



**35<sup>rd</sup> PCC- Xuzhou, China**

# **Impacts of Coal Mining on the Eco-environment in West China and Its Control Measures**

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**Secretary General of Academic Committee,  
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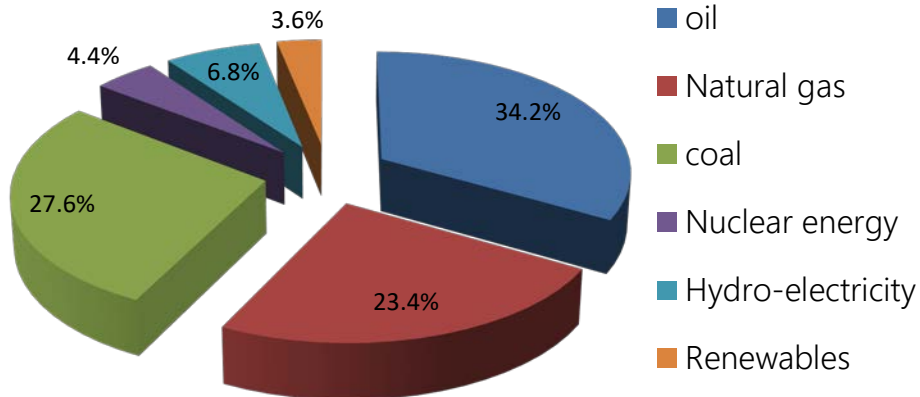
# Scope of Presentation

- 1. Background**
- 2. Key Problems of Scientific and Technology**
- 3. Case Study of the Impact of Coal Mining on Eco-environment**
- 4. Countermeasures of Control**
- 5. Conclusions**

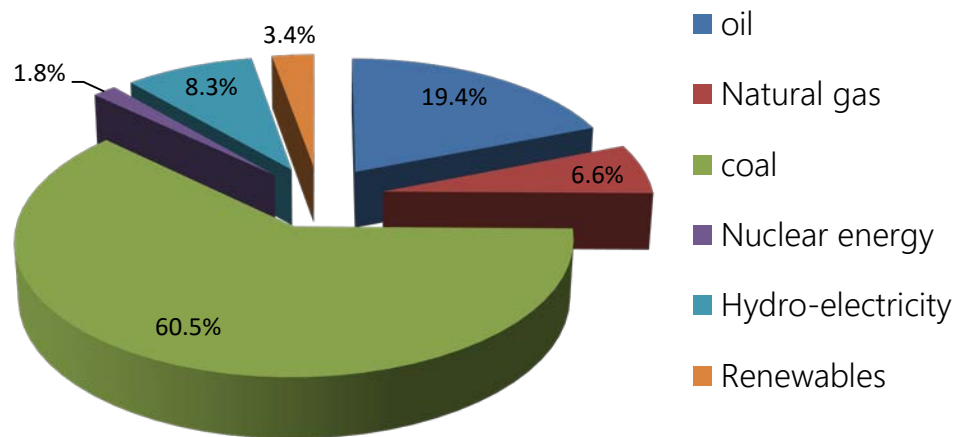


# 1. Background

## ■ Current situation of energy structure in the world and China



world



China

### Energy Consumption Pie Chart 2017

(date from "BP Statistical Review of World Energy June 2018")

**Coal remains absolutely primary energy resource in China, accounting for 60.5% of disposable energy consumption in 2017, and is expected to remain 58% by 2020.**



# 1. Background

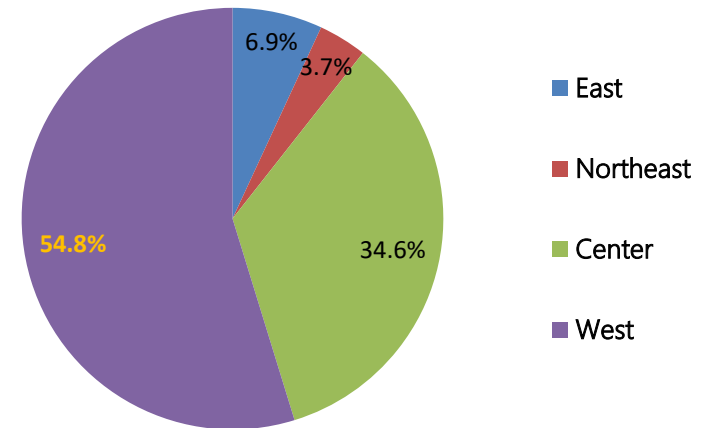
## The distribution of coal resources in China is extremely uneven

Regional division of China

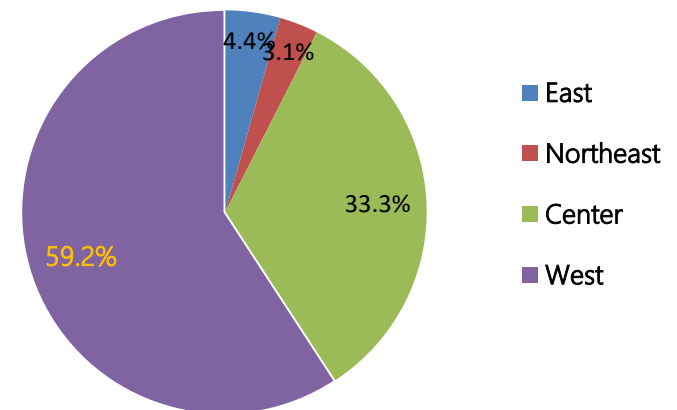


China's coal resources are mainly distributed in the West. In 2016, the western coal output was 2.02 billion tons, accounting for 54.7% of the country's. By 2020, the output's in the western region will reach 2.31 billion tons, accounting for 59.2%.

2016



2020 (projected)



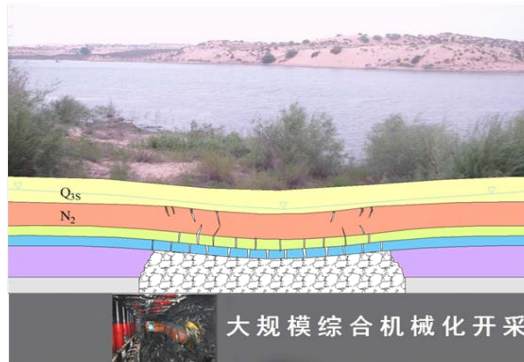
Percentages of regional coal production in China



# 1. Background

## Eco-environmental problems impacted by coal mining in West China

- Surface damaged
- Surface water reduced or dried up
- Drawdown of water table
- Vegetation dead
- Desertification intensified
- Soil erosion intensified







## 2. Key Problems of Science & Technology

Ecosphere-  
hydrosphere-  
coal measures



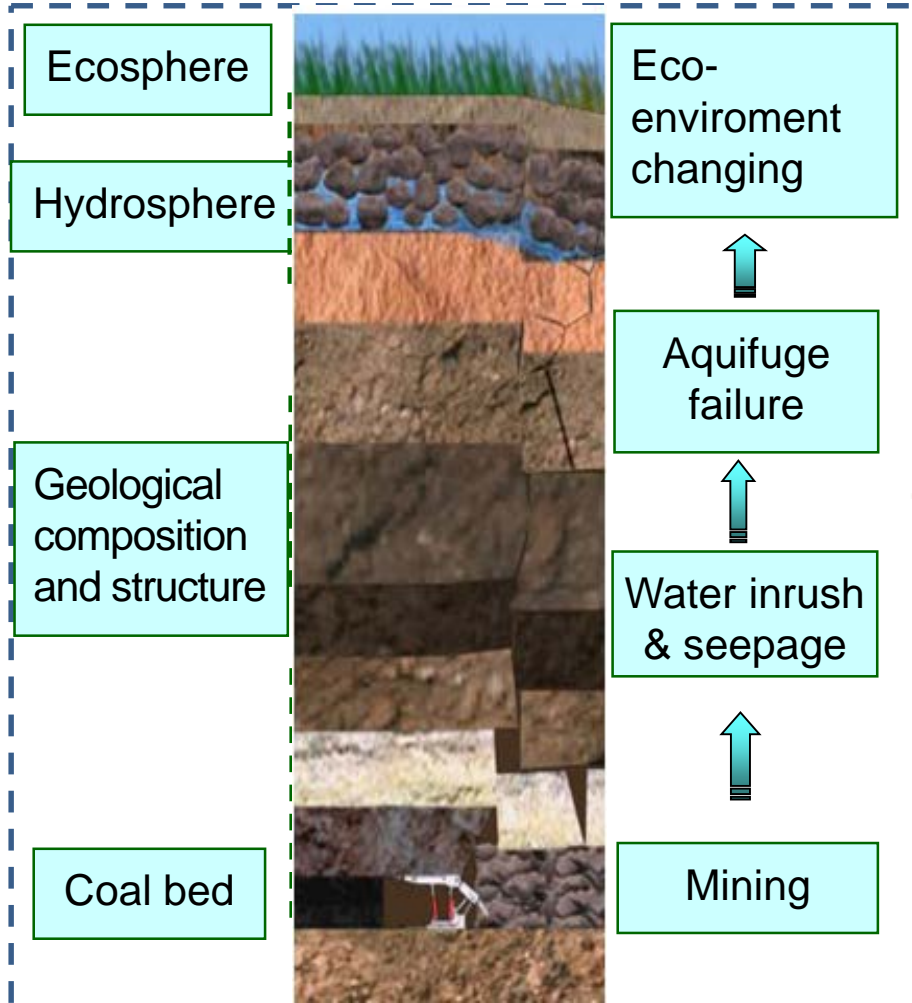
Impact process of  
coal mining to  
eco-environment



Key problems  
of sci.& tech.



