Agro-disaster Assessment with Satellite Data for Crop Insurance Payments

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- *“A superior person cares justice and morality, while a villain keeps his mind only on benefits”.*

- Confucius

Outline

- **Agriculture Insurance in China**
- **Agro-disaster Assessment**
  - Maize Floods
  - Cotton Floods
- **Conclusion**

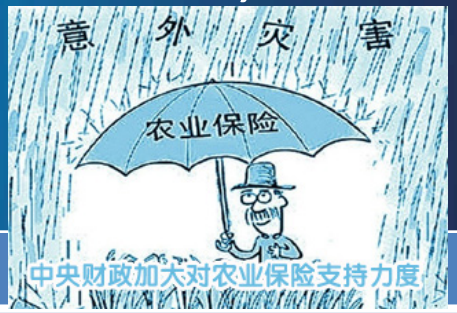
Agriculture Insurance in China

- Chinese government emphasized the importance of agriculture and published 9 documents of “No.1 Central Document” sine 2004.

- The government canceled all agricultural tax in 2006.

Agriculture Insurance in China

- Policy agricultural insurance in China was officially launched in 2006. The central finance 50% of the premiums, provincial and county finance 10-30%, the rest is paid by the farmers. For example, in Shandong province, the farmers will paid premiums like:



crop	Premium	Payment	Disaster
Wheat	10 RMB **per mu**	320 **per mu**	Fire, hail, windstorm, freezing disaster, floods, drought, pest
Maize	10 RMB **per mu**	300 **per mu**	Hail, floods, windstorm
Cotton	18 RMB **per mu**	450 **per mu**	Hail, floods

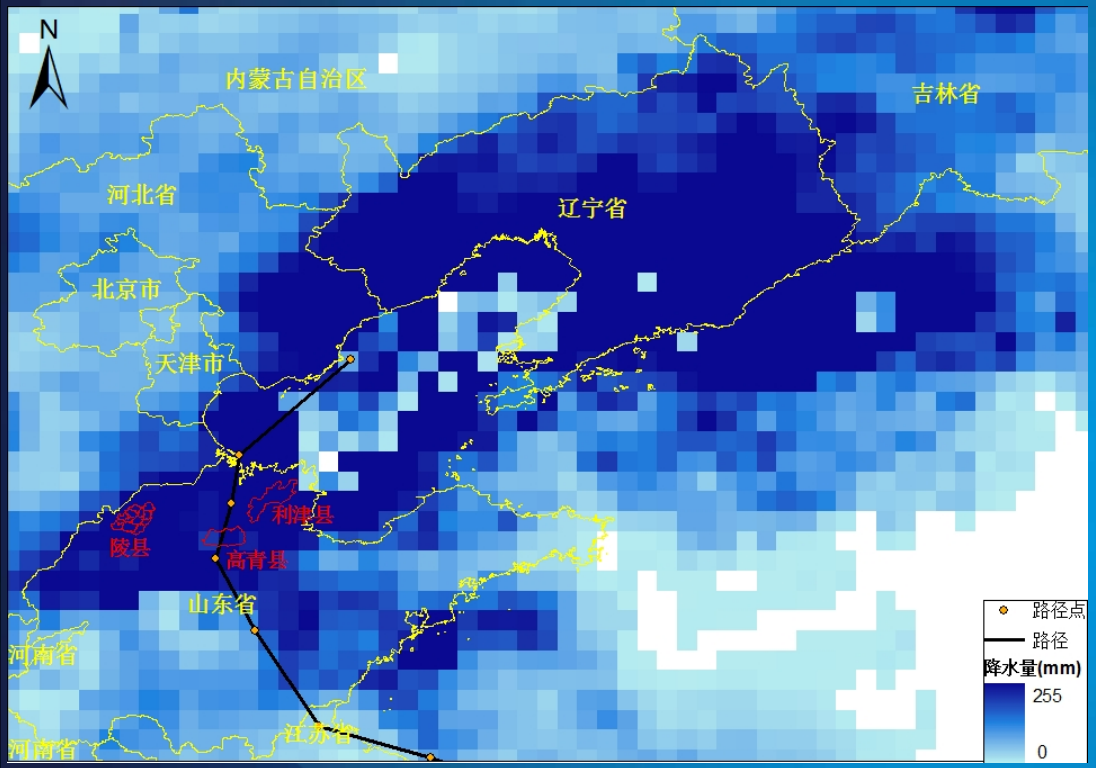
The agriculture insurance industry include serious risk factors

