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New Progresses of Coal Mining Area Land Reclamation in China

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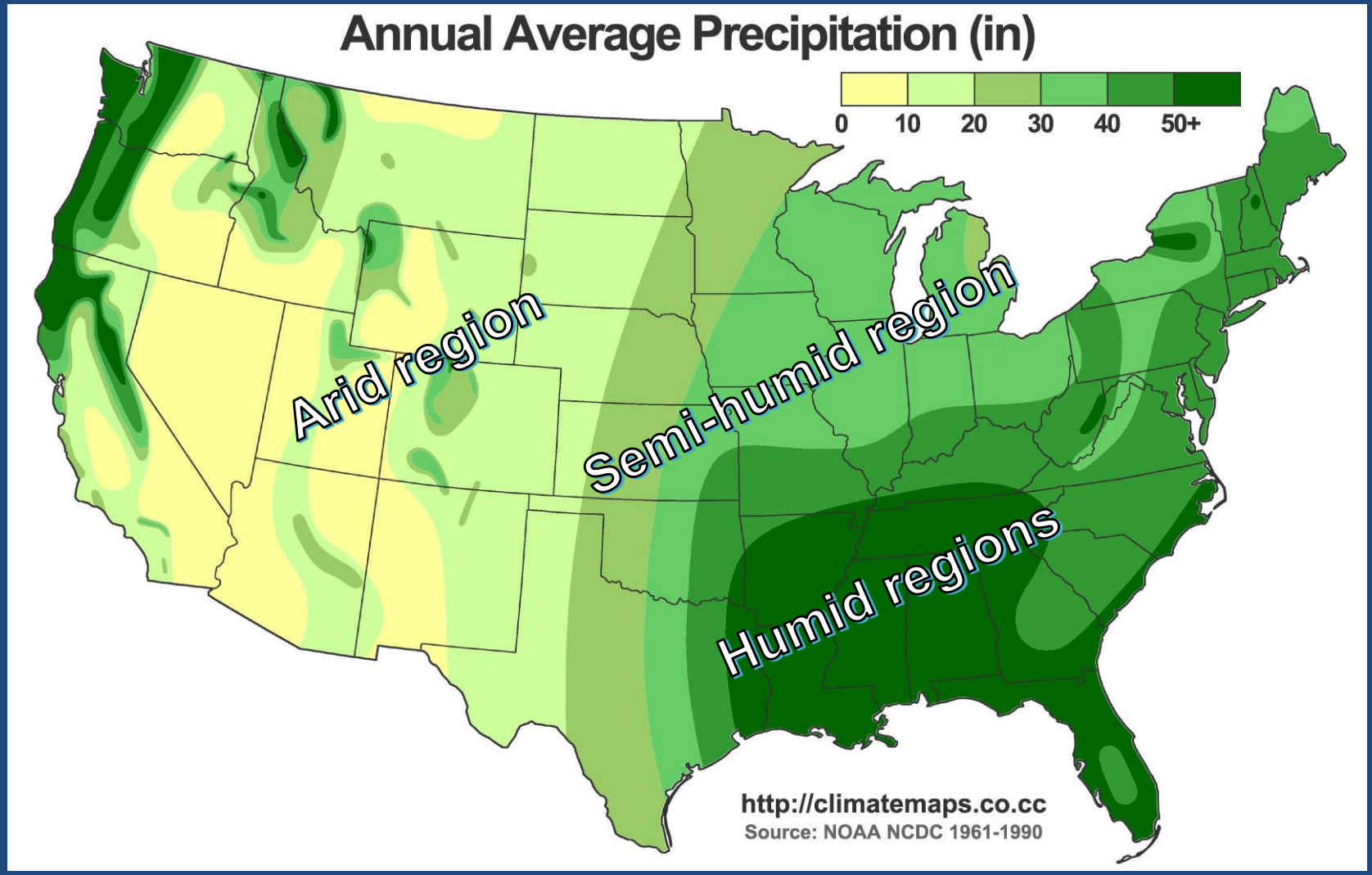
Outline

- **1. Introduction**
- **2. New progress of land reclamation technologies in China**
  - Progress in eastern China
  - Progress in western China
- **3. Policies and Laws improvement**
- **4. Outlooks and prospects**