Control  
Strategies



1. Structure models of  
eco-hydro-sphere and  
coal measures geology



2. Water cycle and  
water resources  
distribution



3. Process evolution of  
fracture-seepage field



4. Models of eco-  
environment changed

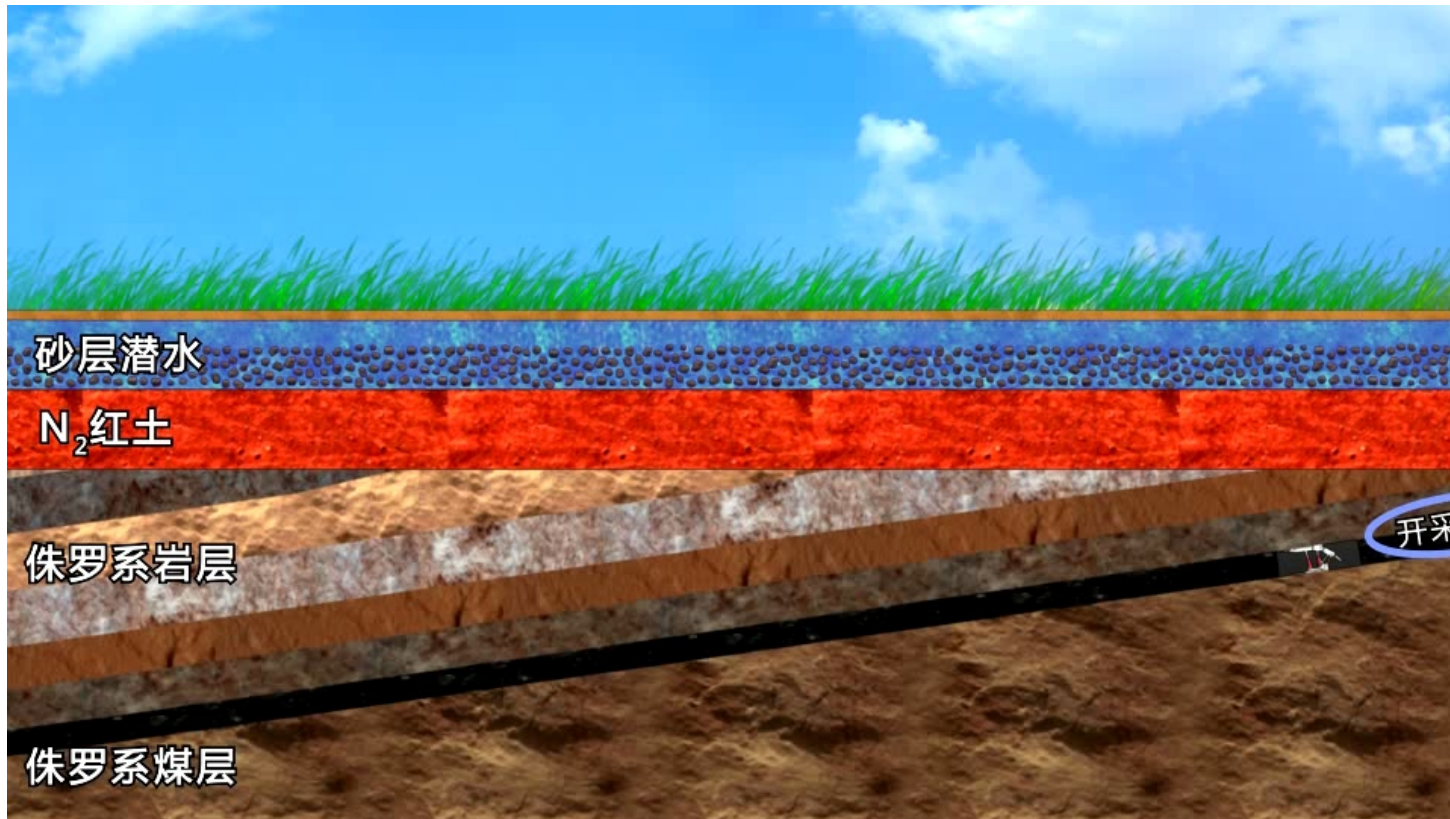
Prevention  
and control  
measures of  
eco-  
environment  
destruction  
impacted by  
coal mining

**Frame diagram**



## 2. Key Problems of Science & Technology

I could show you this dynamic simulation to illustrate the key problems of science and technology, related to the impact of coal mining on the eco- environment in West China



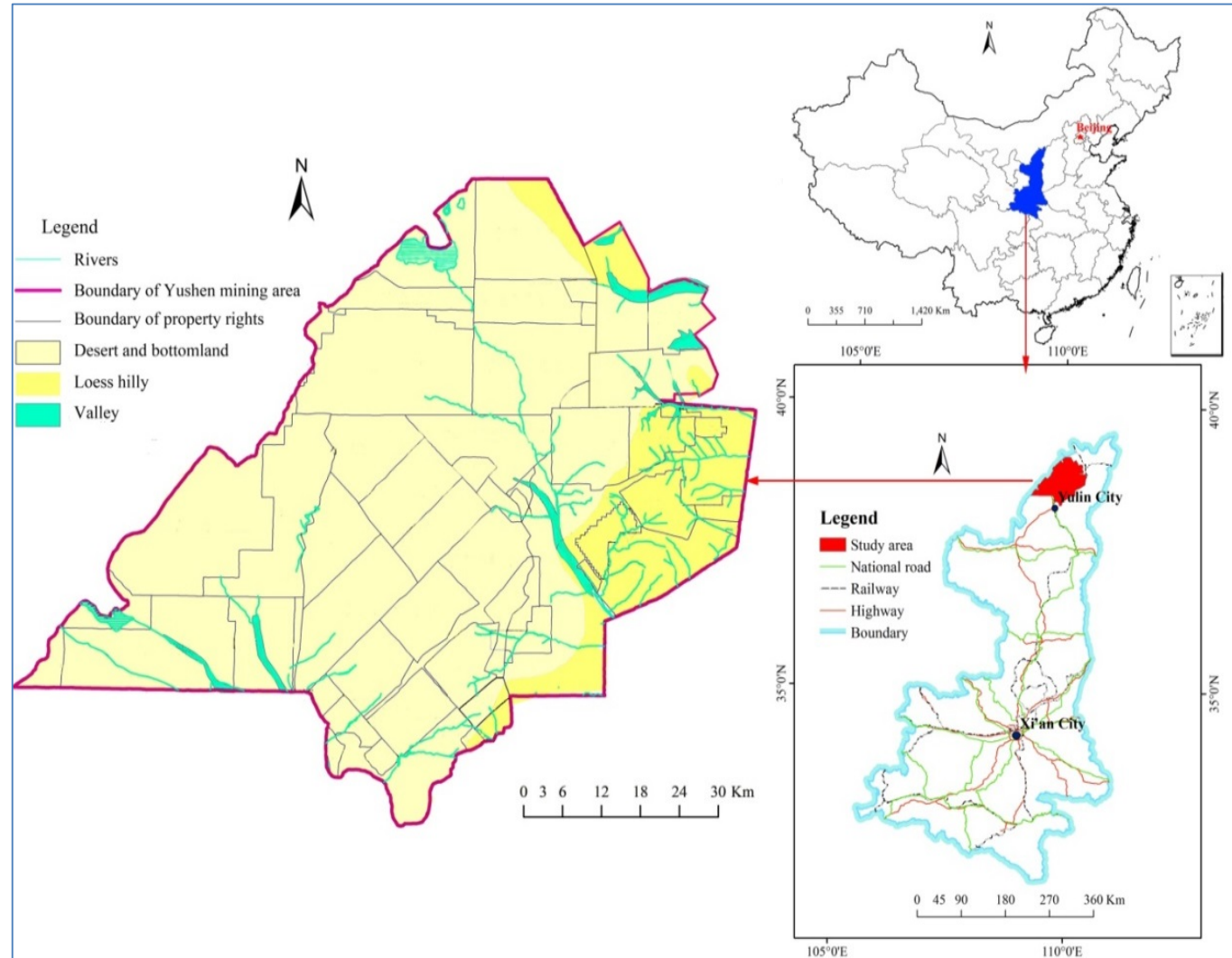
Impacting process of coal mining on the eco-environment in West China



# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## 3.1 Site Overview

- Yu Shen min. area, 5476km<sup>2</sup>, proved coal reserves about 100 billion tons
- Planned mines more than 90, currently put into operation's more than 20
- Now coal yld 300 M tons p.a, by 2020 expected to reach 500M tons



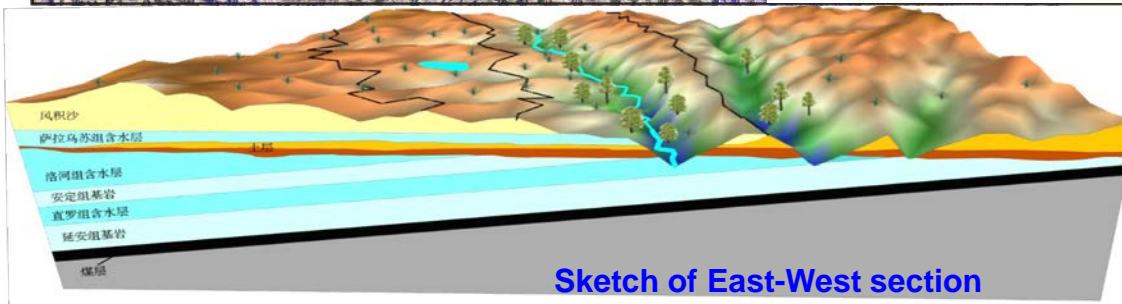
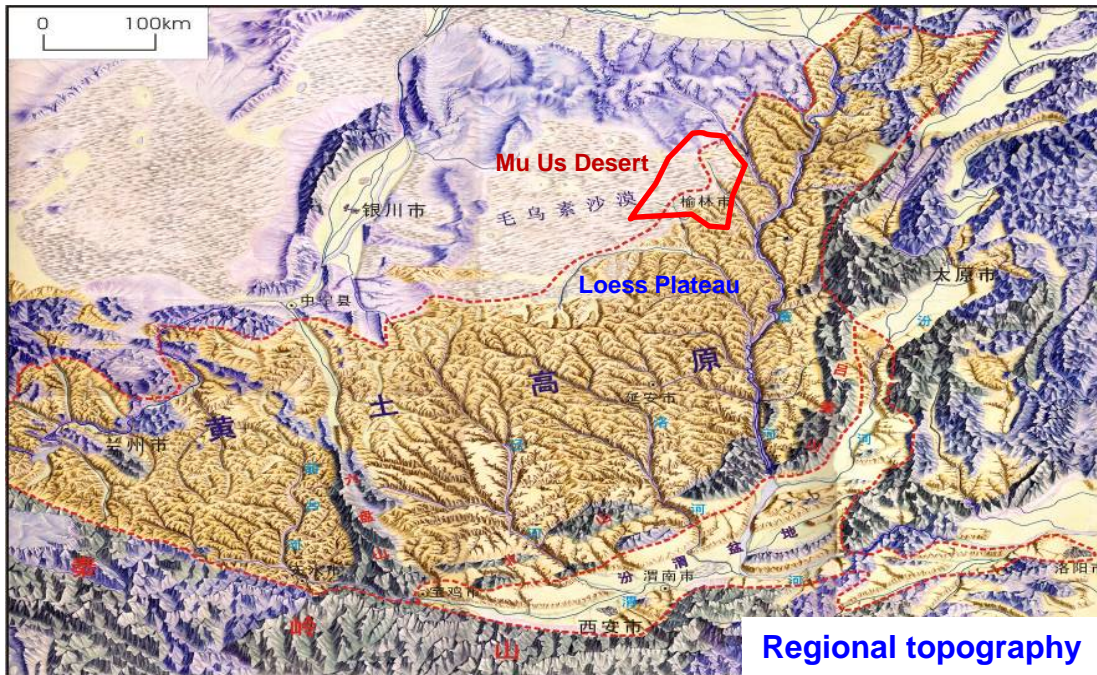




# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## 3.2 Conditions of Eco-hydro-sphere and Coal Measures Geology

### Regional survey



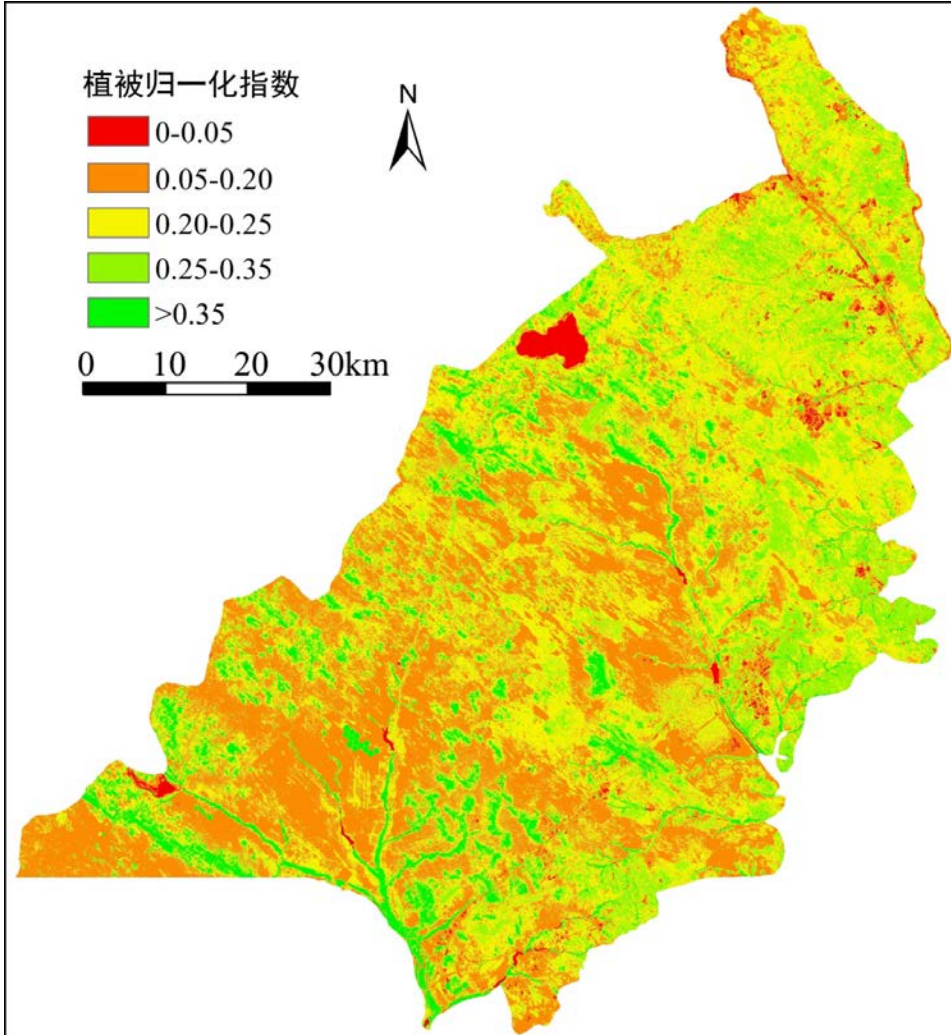
Stratigraphic Unit			Thickness (m)	Histogram
System	Series	Formation		
Quaternary (Q)	Holocene (Q4)	phreatic sand aquifer	0-149.6	
	Upper Pleistocene (Q3)	Sa1 loess (S)	0-166	
	Middle Pleistocene (Q2)	Lishi (Q2L)	0-154	
Neogene (N)	Pliocene (N2)	F2b laterite	0-175	
Jurassic (J)	Middle (J2)	Aniding (J2a)	0-297.87	
		Zhiluo (J2z)	0-237.01	
		Yan'an (J2y)	0-329.69	





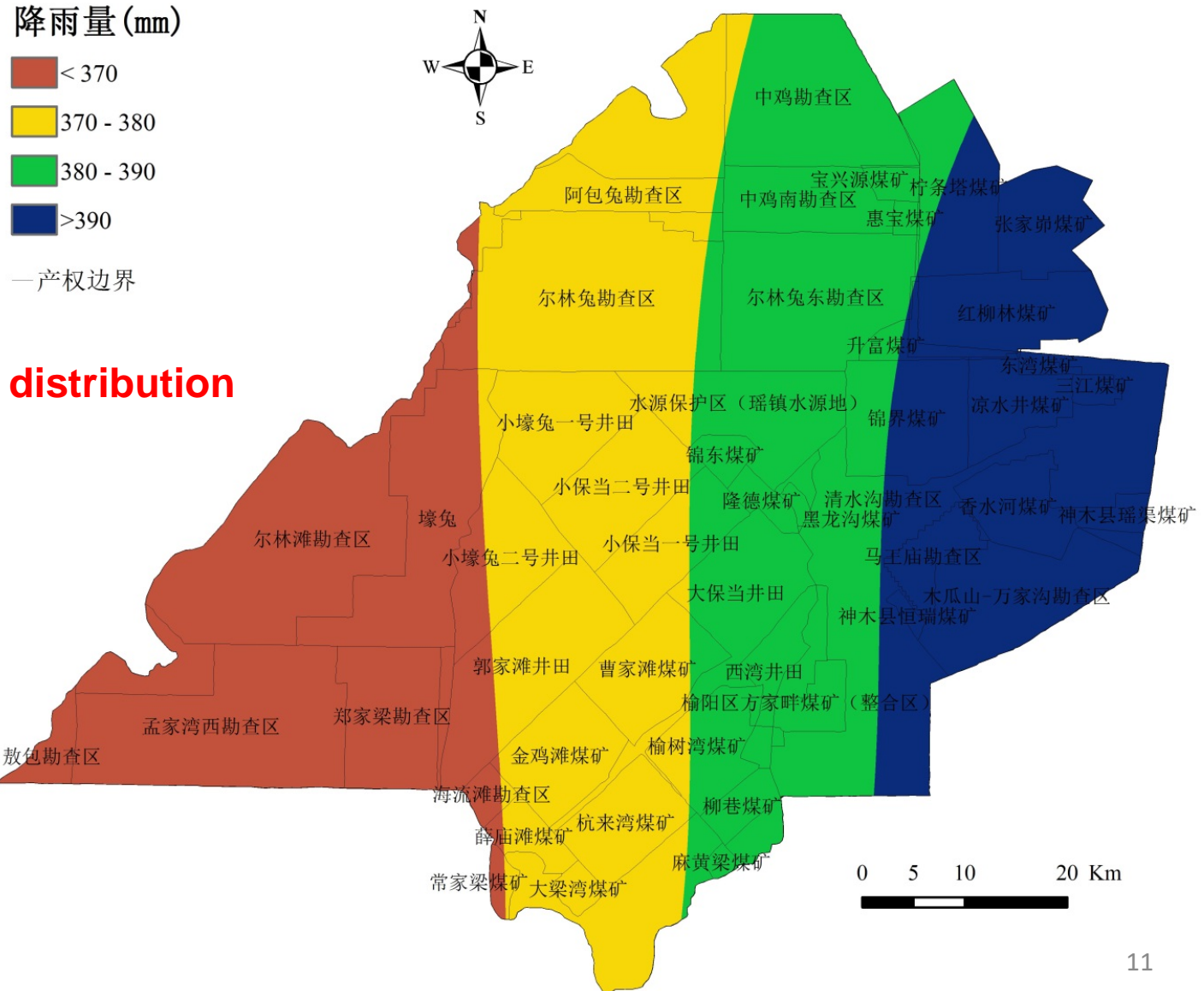
# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## ■ Digital distribution of surface vegetation