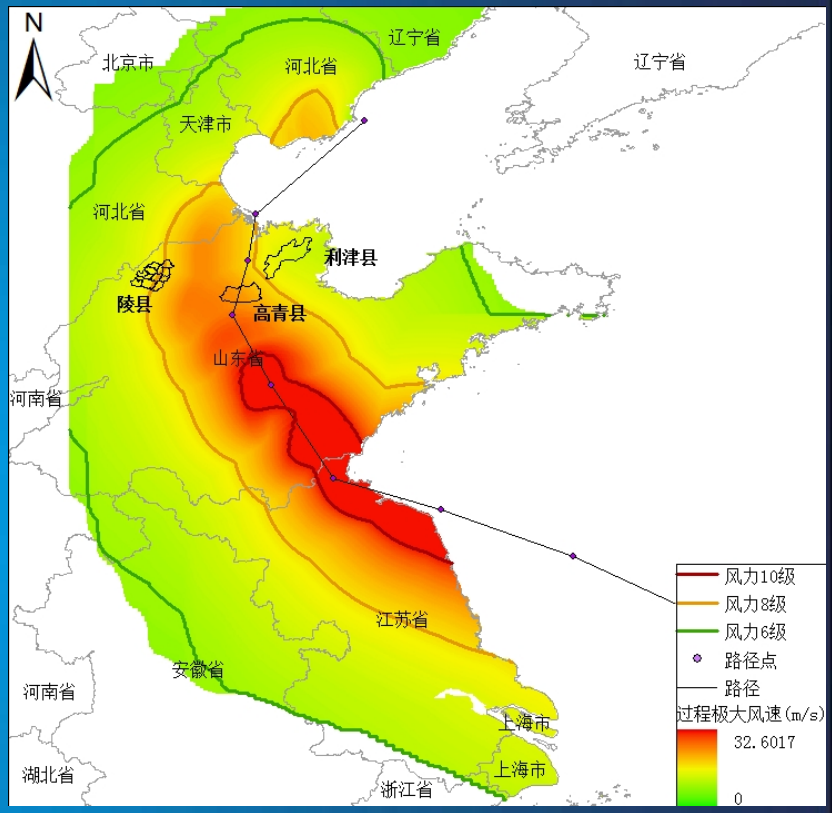
- Adverse selection, moral hazard, low efficiency of indemnity after disasters, high transactional costs, and large damage assessment errors.
- “Premium rates for the national agriculture insurance programs are negotiated between the insurers and provincial governments. ”

- Remotely Sensed agriculture insurance models have been developed to overcome the effects of adverse selection and moral hazard in traditional insurance models;

  Remote sensing information will facilitate fair negotiations, and the affected farmers will get compensation.