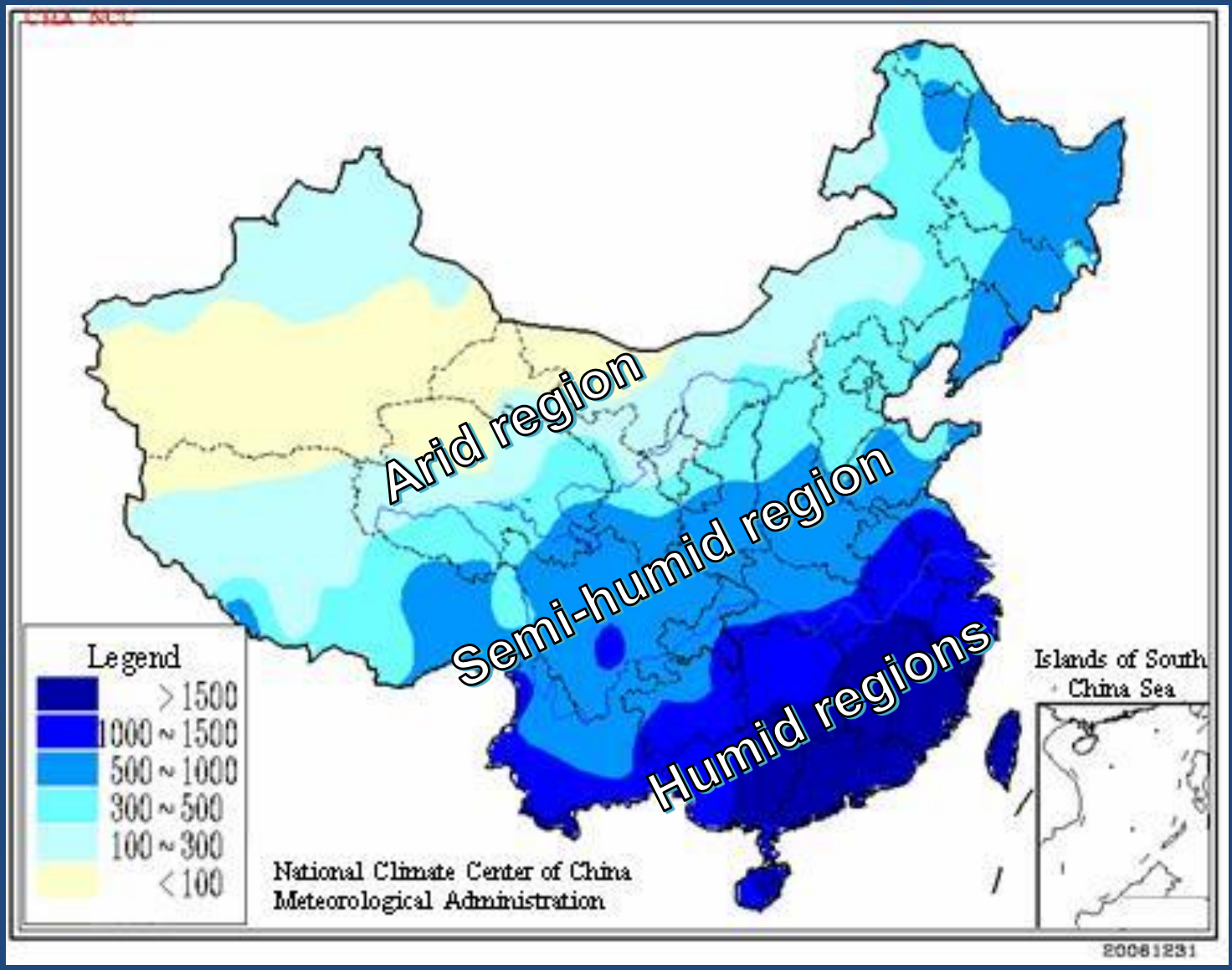
- 1. Introduction

1. Introduction



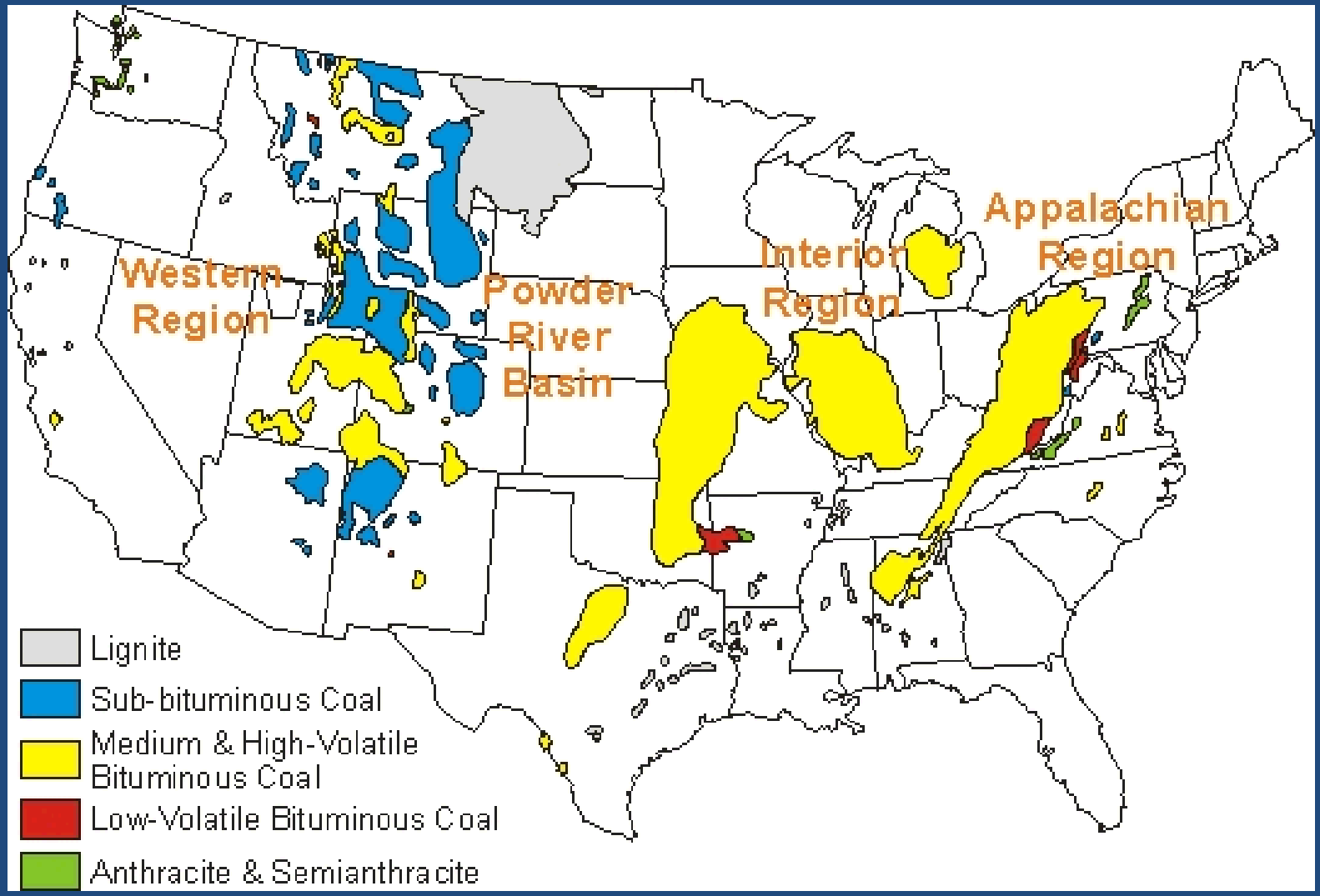
Precipitation in US

1. Introduction

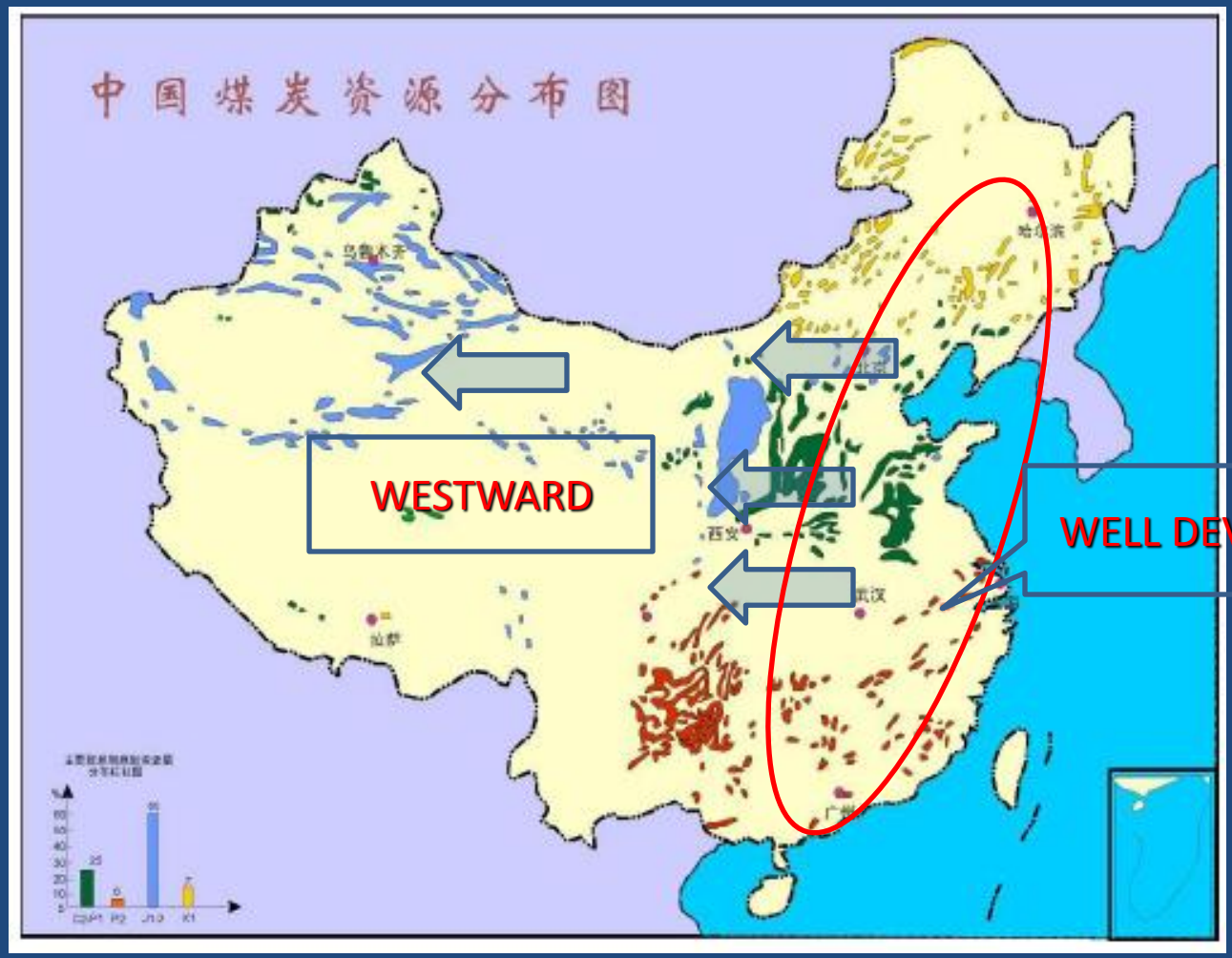


Precipitation in China

1. Introduction



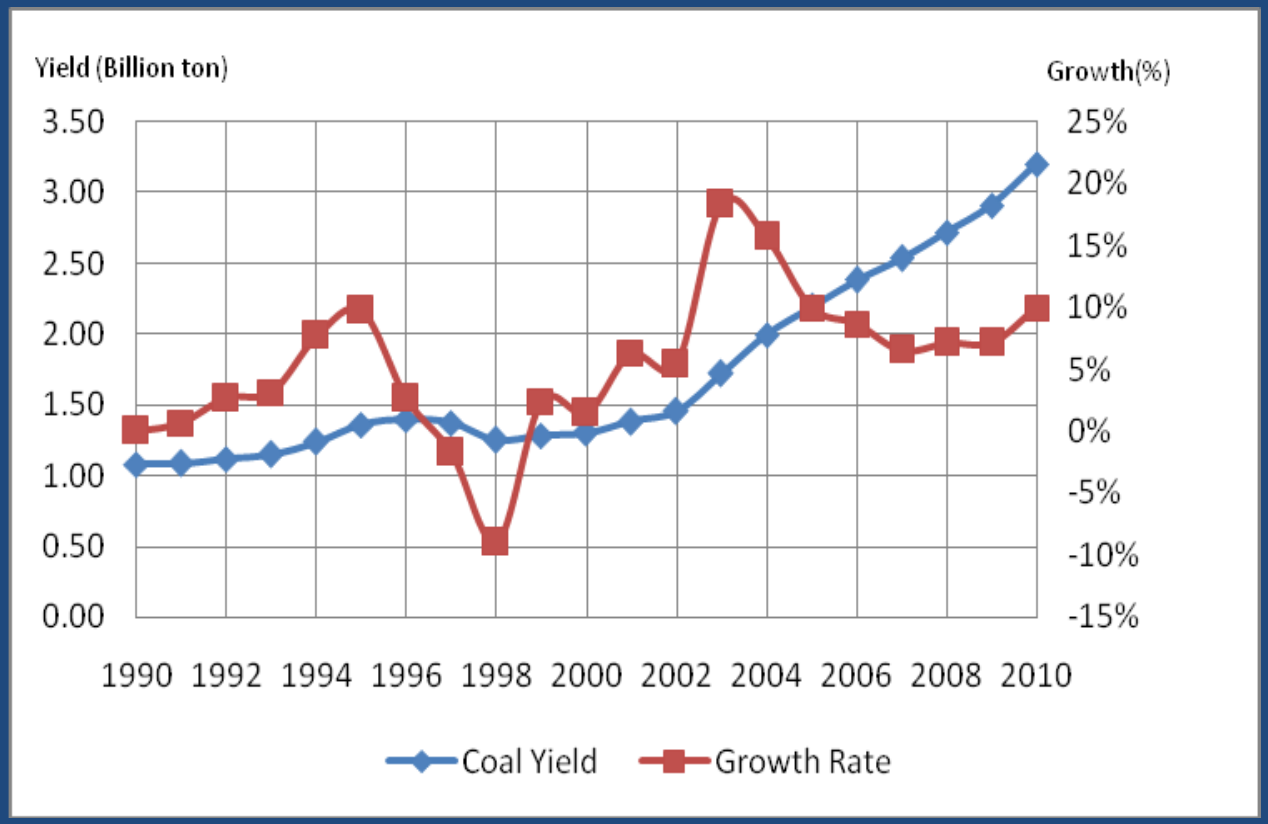
1. Introduction



Coal resources distribution in China


Western region
Eastern region
Southern region
Major Coal Deposit
Selected Coal Mine
Coal Port
Railroad
Russia
Kazakhstan
Mongolia
Kyrgyzstan
India
Nepal
Myanmar (Burma)
Vietnam
Laos
Thailand
Philippines
North Korea
South Korea
Yellow Sea
East China Sea
Ulaanbaatar
Beijing
Shanghai
Chengdu
Chongqing
Wuhan
Kunming
Guangzhou
Hanoi
Manila
Seoul
Pyongyang
0 500 Kilometres
0 500 Miles

1. Introduction



China's coal production was 3.5 billion tons in 2011.

