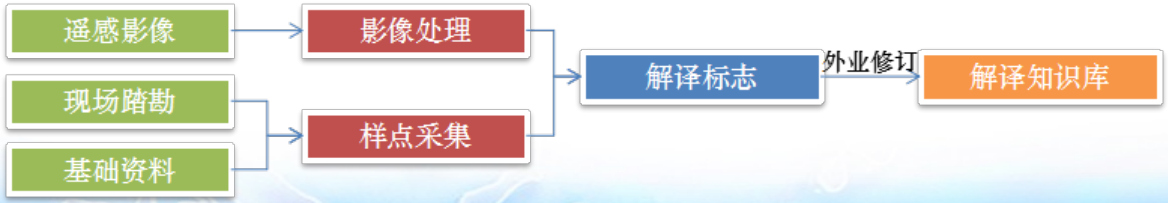
4月			5月			6月			7月		
上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬
播种	出苗	三叶	移栽	返青	分蘖		拔节	孕穗	抽穗	乳熟	成熟

小麦

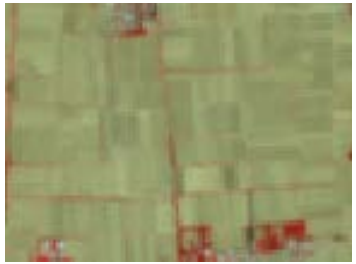
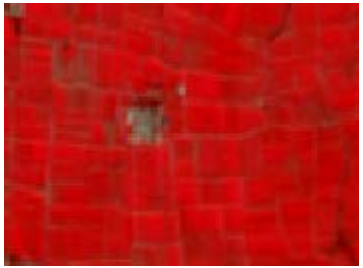
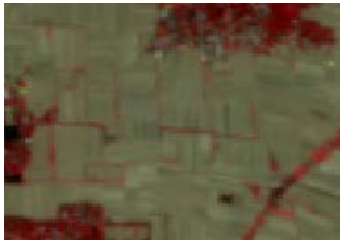
10月			11月			12月			1月	2月			3月			4月			5月			6月	
上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬	全月	上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬
播种	出苗		分蘖			越冬							返青			拔节	抽穗开花		成熟				

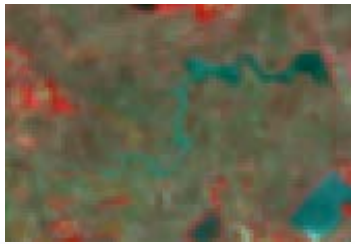
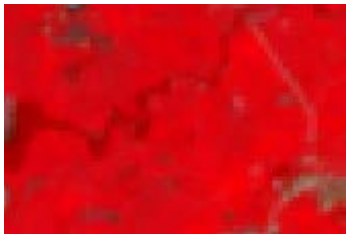
玉米

6月		7月			8月			9月		
中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬	上旬	中旬	下旬
出苗	七叶	拔节			抽雄			灌浆乳熟.		成熟



3.Design, organization and implementation of remote sensing measurement

	6 月	7 月	8 月	10 月
玉米				
	裸地	植被信息	红色	裸地

	5 月	6 月	8 月	9 月
中稻				
	暗色裸地	红色	红色	裸地

3.Design, organization and implementation of remote sensing measurement

- Measurement type 2

A. number of measurements

Once a year.

B. Image spatial resolution: about 2m.

C. Measuring ground object type

Crop, horticultural fruit tree, meadow, establishment agriculture 9 kinds.

D. Measurement accuracy requirements

Area accuracy: better than 98%.

Ground object type accuracy: better than 98%.