# 3. Case Study of the Impact of Coal Min. on Eco-eviron.



## Annual rainfall distribution

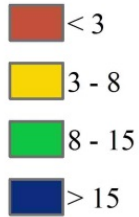




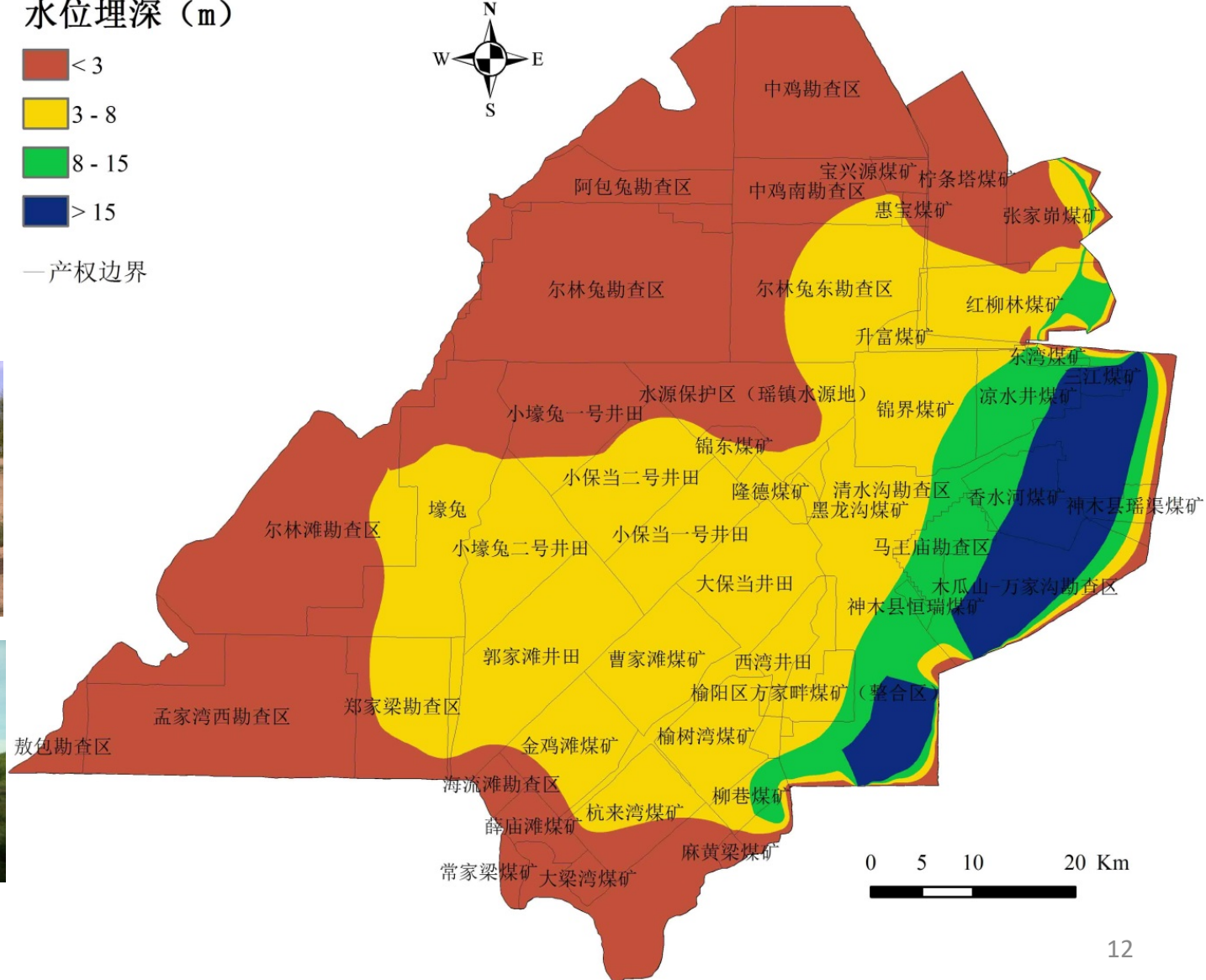
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■ Depth of water level

水位埋深 (m)



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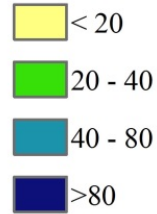




# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

**Thickness of sand phreatic aquifer**

砂层厚度 (m)



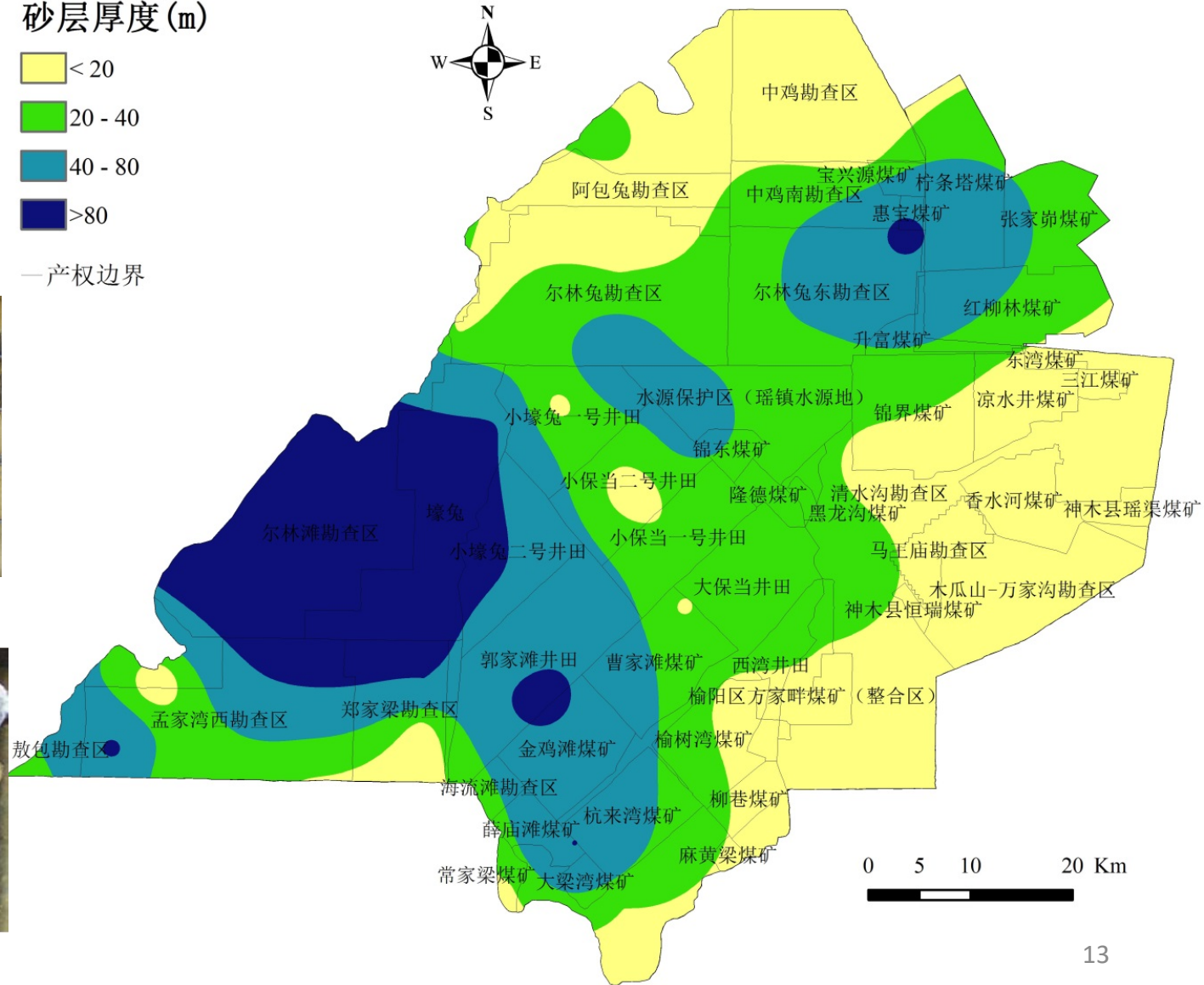
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Aeolian sand(Q<sub>4</sub>)



Salawusu sand (Q<sub>3</sub>)

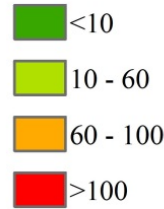




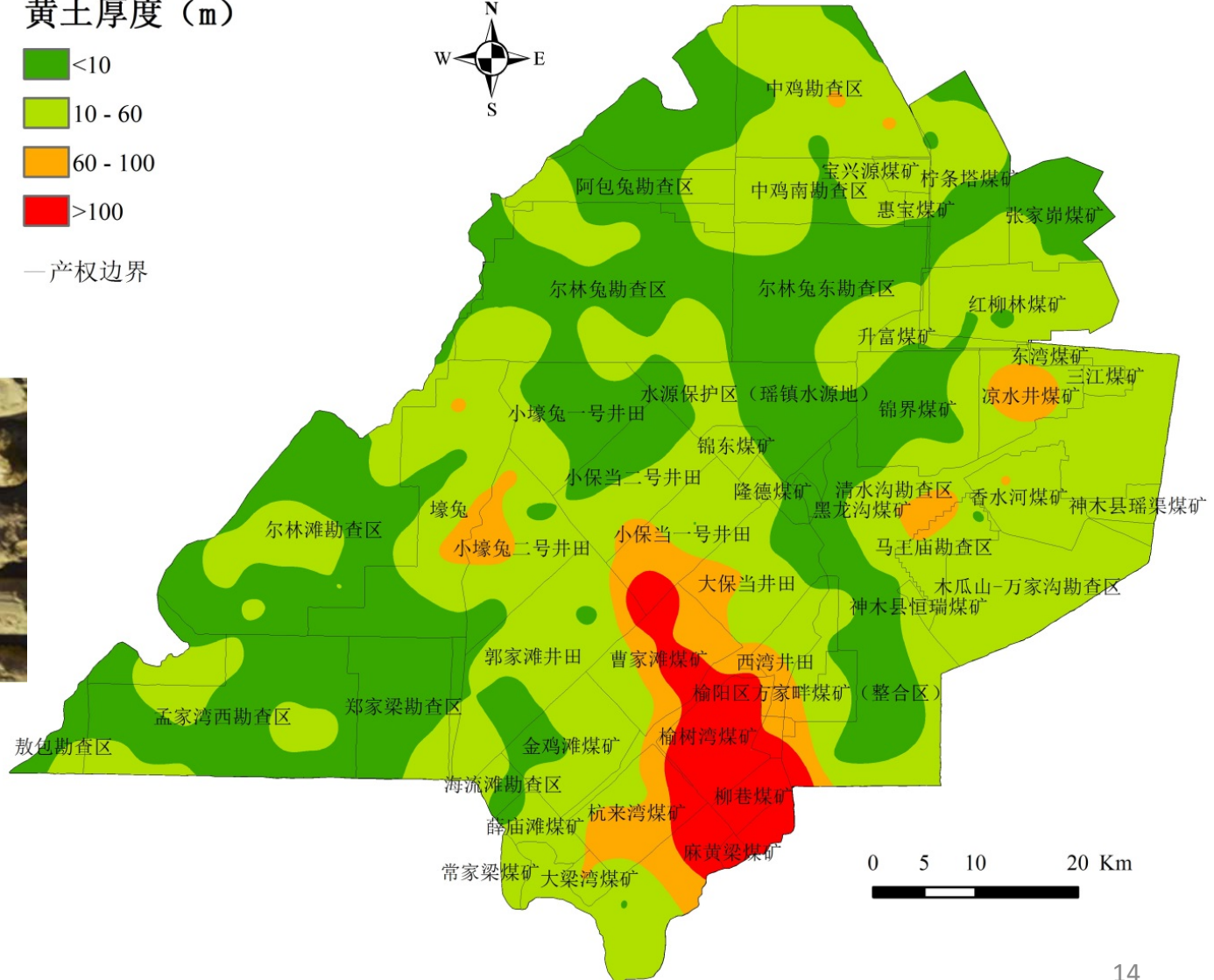
# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