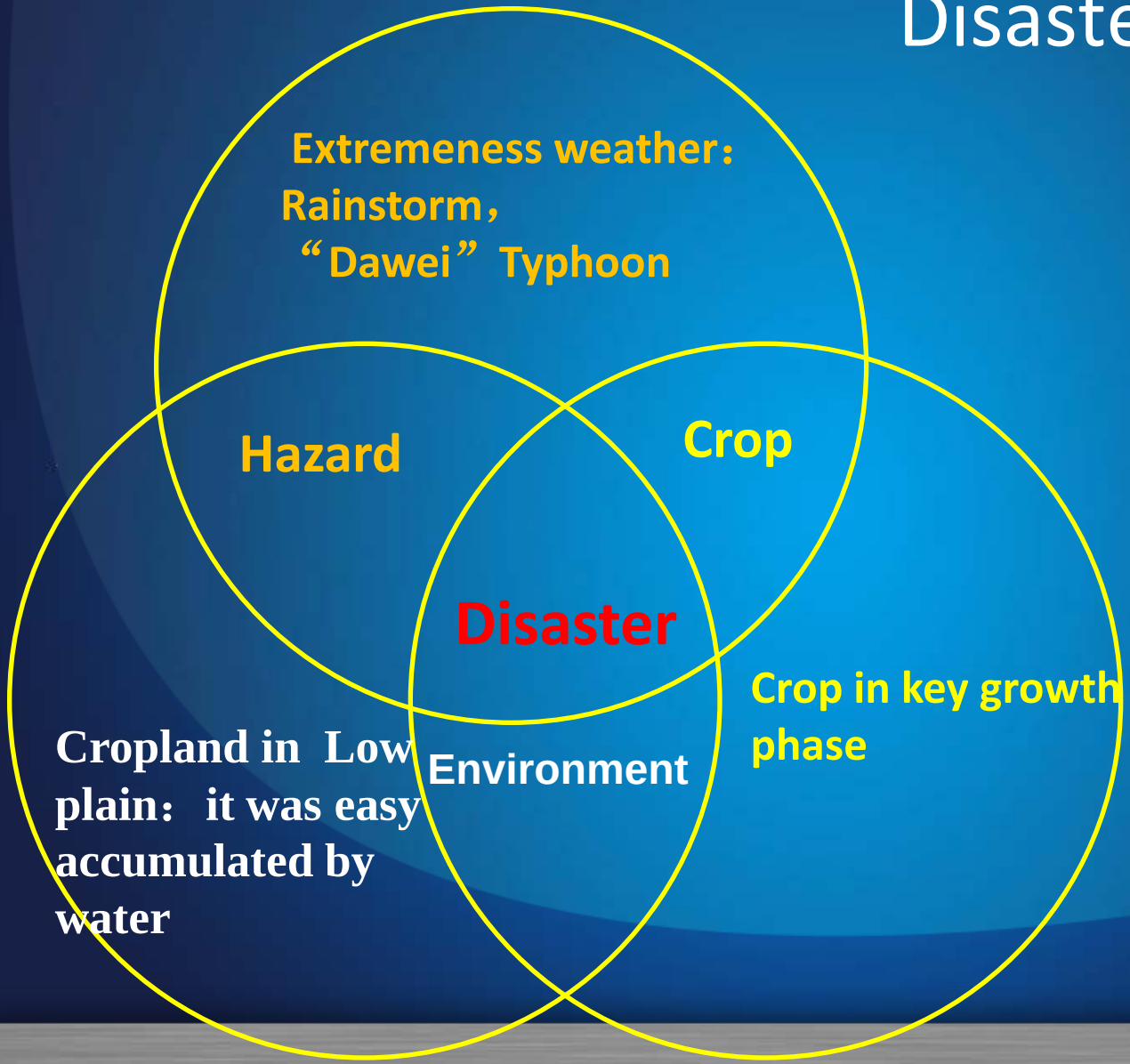
Study Area





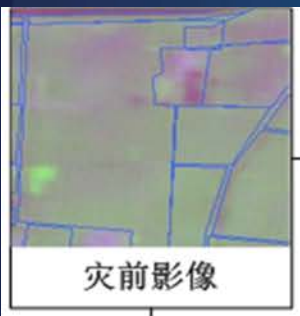
The study area were affected by rainstorm and typhoon-storms in the end of 2012 July and in early August.