92% come from underground mining

Coal yield and growth rate from 1990 to 2010 in China

1. Introduction

Mining subsidence in Gansu Province

Mining subsidence in Shanxi Province

1. Introduction

Zhungeer Surface Coal Mine in Inner Mongolia

1. Introduction

Eastern region

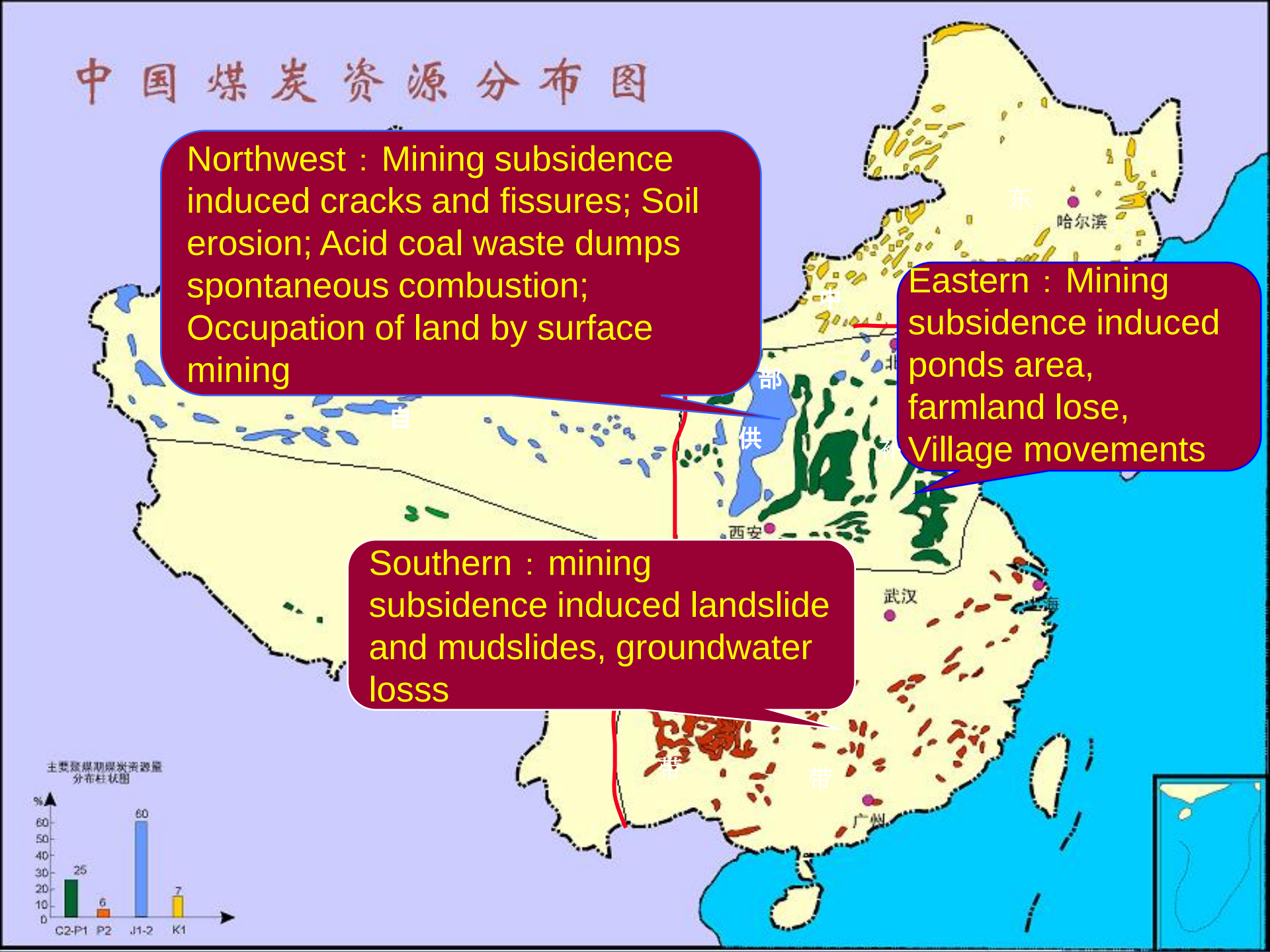
Mining subsidence in Jining coal field

1. Introduction

Southern region

Mining subsidence induced landslides in Sichuan Province

Groundwater falls in Chongqing


中国煤炭资源分布图
Northwest：Mining subsidence induced cracks and fissures; Soil erosion; Acid coal waste dumps spontaneous combustion; Occupation of land by surface mining
Eastern：Mining subsidence induced ponds area, farmland lose, Village movements
Southern：mining subsidence induced landslide and mudslides, groundwater losss
哈尔滨
西安
武汉
广州
主要聚煤期煤炭资源量分布柱状图
%
60
50
40
30
20
10
0
25
6
60
7
C2-P1
P2
J1-2
K1

- **2. New progress of land reclamation technologies in China**

•2. New progress of land reclamation technologies in China

Eastern China

- Concurrent Mining and Reclamation (CMR)
- Yellow river sediments backfilling
- Landscape reclamation of farmland and comprehensive utilization

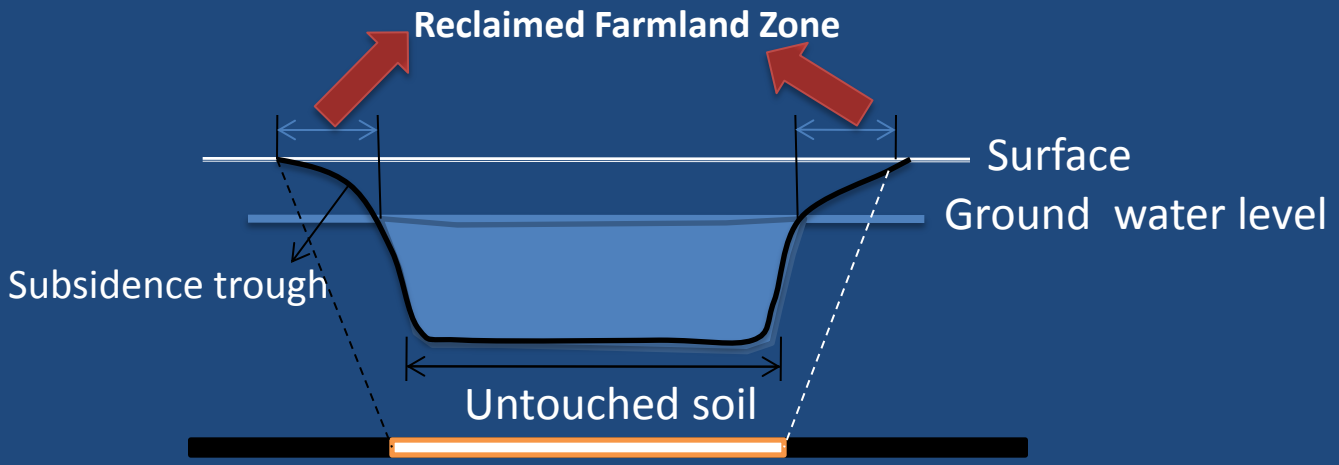
Western China

- Monitoring and Assessment of mining subsidence in western China
- Topsoil alternatives based on bedrock

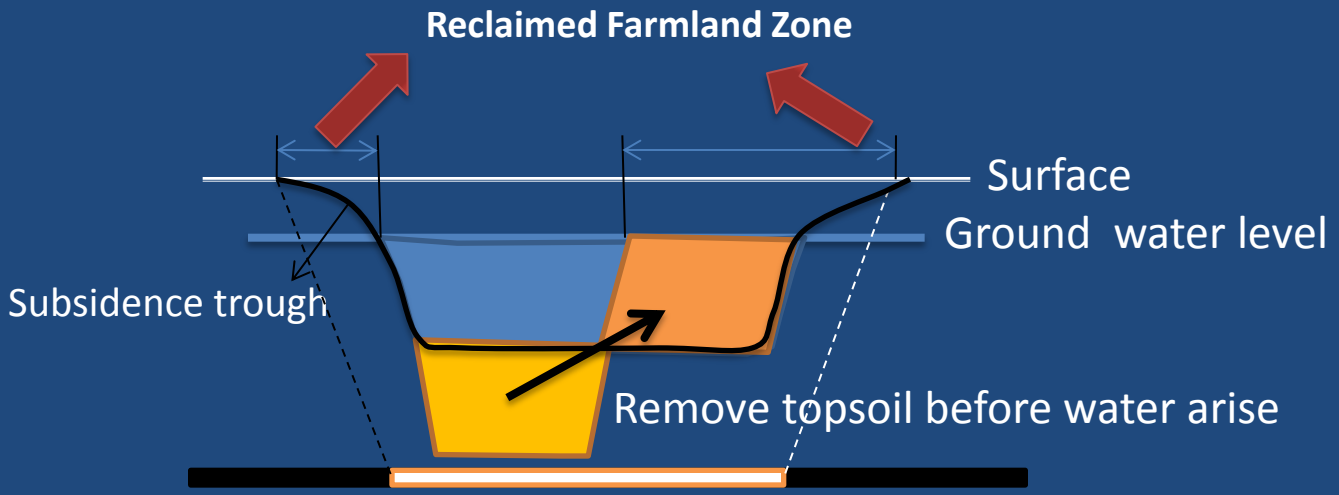
Eastern China

(1) Concurrent Mining and Reclamation (CMR)