3.Design, organization and implementation of remote sensing measurement

- Measurement type 2

Nine broad categories of interpretation marks

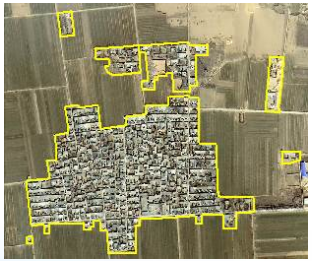
Crops

Gardening

Forest

Grassland

Water area



Building

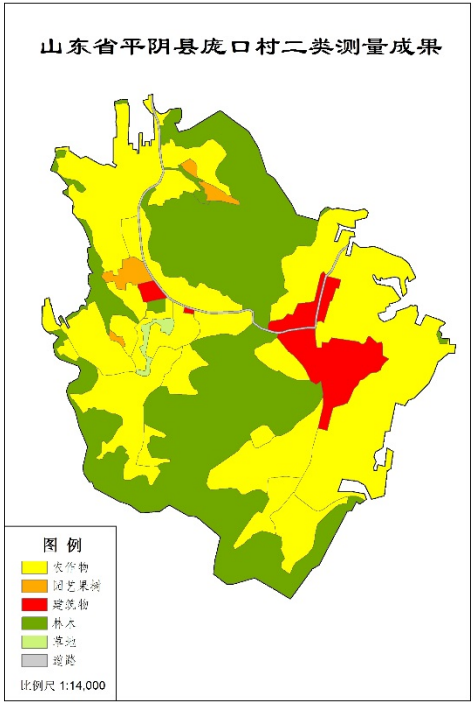
Roads

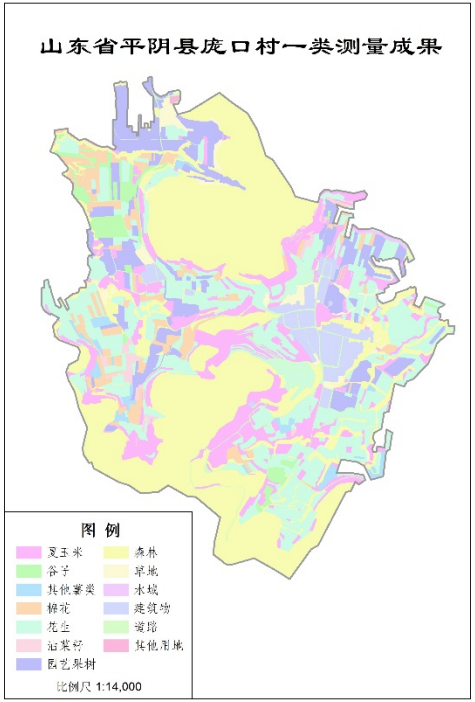