**■ Thickness of loess**

黄土厚度 (m)



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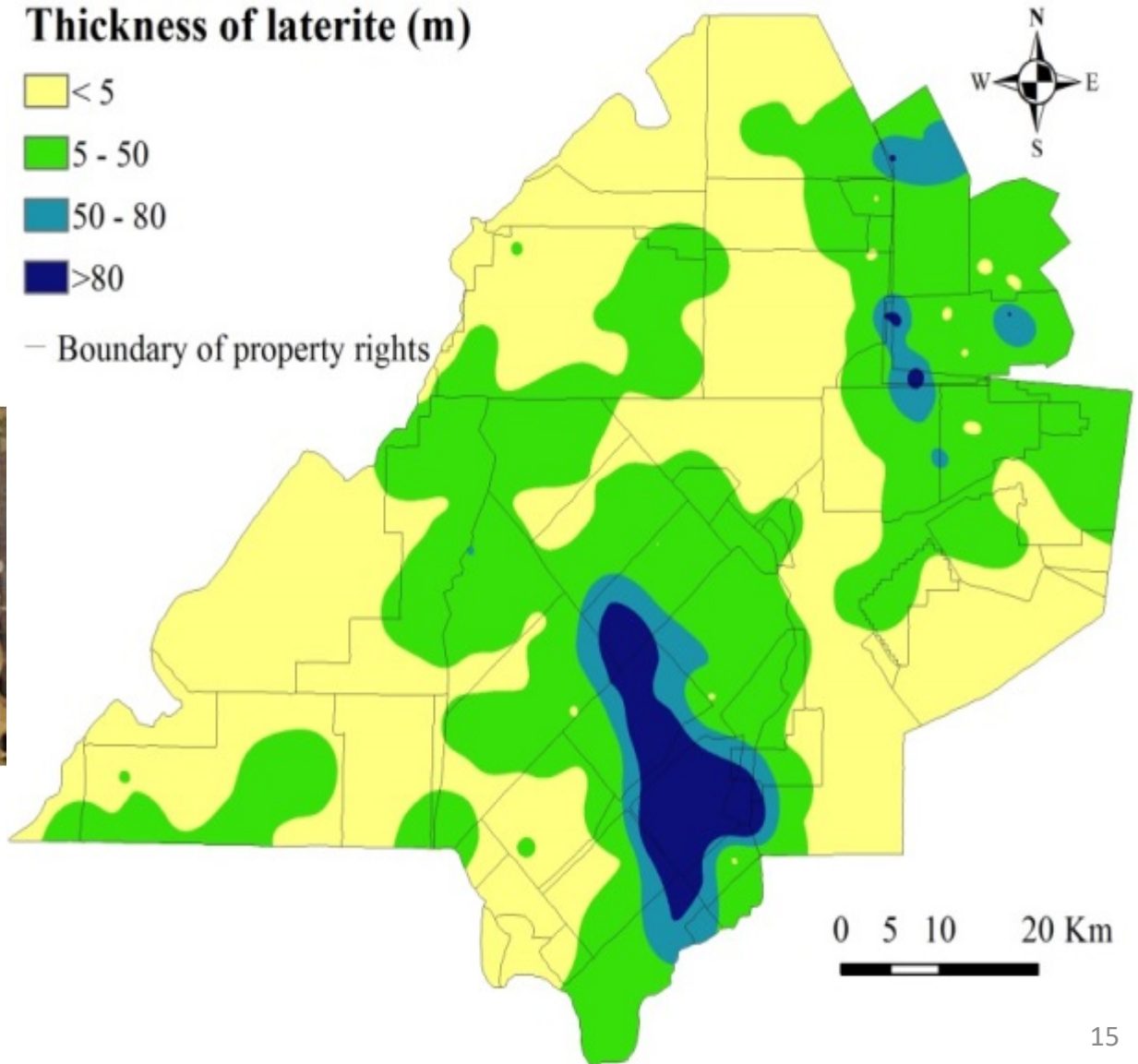
# 3. Case Study of the Impact of Coal Min. on Eco-viron.

## ■ Thickness of laterite

Thickness of laterite (m)

- < 5
- 5 - 50
- 50 - 80
- > 80

— Boundary of property rights



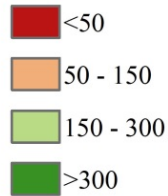




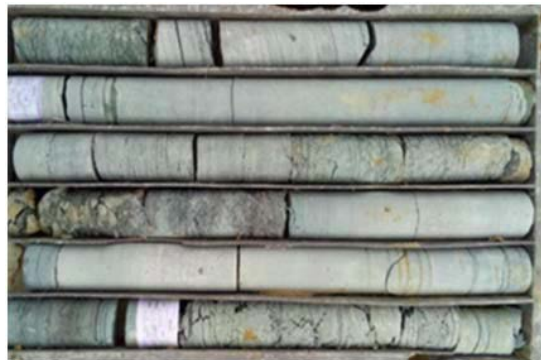
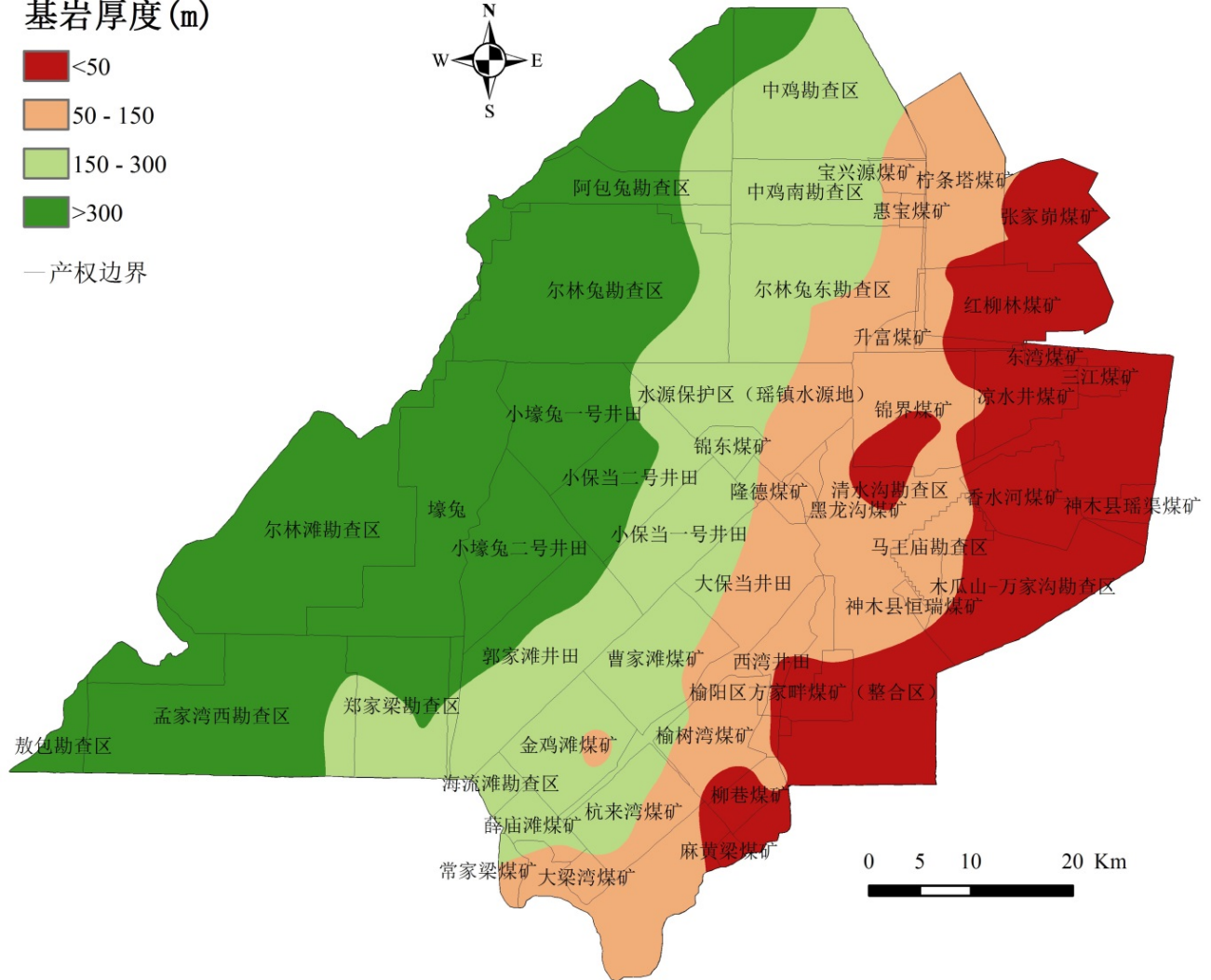
# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## ■ Thickness of overlying bedrock

基岩厚度 (m)



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# 3. Case Study of the Impact of Coal Min. on Eco-viron.