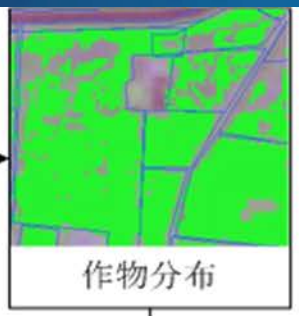
Disaster Reasons

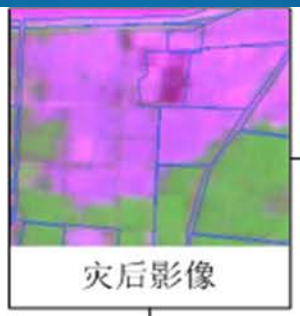


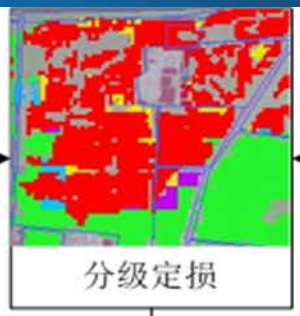
- Crop was in key growth phase and sensitive to flood.
- In addition, typhoon enhanced crop loss.

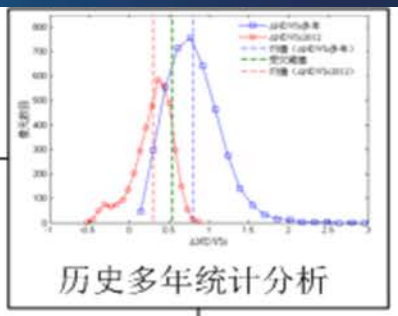