Reclamation after land subsided



Reclamation before or during land subsided

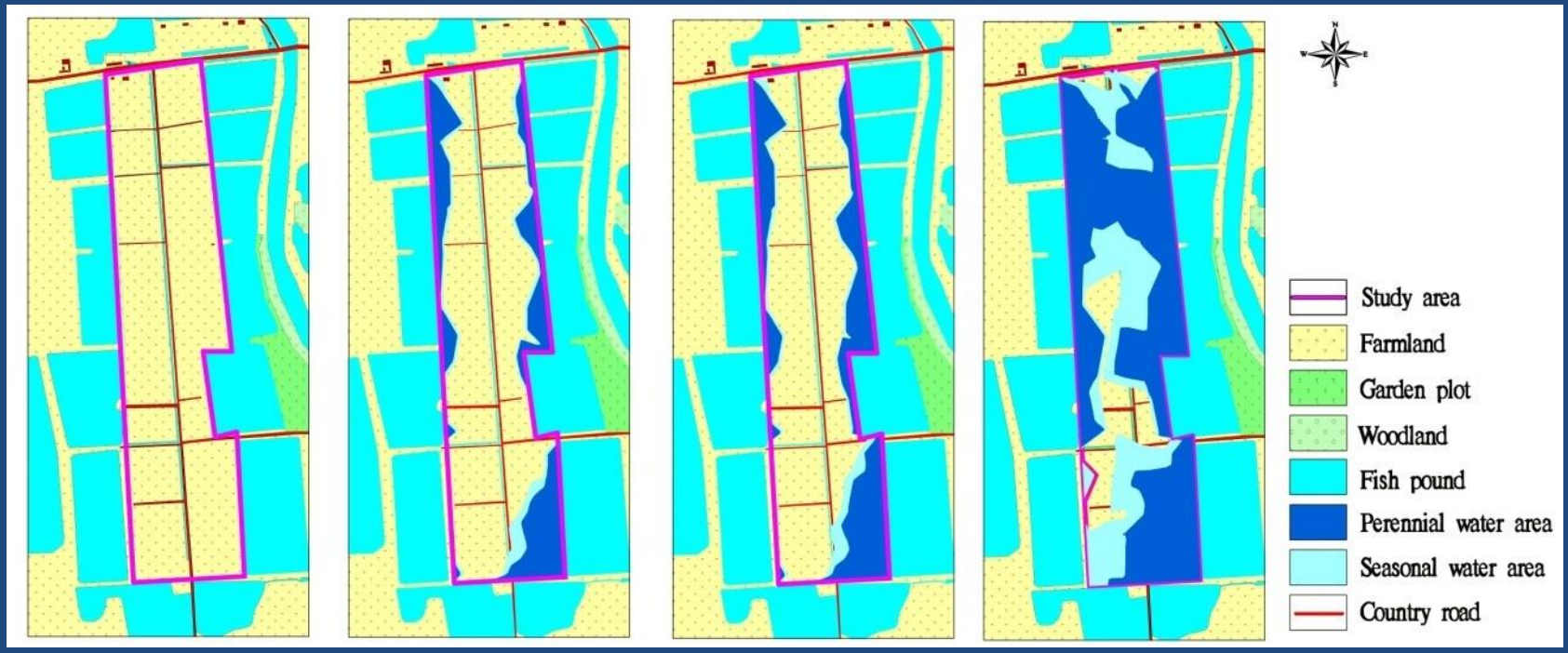


CMR

Eastern China

(1) Concurrent Mining and Reclamation (CMR)

Subsidence prediction for various stages:



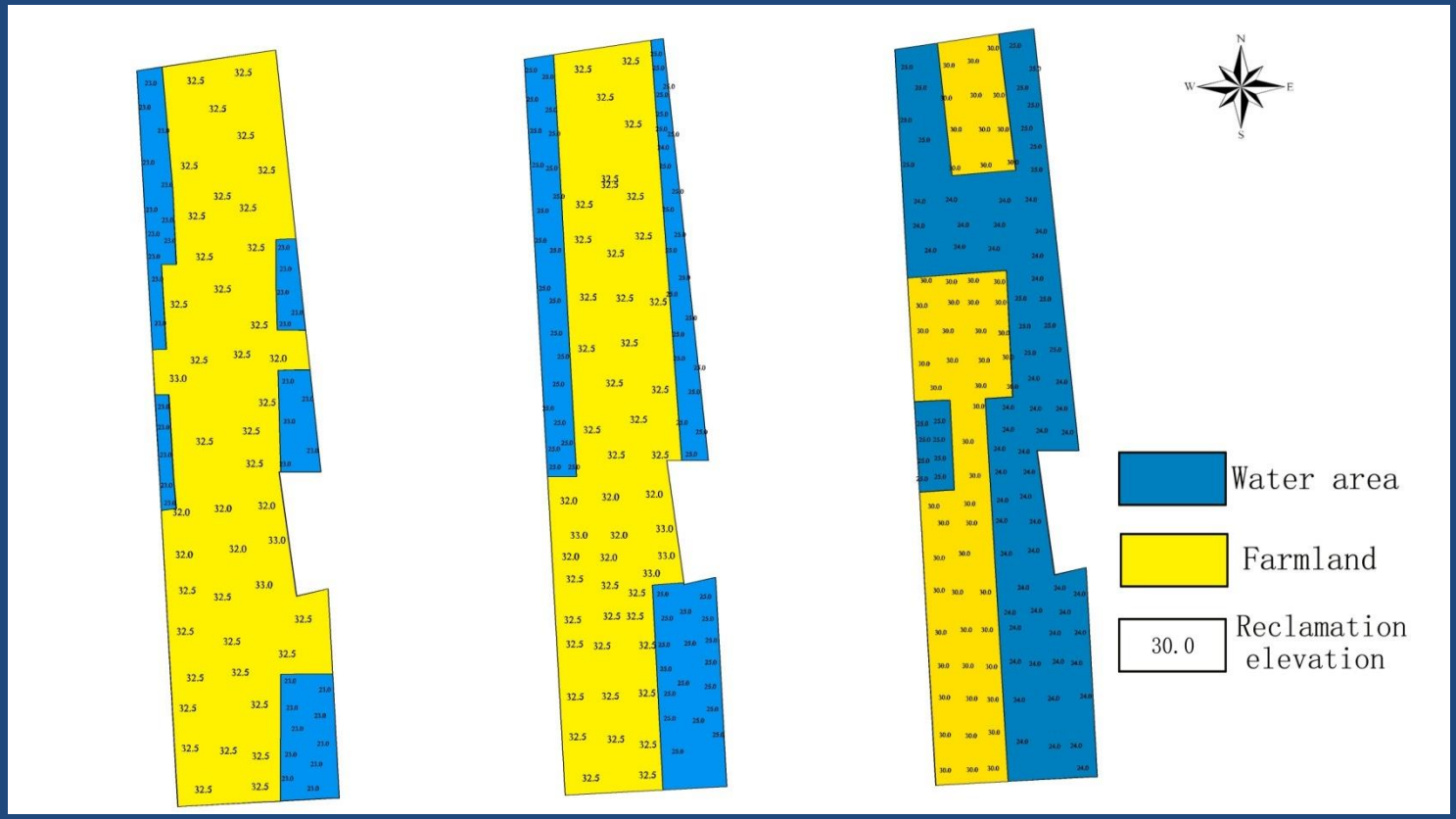
(a) (b) (c) (d)

Proportions of cultivated land were 100%, 72.5%, 67.3%, 14.4%, respectively.

Excavation of No.4 coal seam led to a lot of farmland loss because of water accumulation due to mining subsidence.