Others

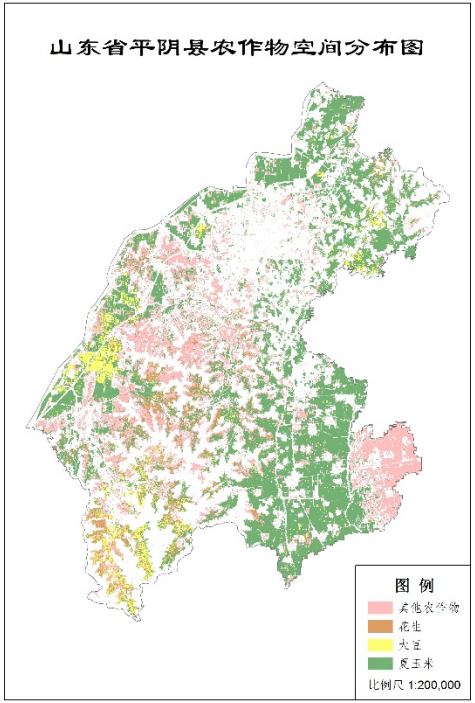
Facility agricultural land

3.Design, organization and implementation of remote sensing measurement

- Results





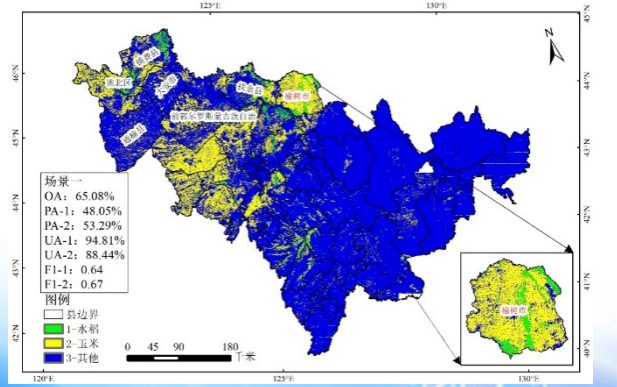


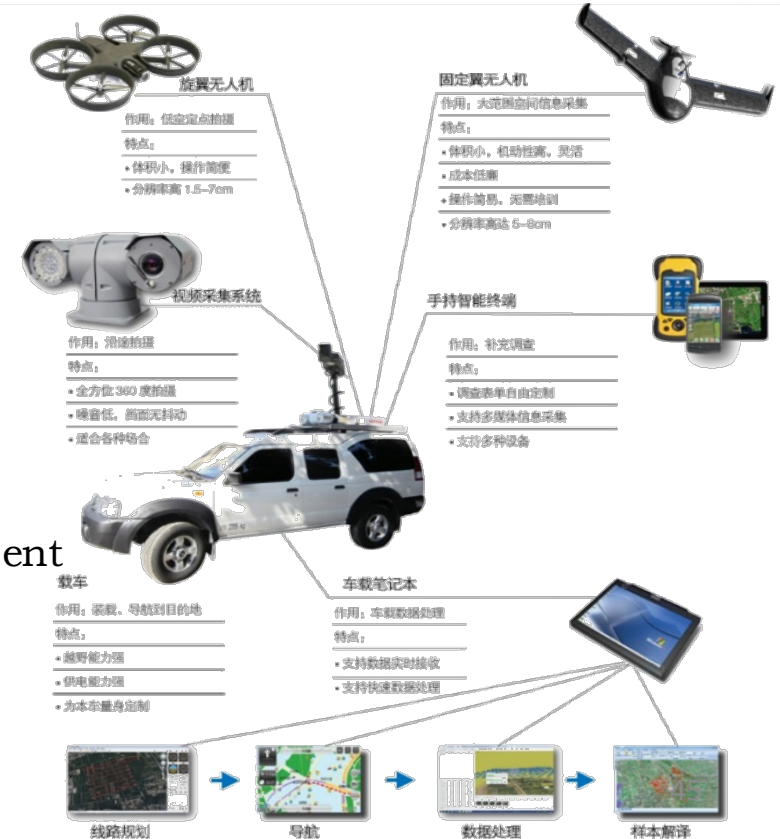
4. Application progress since agricultural census