Technology flow include


灾前影像


作物分布

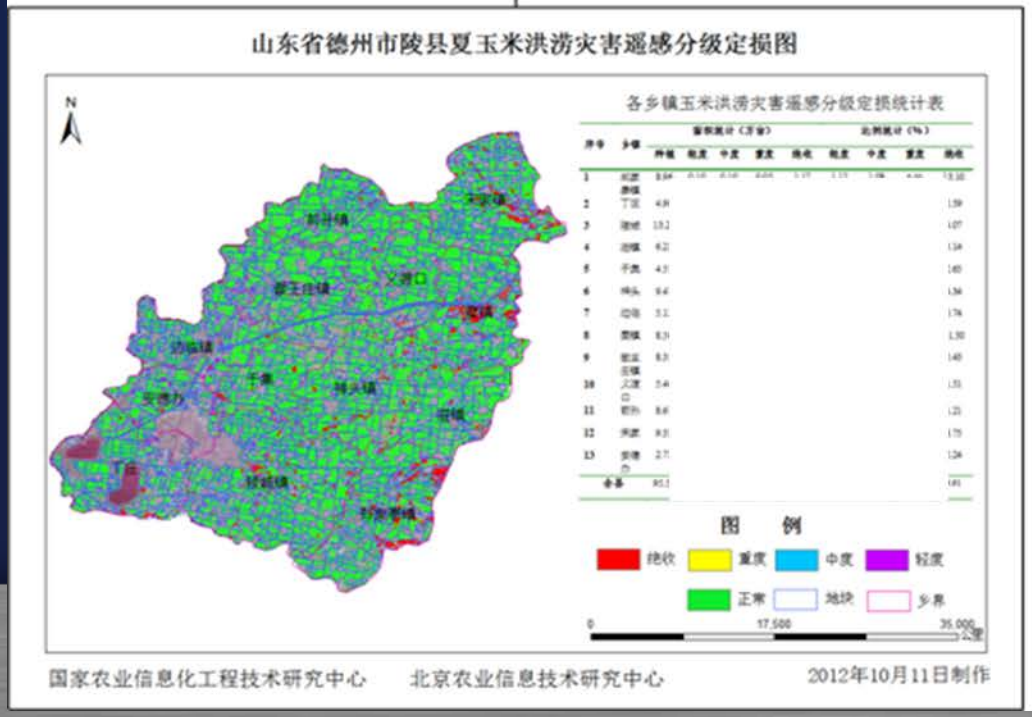

灾后影像

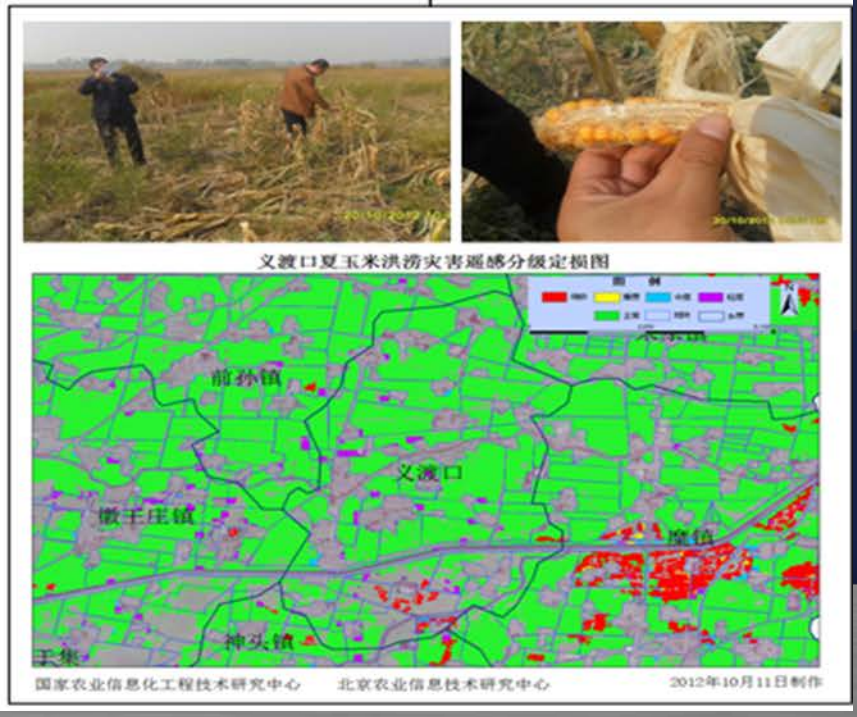

分级定损


历史多年统计分析

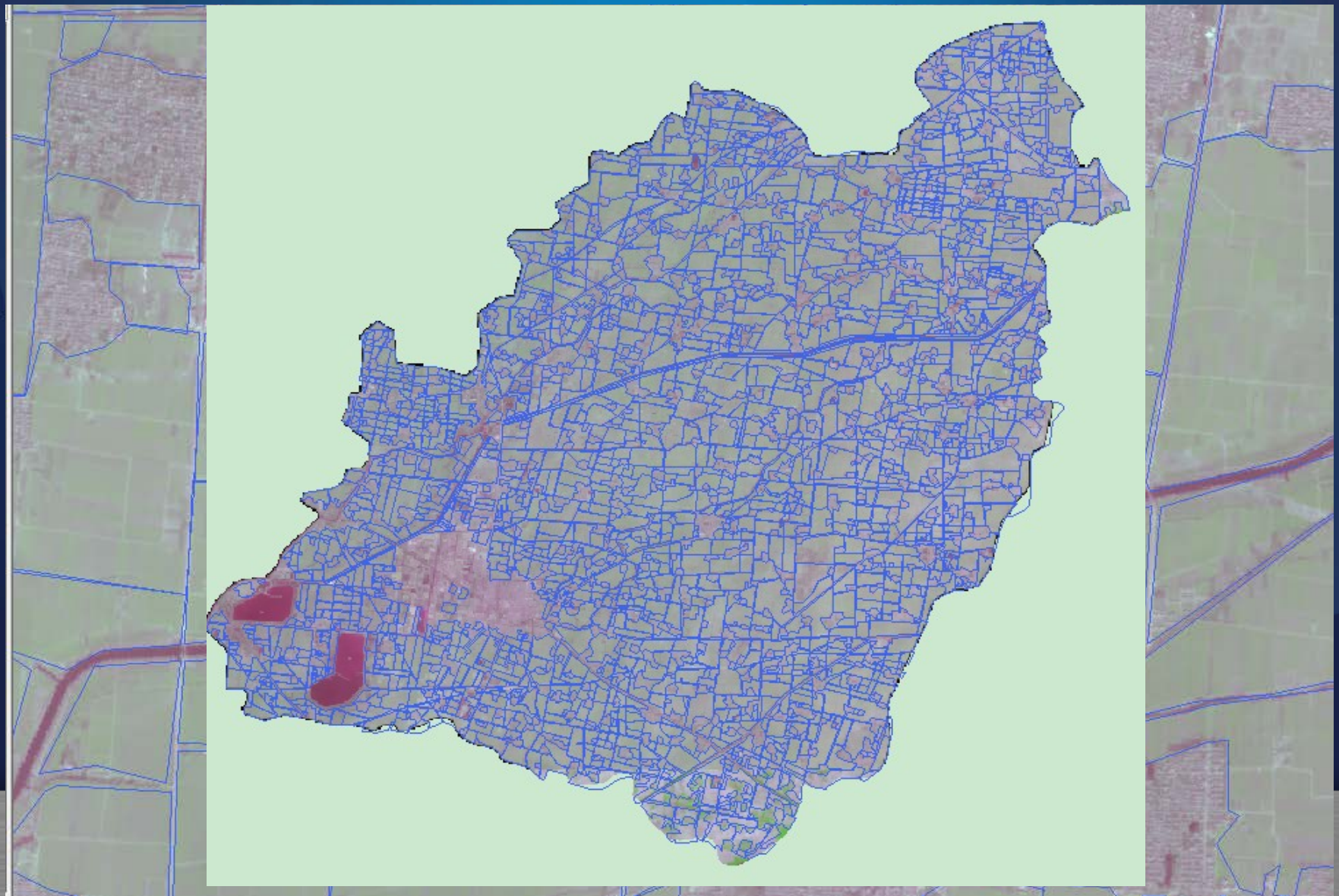
Identify **Crop distribution** → Do **Loss assessment**