Eastern China

(1) Concurrent Mining and Reclamation (CMR)

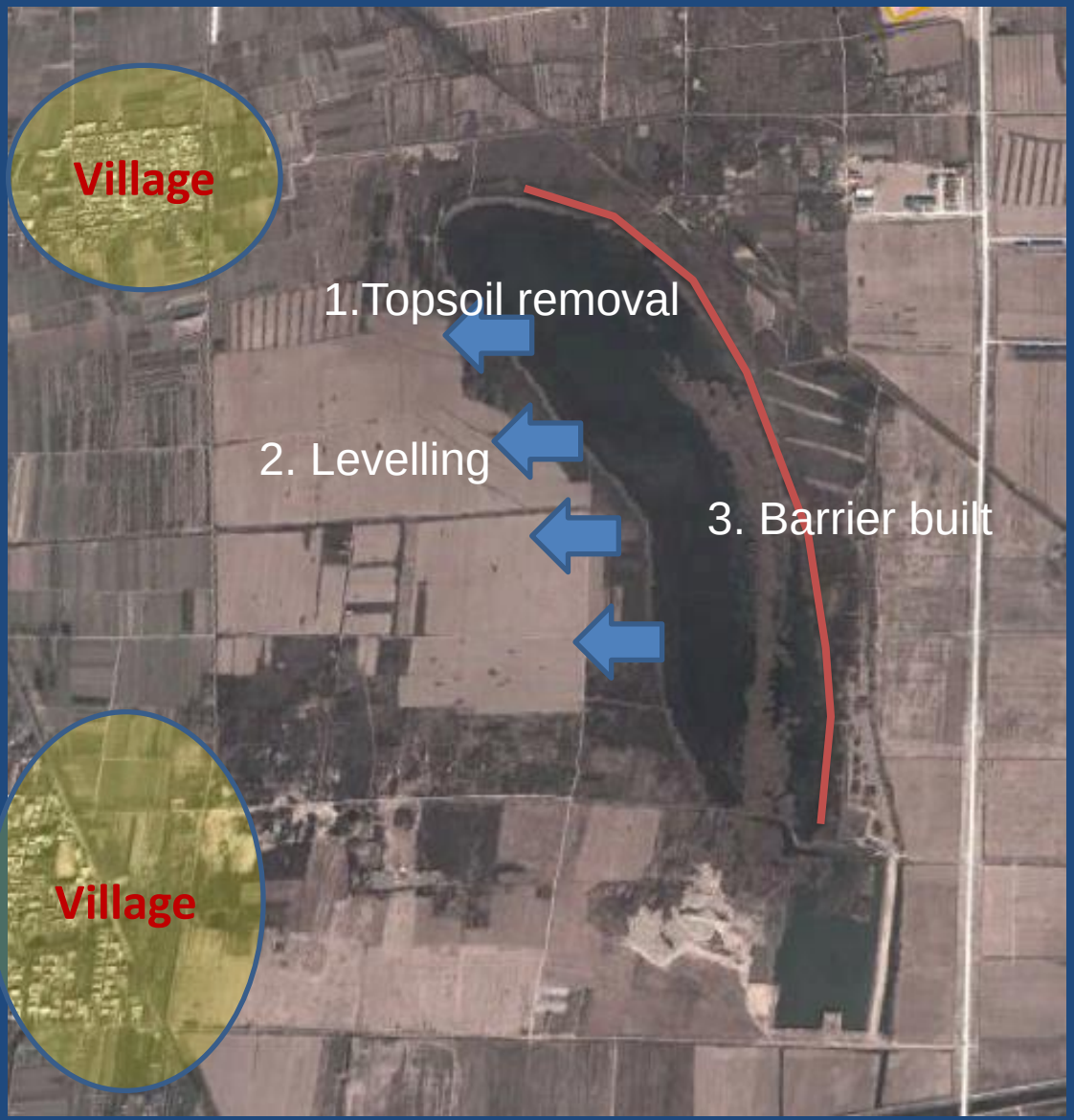


(b) (c) (d)

The percentage of reclaimed farmland could reach 78.3%, 73.3% and 40.7% at the stage (b), (c) and (d) respectively.

Eastern China

(1) Concurrent Mining and Reclamation (CMR)

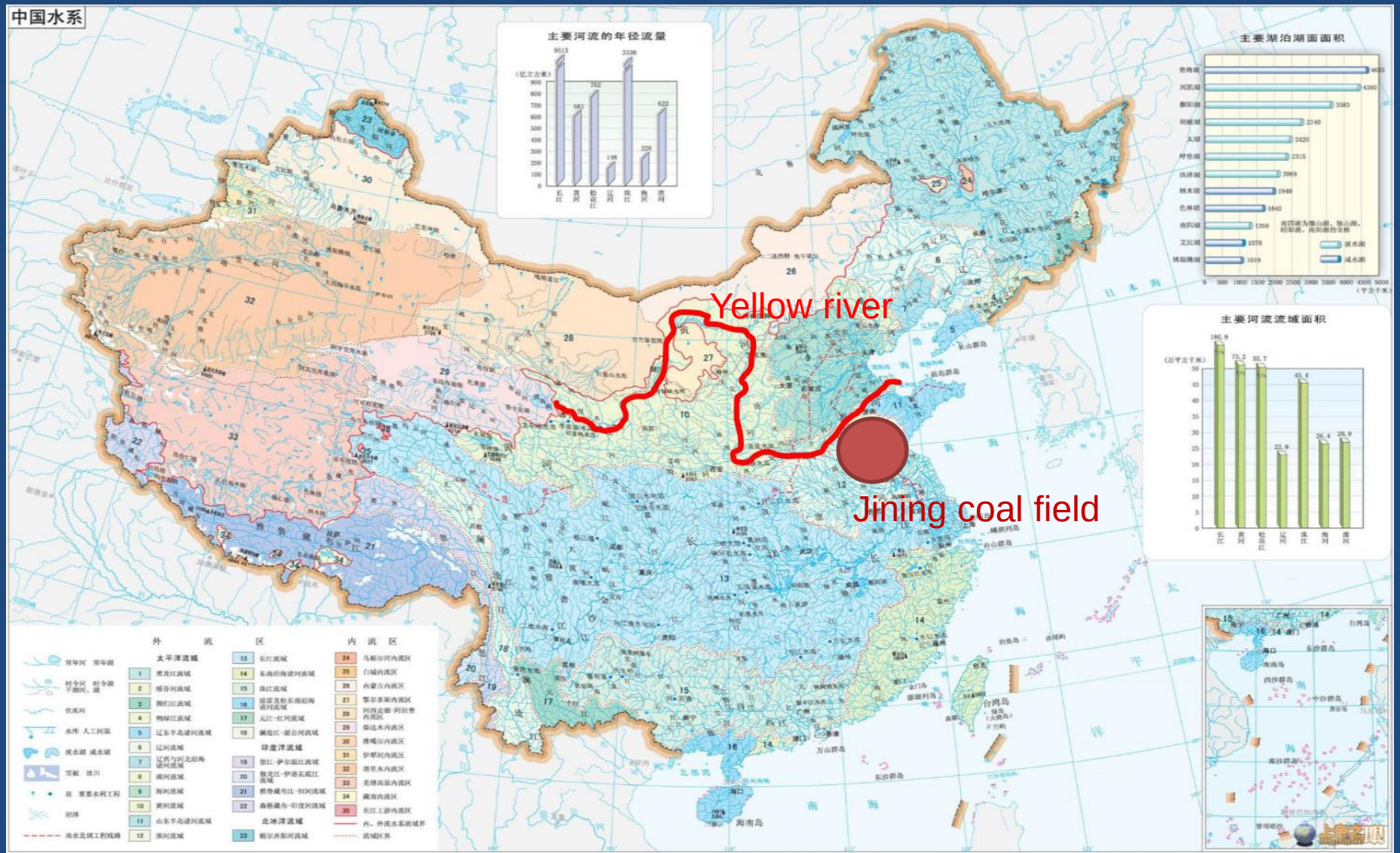


CMR is a innovative technology, also an advanced concept and theory.

CMR technology implementation in Longgu coal mine, Shandong Province.

Eastern China

(2) Yellow river sediments backfilling



Eastern China

(2) Yellow river sediments backfilling

The Yellow River basin has an east-west extent of 1900 km (1,180 miles) and a north-south extent of 1100 km (684 miles). Total basin area is 752,443 km^2 (290,520 $mile^2$).