■ Thickness of coal seam

Thickness of coal seam (m)

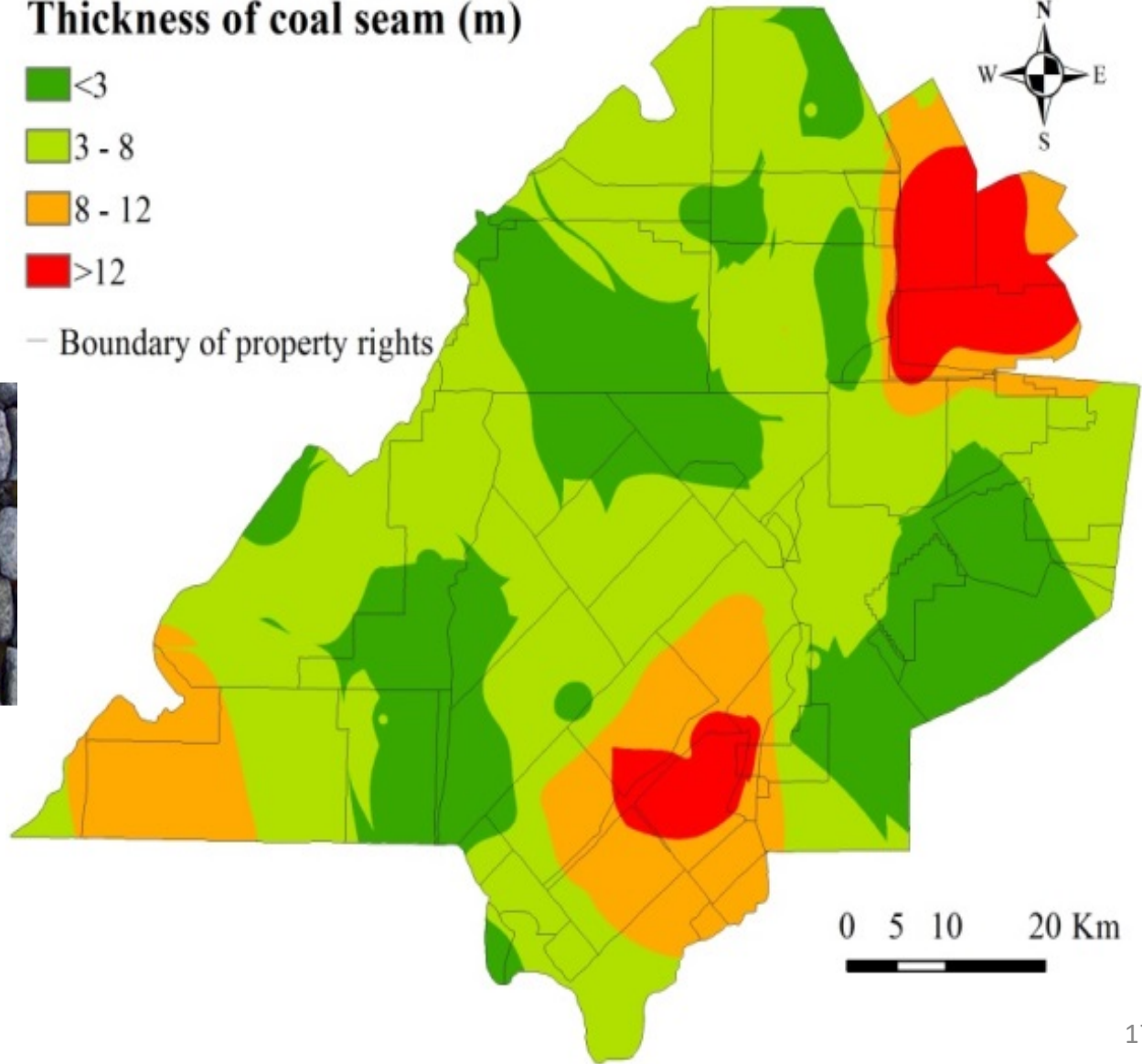
<3

3 - 8

8 - 12

>12

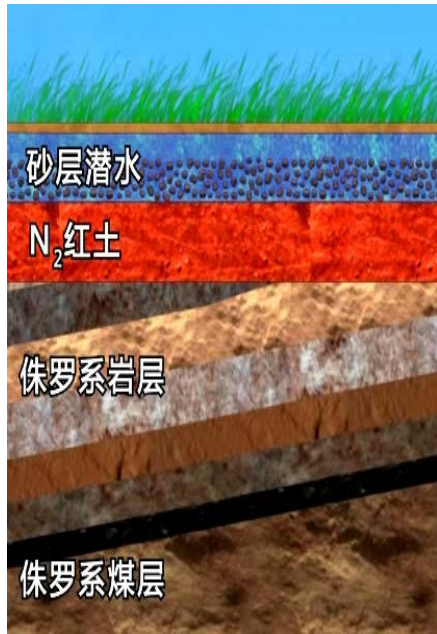
— Boundary of property rights



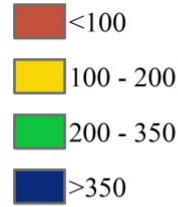


# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

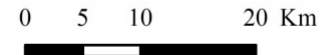
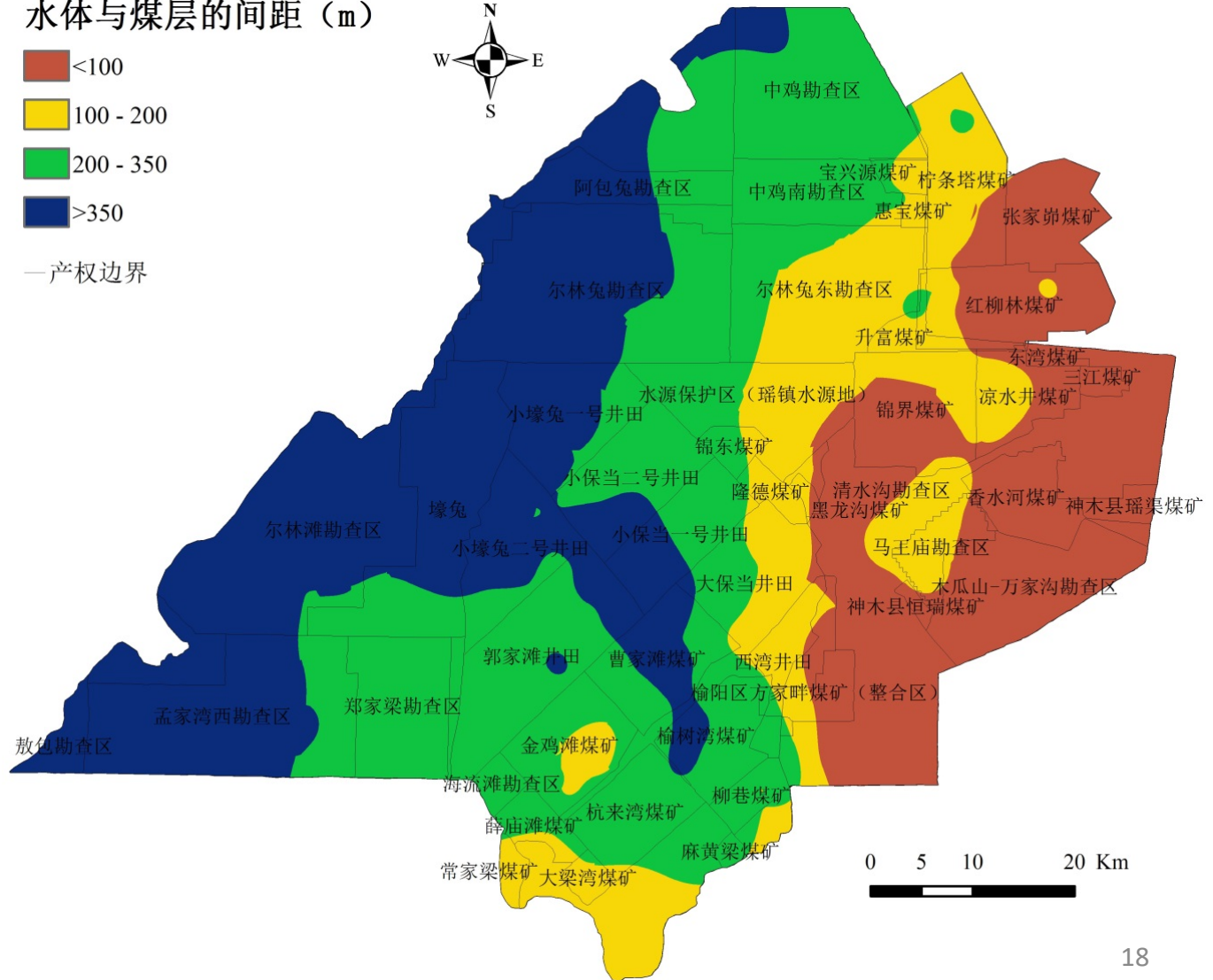
## ■ Spacing between water and coal seam



水体与煤层的间距 (m)



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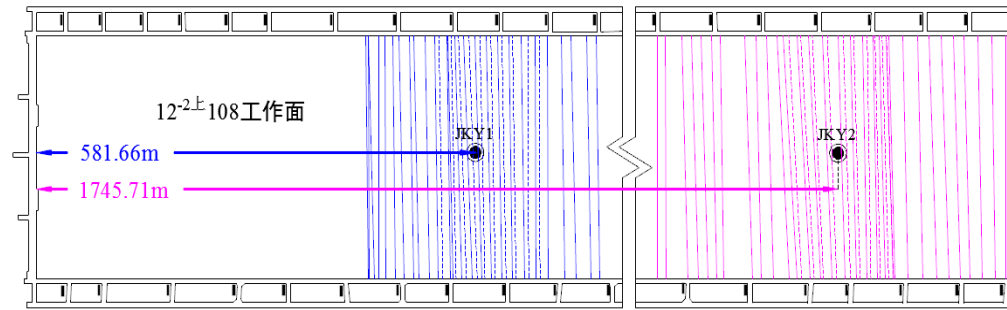