give **Payments** ← Do **Investigation**



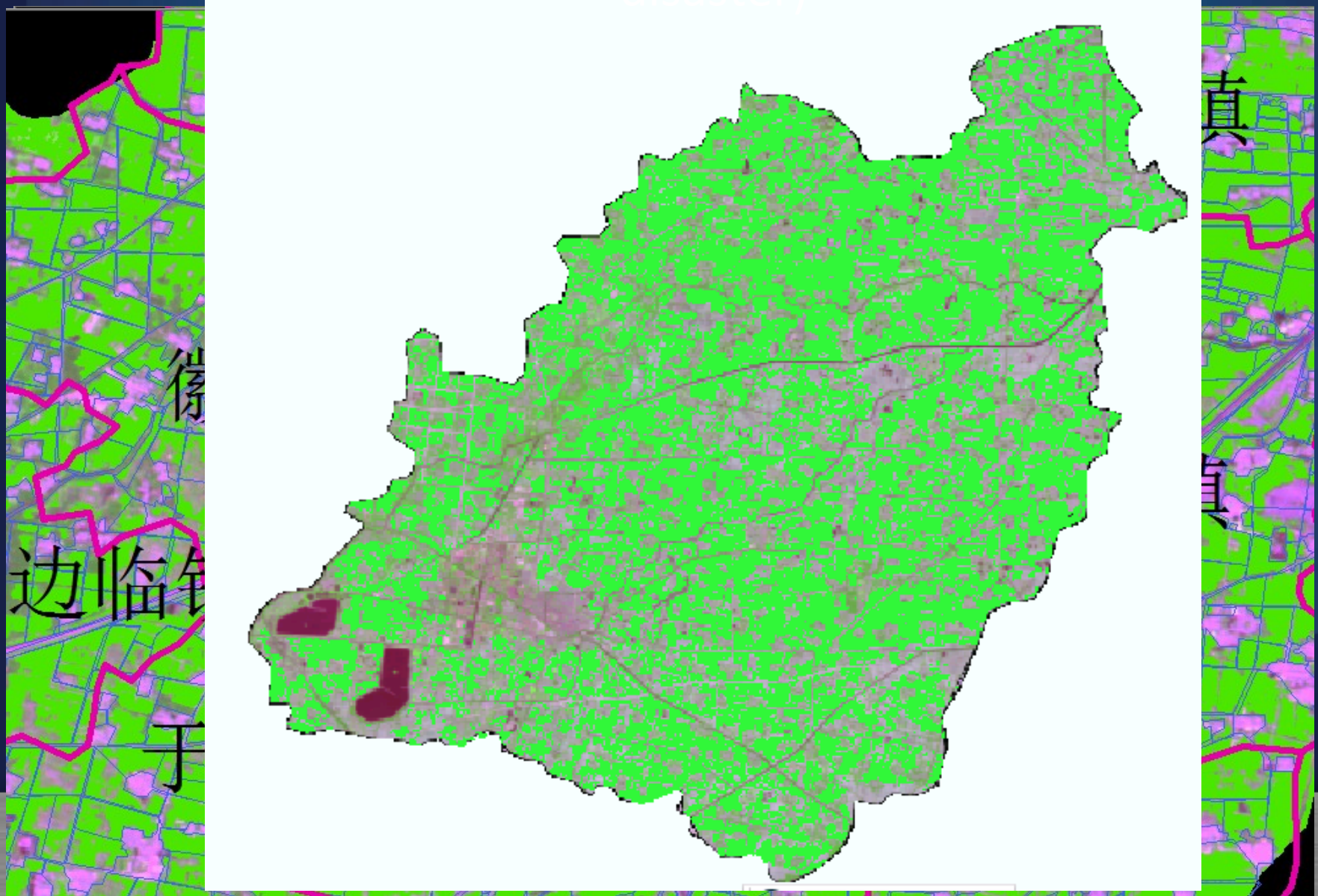


Parcel extraction based on High resolution satellite data