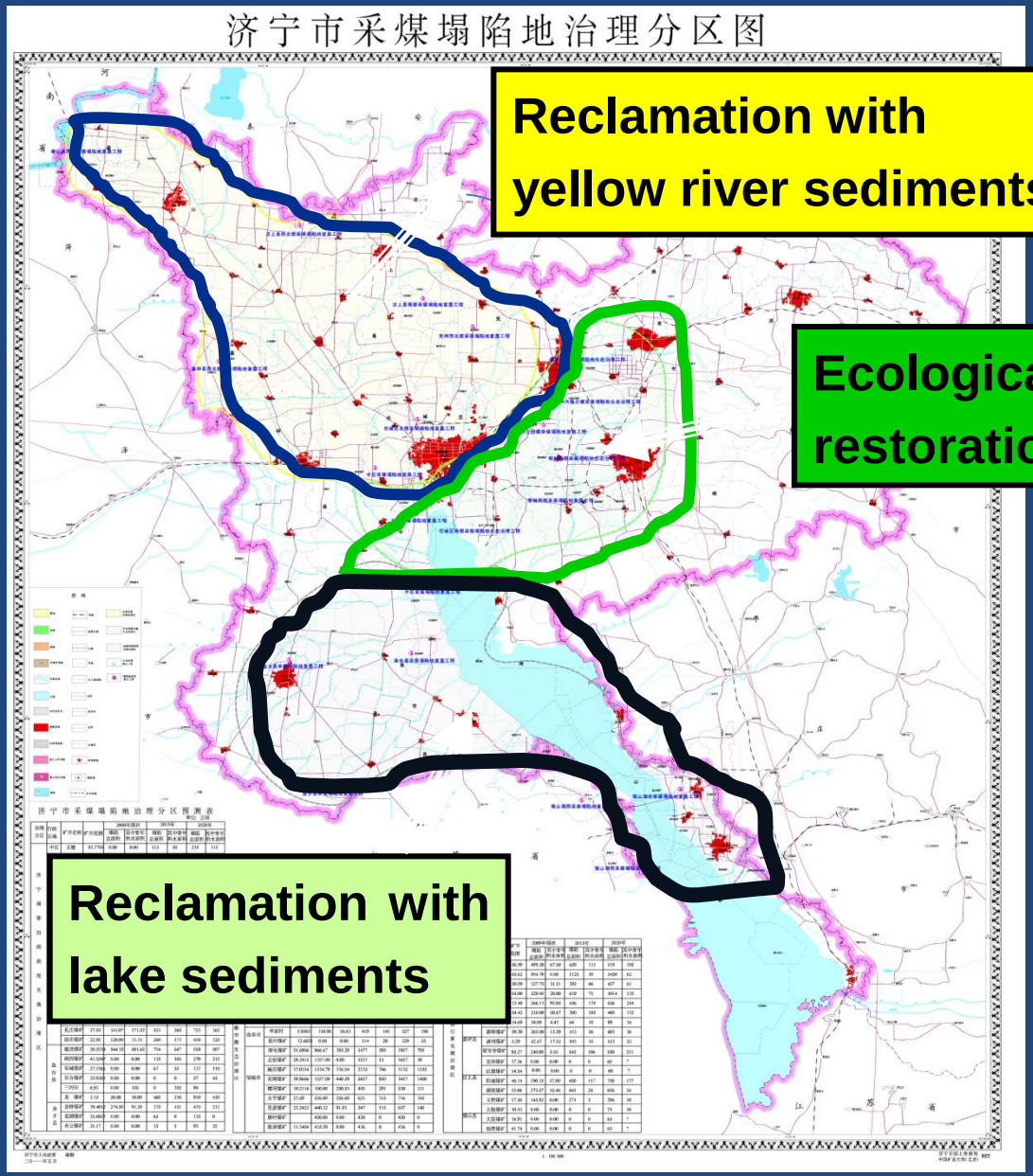
Since its middle section flows through China's Loess Plateau region, a large amount of sediments carried along. Thus, it is also regarded as the river with the most sediment in the world.

Eastern China

Jining City locates in Shandong province, close to Yellow river.

It is the one of big coal-bases in China, Yanzhou coal company is in this city.

Subsided land : 24575.79hm^2 (2009)
Predict:
2015: 47199.34 hm^2
2020: 68100.53 hm^2



Eastern China

(2) Yellow river sediments backfilling

Key technologies:

1. **Position and method to take sediments from Yellow river**

2. Sediment transportation methods

3. Filling, drainage, soil reconstruction and restoration of high quality farming

Eastern China

Short distance filling reclamation case studies with Yellow River sediments in Dezhou city, Shandong Province

Being reclaimed

Eastern China

(3) Comprehensive utilization of subsided land

Subsided ponds was also being utilized as solar photovoltaic power plant. Huahan solar photovoltaic power plant in southeast Jining city is Asia's largest thin-film solar photovoltaic power plant. The total investment is 900 million Yuan, the total size of the solar power plant would be 30 MW.

Western China

(1) Monitoring and Assessment of mining subsidence in western China

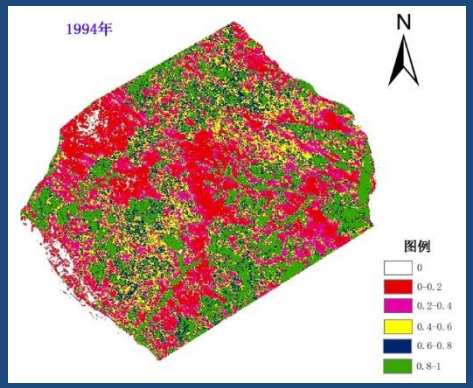


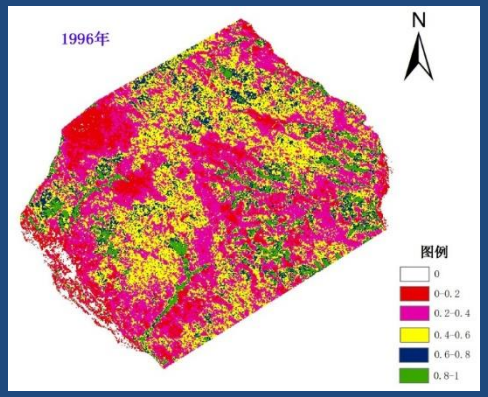


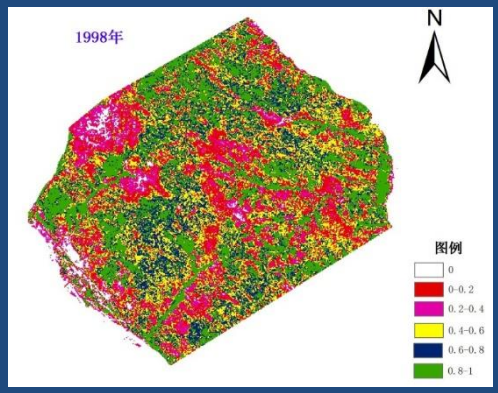
- Zhenqi Hu from China University of Mining and Technology, Beijing
- Zhengfu Bian and Shaogang Lei from China University of Mining and Technology, Xuzhou
- Xiao He from Inner Mongolia Agricultural University
- Hongmei Zhao from Chinese Academy of Geological Science

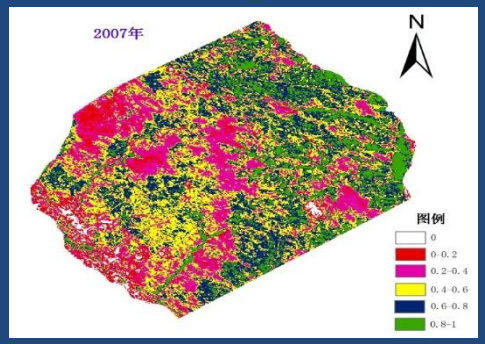
Western China

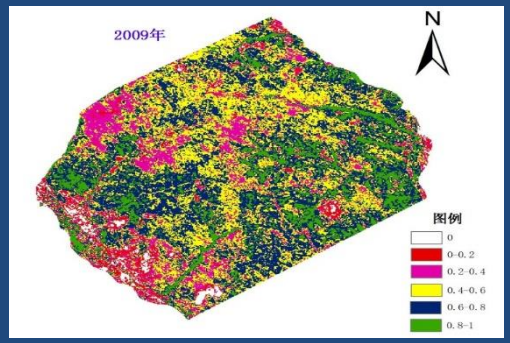
(1) Monitoring and Assessment of mining subsidence in western China

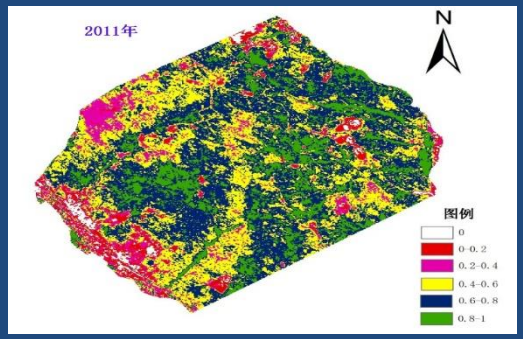








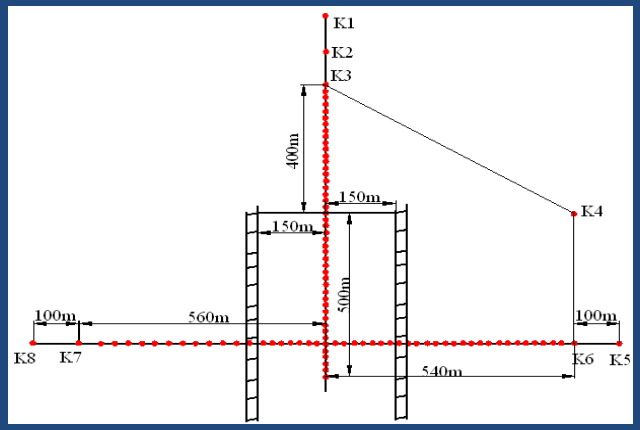




Remote sensing was employed to monitoring LUCC in Shendong coal field.

Western China

(1) Monitoring and Assessment of mining subsidence in western China



Observation station was built to monitoring ground movement induced by underground mining.

Dynamic fissures development was firstly investigated by CUMTB in 2010-2013.