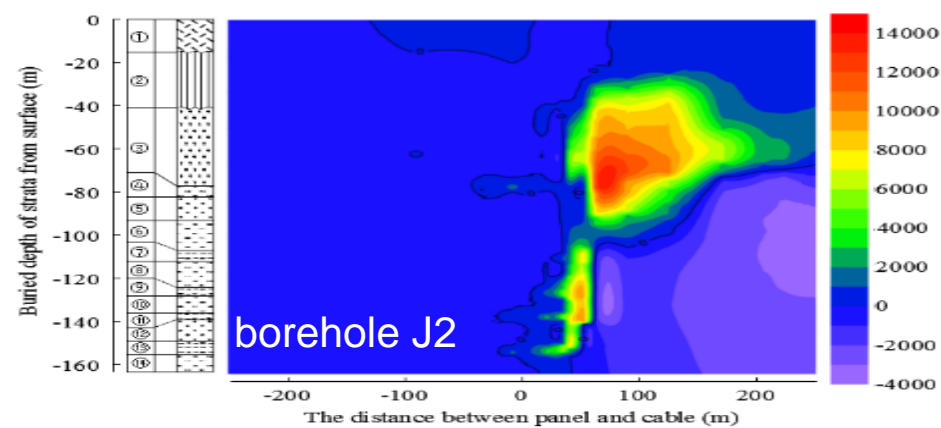
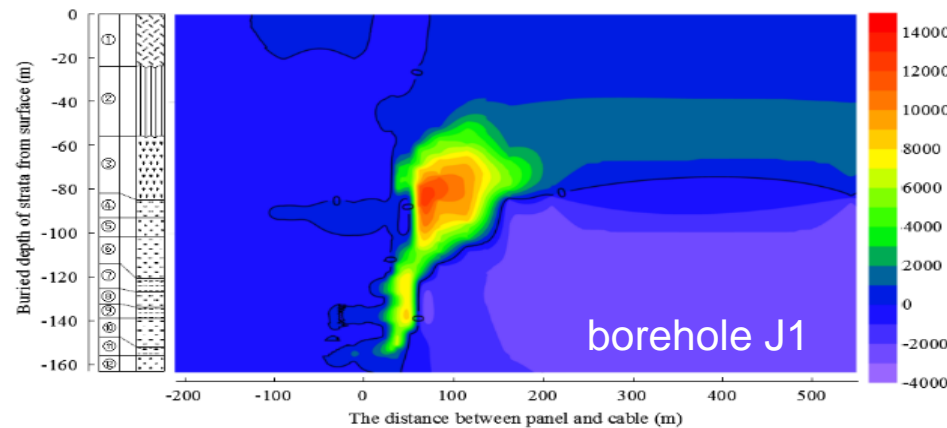
# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## 3.3 Researchs of Aquifuge Failure Due to Coal Mining

- In-situ testing of the dynamic failure process



Field installation of distributed optical fiber sensors



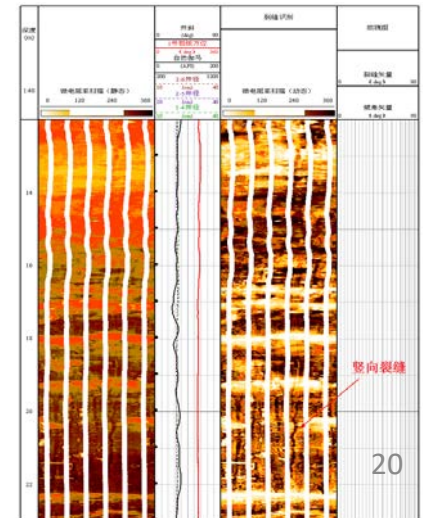
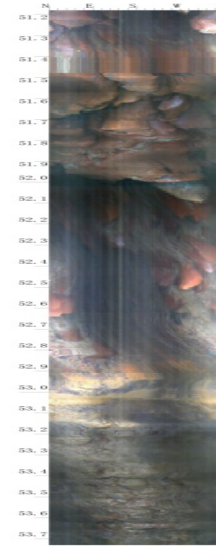
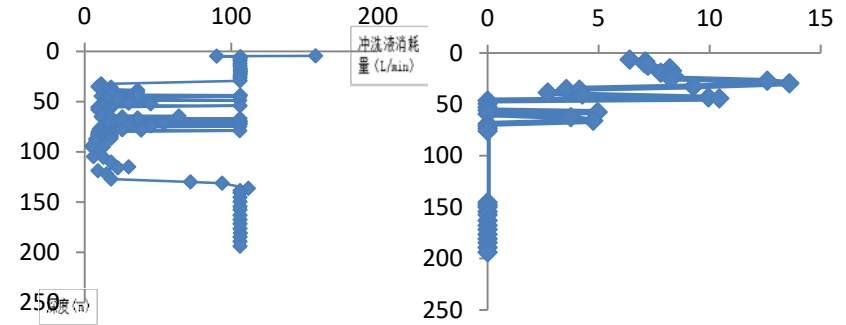
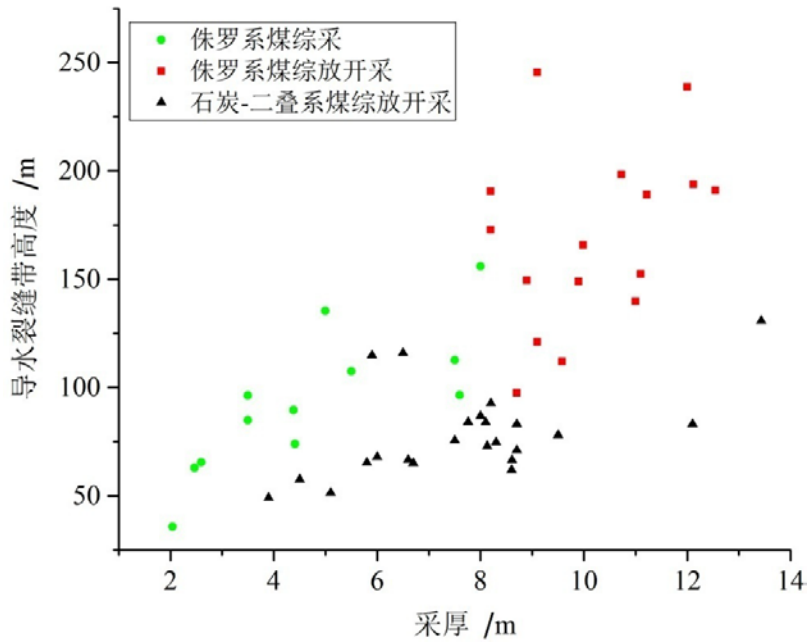
Variation in time and space of strain distribution during mining





# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## ■ Height Prediction of Water Flowing Fractured Zone of coal mining



$$H_{li} = 4.82M + 60.13 \ln \frac{s}{100} + 3.43M \ln \frac{b}{100} + 16.17$$

Prediction formula





# 3. Case Study of the Impact of Coal Min. on Eco-viron.

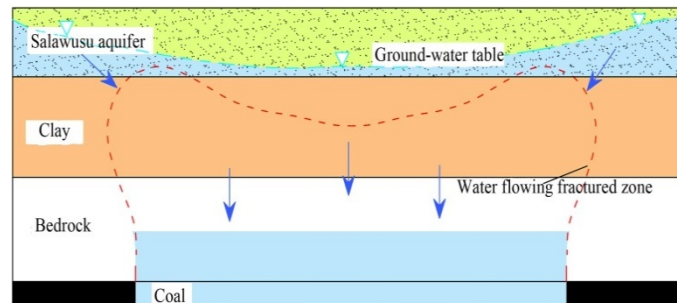
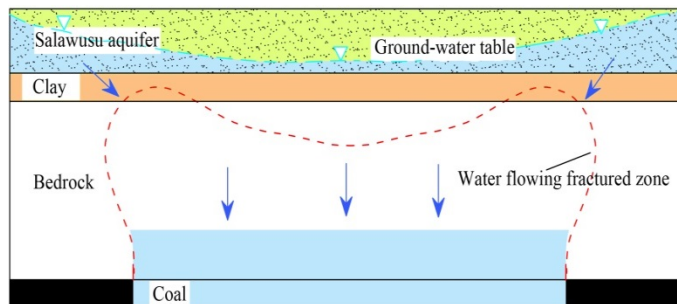
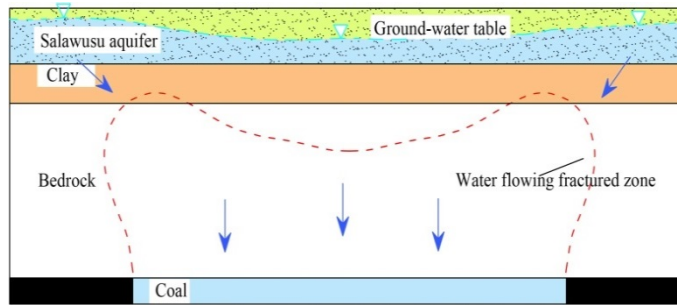
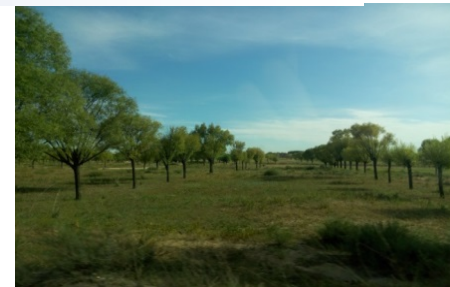
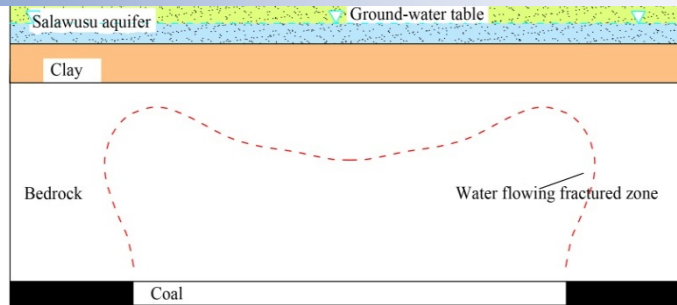
## 3.4. Four Models of Eco-environment Changes