4.1 The integrated investigation system of space and sky has been constantly improved

Crop growth environment monitoring

Deep learning of crop distribution





4. Application progress since agricultural census

4.2 The working mode of remote sensing measurement is becoming more and more mature

Indepen-dently design work plans

Technic-al service of public bidding

Indepen-dently carry out field surveys

Compan-ies carry out measure-ment

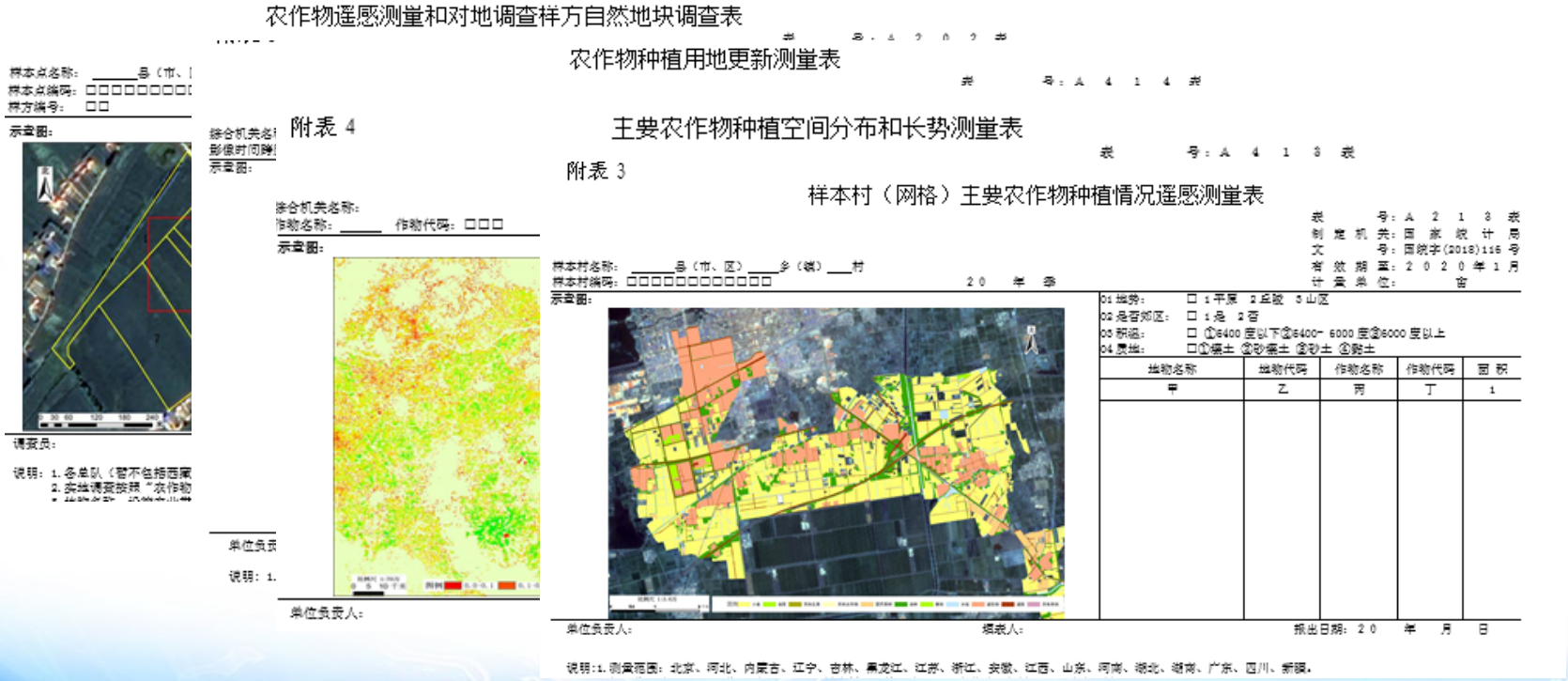
Third party audit

Survey progress report at any time

Complet-e task

4. Application progress since agricultural census

4.3 Remote sensing measurement enters system of national agriculture statistical investigation



农作物遥感测量和对地调查样方自然地块调查表

样本点名称：_____县（市、

样本点编码：□□□□□□□□□

样方编号：□□

示意图：

调查员：

说明：1.各单队（暂不包括西藏

2.实地调查按照“农作物

农作物种植用地更新测量表

表　　号：A 4 1 4 表

附表 4

综合机关名

部级时间

示意图：

综合机关名称：

作物名称：_____　作物代码：□□□

示意图：

单位负责

说明：1.

单位负责人：

主要农作物种植空间分布和长势测量表

表　　号：A 4 1 3 表

附表 3

样本村（网格）主要农作物种植情况遥感测量表

表　　号：A 2 1 3 表

制定机关：国家统计局

文　　号：国统字(2018)116号

有效期至：2020年1月

计量单位：　　亩

样本村名称：_____县（市、区）____乡（镇）___村

样本村编码：□□□□□□□□□□□□

20　年　季

示意图：

01 地势：　□ 1 平原　2 丘陵　3 山区

02 是否郊区：　□ 1 是　2 否

03 积温：　□ ①6400 度以下 ②6400- 6000 度 ③6000 度以上

04 质地：　□①壤土 ②砂壤土 ③砂土 ④黏土

地物名称	地物代码	作物名称	作物代码	面积
甲	乙	丙	丁	1

单位负责人：　　填表人：　　报出日期：20　年　月　日

说明：1.测量范围：北京、河北、内蒙古、辽宁、吉林、黑龙江、江苏、浙江、安徽、江西、山东、河南、湖北、湖南、广东、四川、新疆。

Thank you!