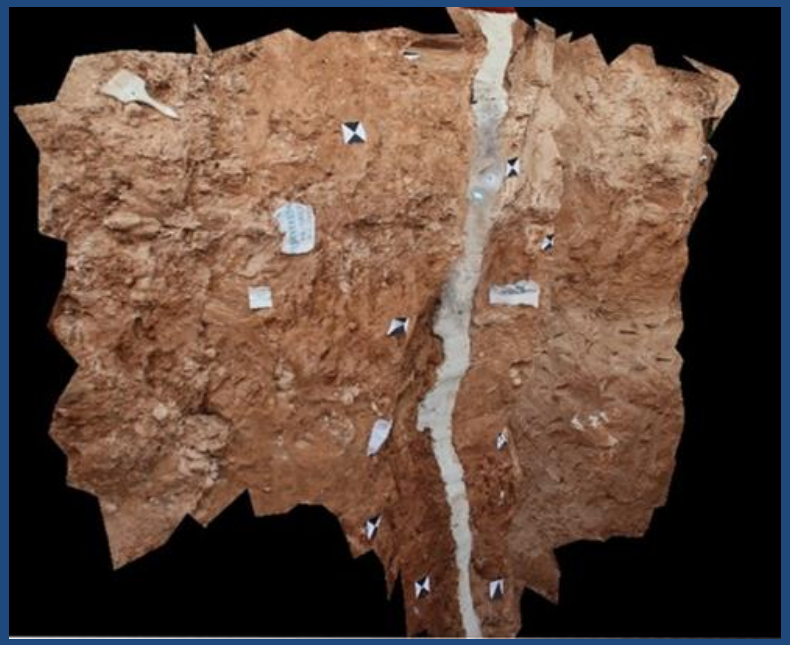
Western China

(1) Monitoring and Assessment of mining subsidence in western China

Soil moisture monitoring in mining subsidence area by Neutron probe

Western China

(1) Monitoring and Assessment of mining subsidence in western China



Ground Penetrating Radar (GPR) and Photogrammetry was used to investigate fissures underground and its dynamic development on the ground.

Western China

(1) Monitoring and Assessment of mining subsidence in western China

Conclusions:

1.In Daliuta coal field, vegetation coverage changed from 52.23% in 1994 to 53.36% in 2011. Mining actives DO NOT have a significant influence on vegetation coverage.

2.Precipitation and vegetation cover was significantly correlated, the correlation coefficient between 0.514 to 0.747.

3.Dynamic ground fissures was monitored, a open-close-open-close (2 cycles) was recorded, the mechanism was under reseach.

4.Disturbed land has a self-healing in the bottom of the subsidence basin, and should be man-restoration in the edges.

Western China

(2) Topsoil alternatives based on bedrock

Western China

(2) Topsoil alternatives based on bedrock

(1) Thin topsoil;
(2) Soil loss and degradation during stripping, stockpiling and backfilling;
(3) A lot of slope reclamation area increased reclamation area;

The shortage of topsoil ;
Looking for suitable topsoil substitute material is very necessary.

In western China:
(1) The thick coal bed
(2) Shallow buried depth
(3) Open-pit mining.

Coal mines in this area mostly locate in the arid area, where the ecological environment is very fragile, and the coal mining aggravates the process of desertification and soil erosion.

Western China

CAN WE FIND TOPSOIL ALTERNATIVES?

Western China

(2) Topsoil alternatives based on bedrock

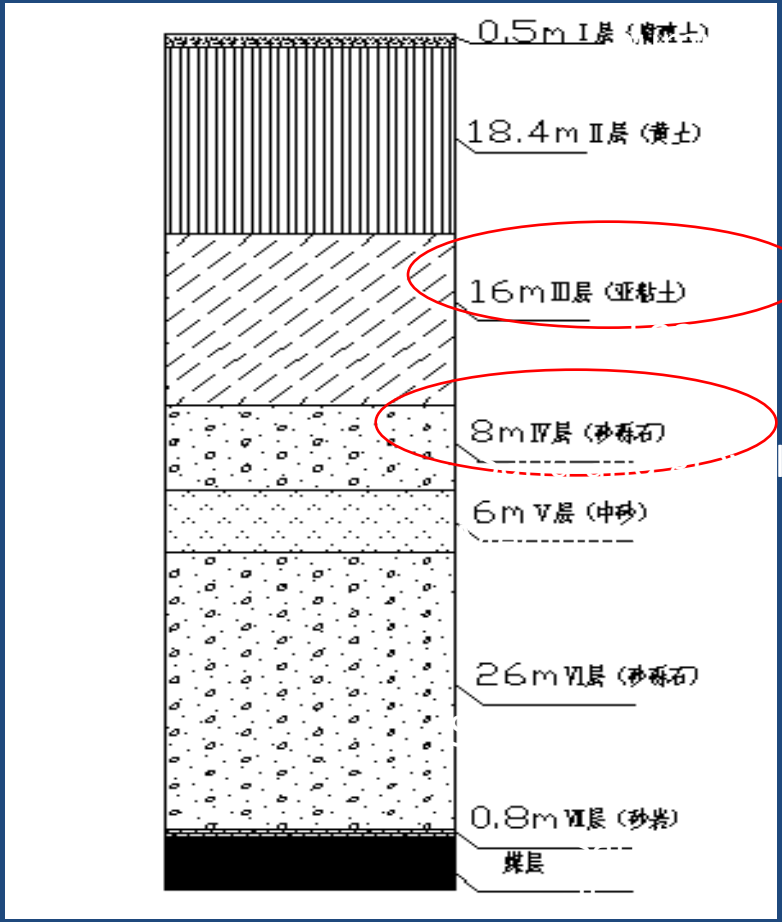


Fig.2 The study area's schematic diagram of geologic section

Western China

(2) Topsoil alternatives based on bedrock

Procedures:

Field investigation and observation of overburden characteristics, topsoil alternatives was selected based on geologic section.

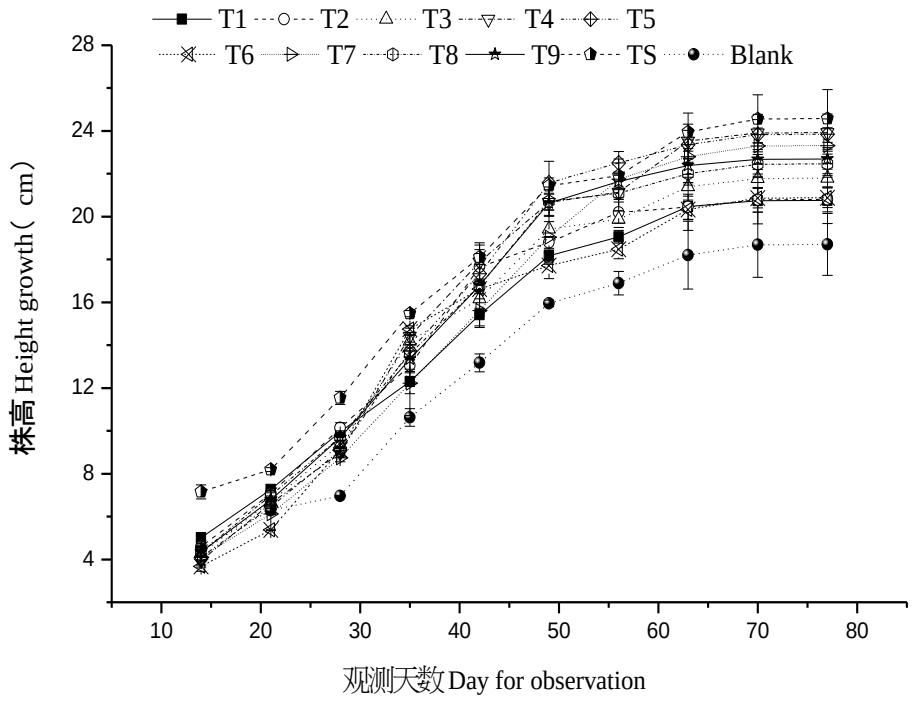
Physical and chemical properties, nutrient and heavy metal content in the selected overburden layer was measured in laboratory.

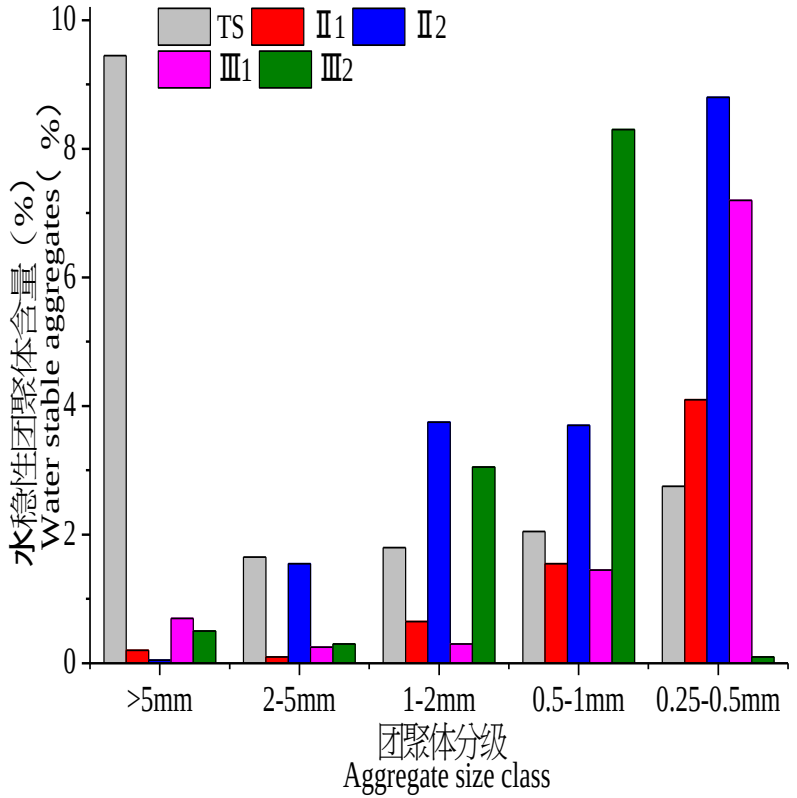
Pot experiments were implemented to determine whether obstacle factor exist for crops.