**Basically unaffected**  
(environment-friendly)

**Gradually restored after destruction**  
(environmental gradual recovery)

**Gradually deteriorated**  
(environmental gradual deterioration)

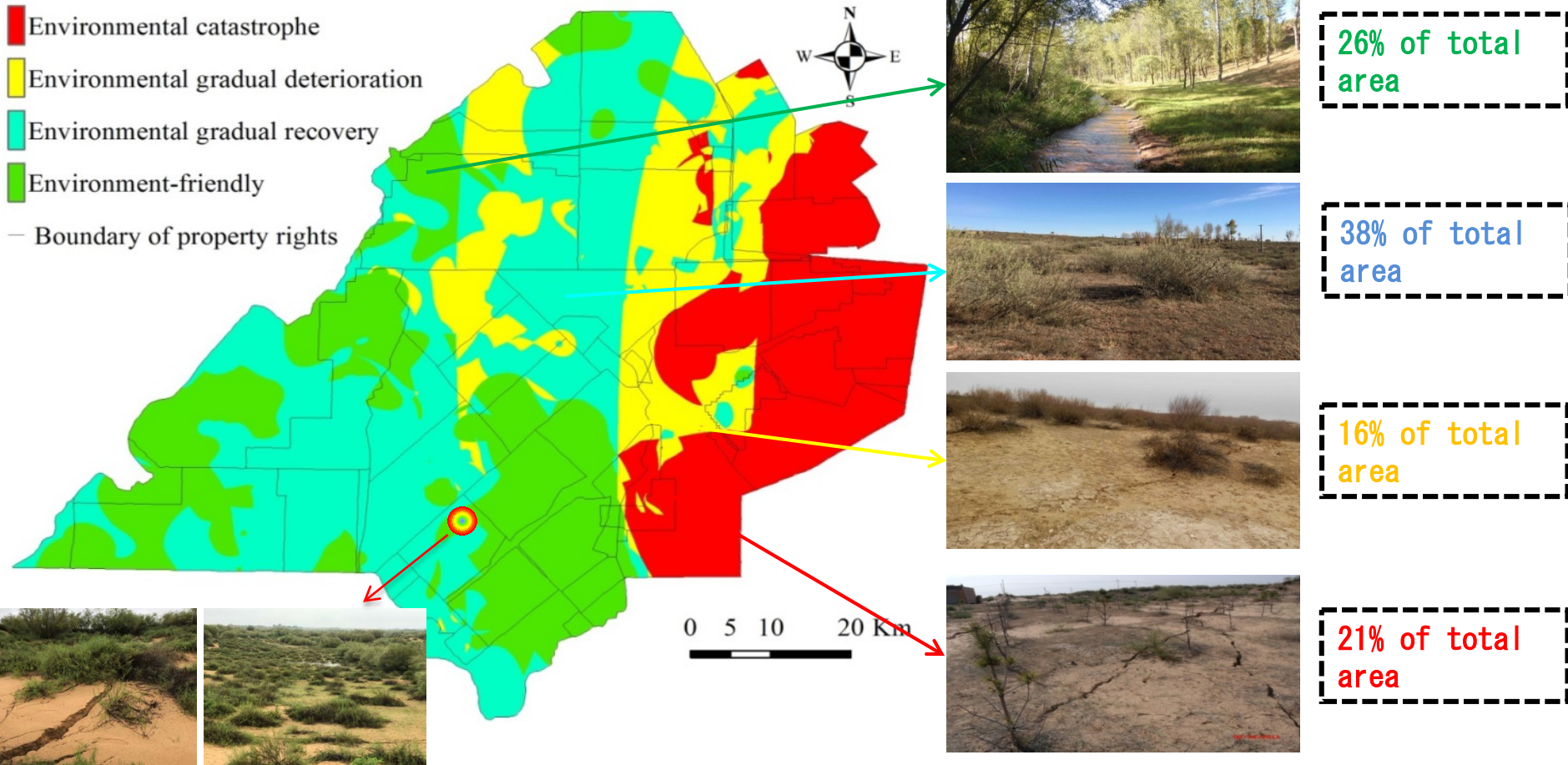
**Disaster changed**  
(environmental catastrophe)





# 3. Case Study of the Impact of Coal Min. on Eco-eviron.

## 3.5 Results of Predictive Evaluation



Practical verification of environmental change after coal mining

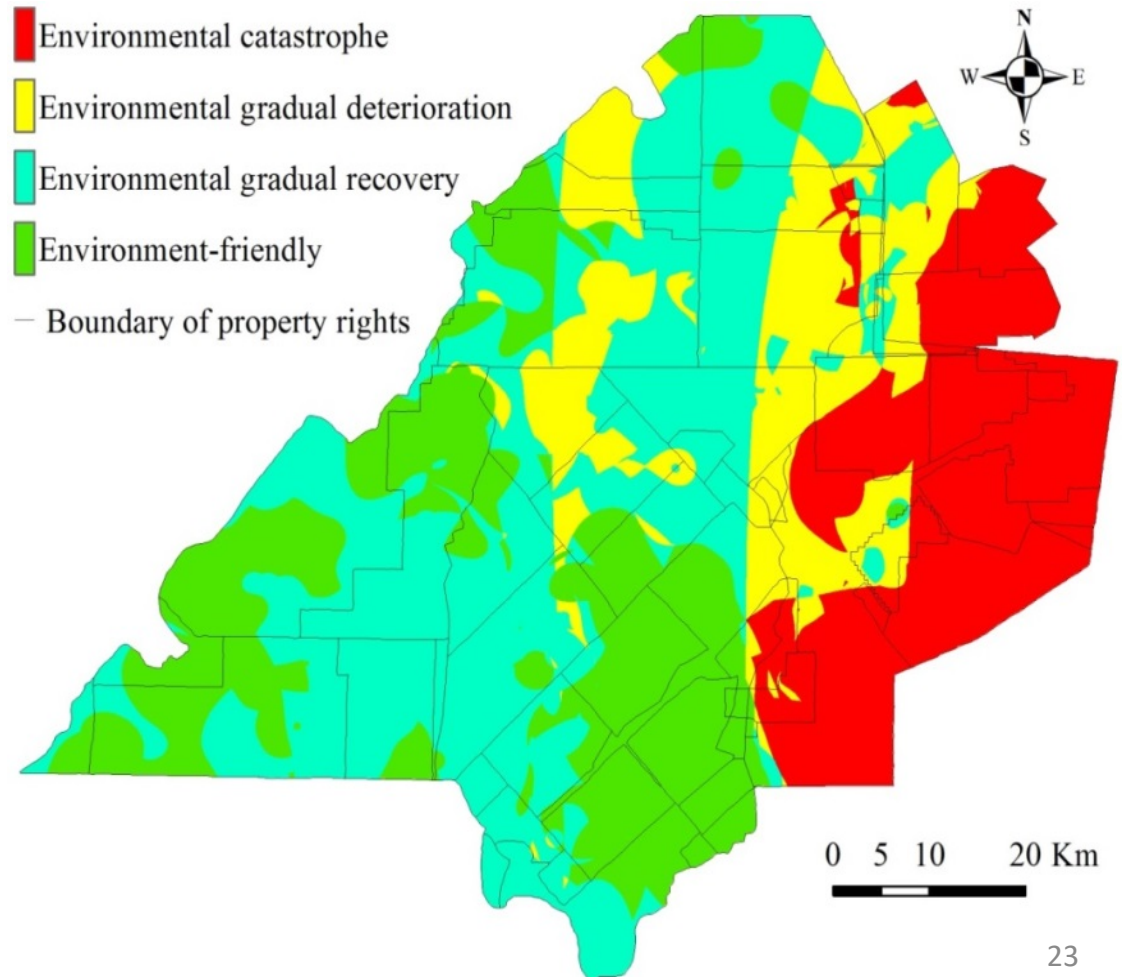




## 4. Countermeasures of Control

In order to prevent and control the catastrophic damage of the eco-environment impacted by the large-scale development of coal in West China, we'd like to put forward the following major countermeasures.

- **First of all, the eco-environment assessment impacted by coal mining in West China area should be carried out.**
- **Secondly, the corresponding Scientific Capacity of Coal Yield(according to Qian Minggao et al) should be determined according to the results of the eco-environment assessment.**

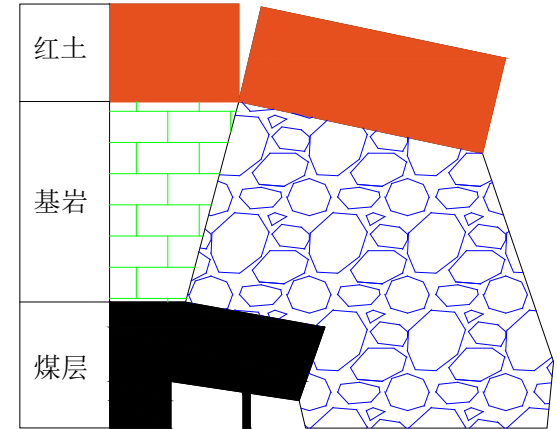






# 4. Countermeasures of Control

Thirdly, we should take measures to reduce the damage to the ecological environment, such as **slice mining limited thickness**, **filling mining**, **strip mining**, and so on.



Fourthly, ecological environment restoration should be carried out, particularly in the areas of the eco-environment disaster changed and gradually deteriorated.





## 5. Conclusions

- ❑ China is one of the few countries with coal as the main energy source, environmental pressure impacted by coal exploitation is enormous, particularly in the west China.
- ❑ From the system structure of eco-hydrosphere and coal measures geology, the key problems of science and technology related to the impact of coal mining on the eco-environment in the west China are discussed.
- ❑ Four models of eco-environment changes impacted by coal mining in the west China are discussed and put forward.



## 5. Conclusions

- ❑ **A case study shows the impacting conditions of coal mining on the eco-environment , researching method and results.**
- ❑ **The corresponding countermeasures to control the destruction of eco-environment impacted by coal mining in the west China are recommended.**





**Thank you for  
your attention!**