The optimistic ratio of Vermiculite ,Nitro humic, and straw was obtained by orthogonal pot experiment to improve Topsoil alternatives

Western China

2) Topsoil alternatives based on bedrock





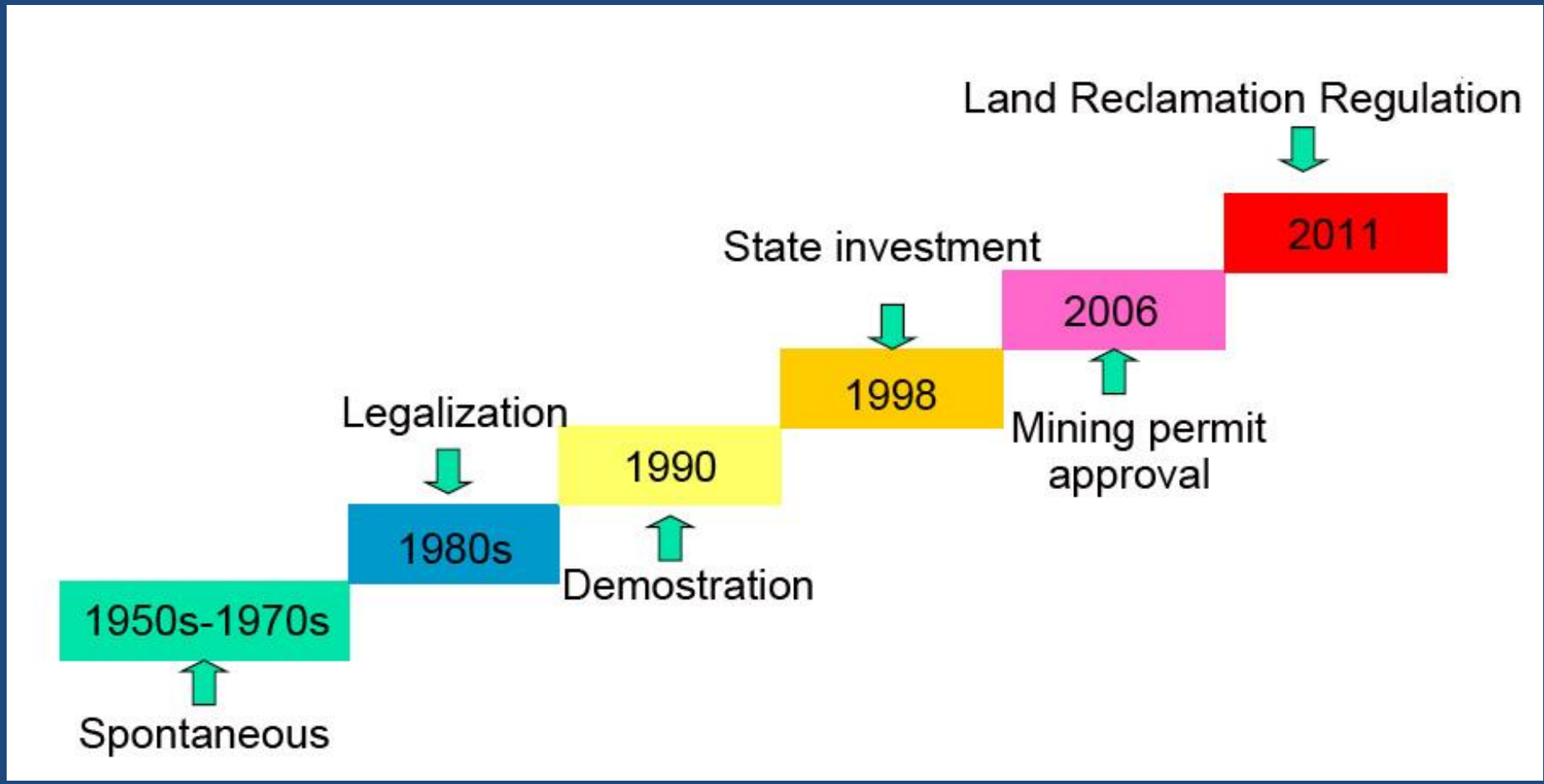
Alfalfa

Western China

(2) Topsoil alternatives based on bedrock

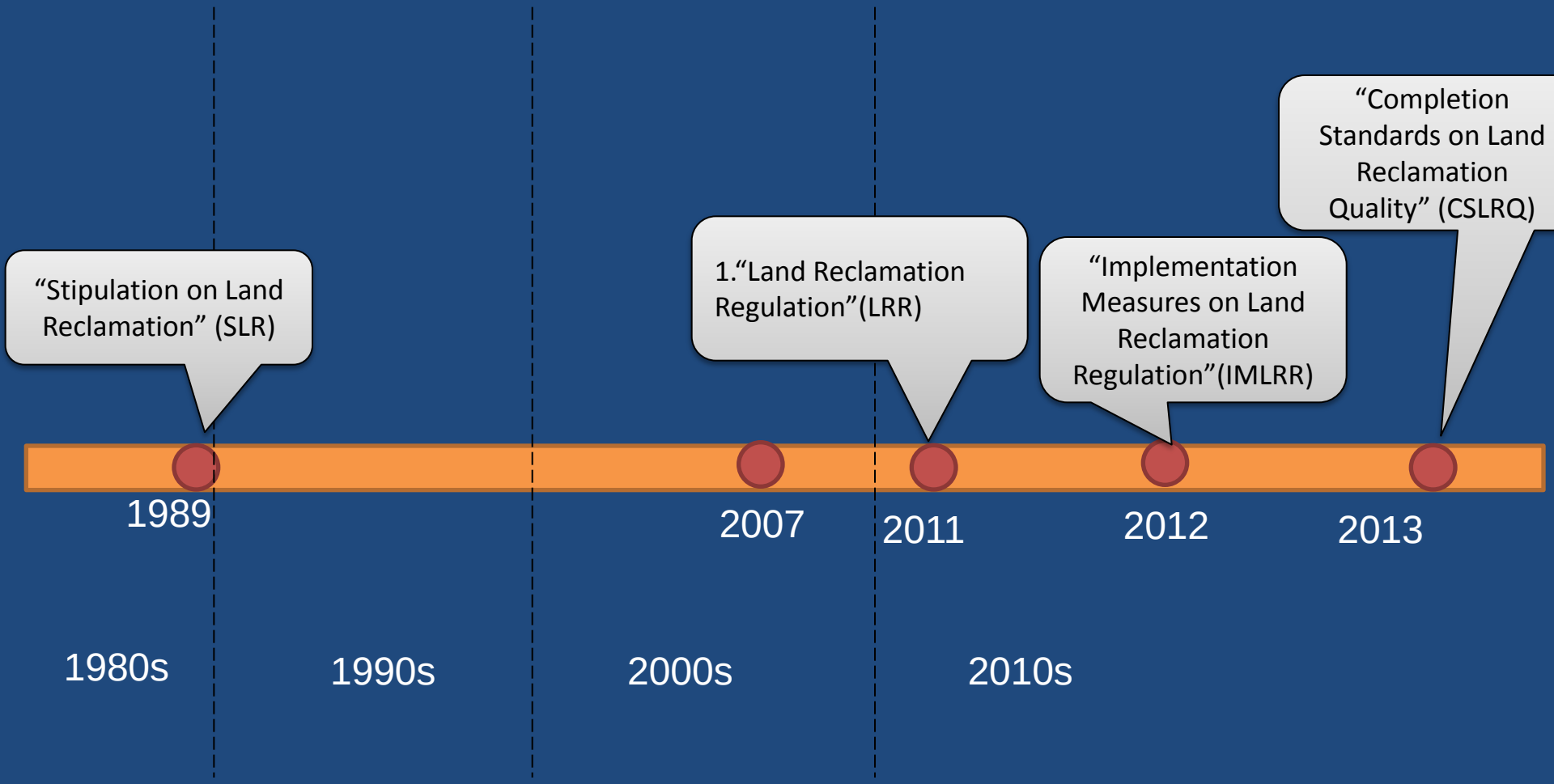
Case study area

•3. Policies and Laws improvement



Milestones of land reclamation in China

•3. Policies and Laws improvement



Important policies and laws

•4. Outlooks and prospects

- Land strategies are different because of the natural and geological aviation in China. By the past 5 years, many important laws and regulation has successively promulgated, and promote land reclamation greatly. Land reclamation research are focused on prime farmland protection in eastern China and ecological restoration in western and south China.

- With the rapidly economic development, corporate social responsibility and public awareness advance. More and more attention has been paid to land reclamation area. Land reclamation are and will still be one of the most important part of coal industry in the future, more efforts and funds are expected to get involved.

Theme: Legislation, technology and practice of mine land reclamation

The LRER 2014, Beijing International Symposium on Land Reclamation and Ecological Restoration will be held from 16th to 19th October, 2014 at Beijing, China. This symposium is the second land reclamation international conference in China, the first one was Beijing International Symposium on Land Reclamation (ISLR 2000), which has a profound influence on land reclamation in China. After more than 10 years, the research concerning land reclamation has improved a lot both in China and abroad, thus, the main purposes of LRER 2014 are: Promoting communication of land reclamation and ecological restoration technology and experience internationally; Advancing and renovating of reclamation and ecological restoration technology and practice; Accelerating international collaboration in this field.

Welcome to LRER 2014, *16th to 19th October, 2014*

- Thank you!!

Questions or comments