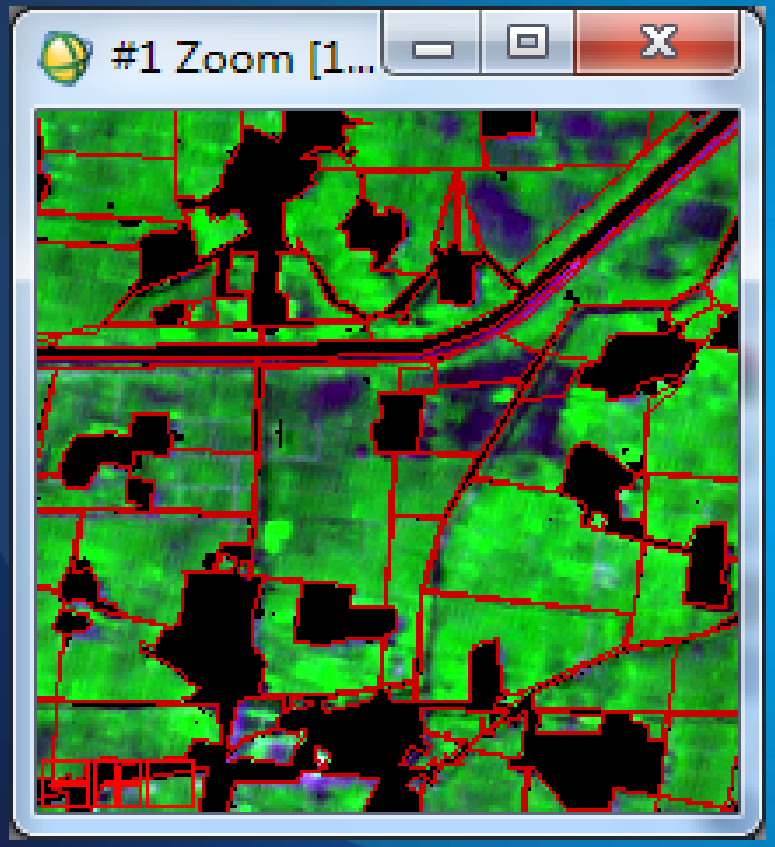


Corn spatial distribution was extracted based on multi-temporal HJ-1 satellite imagery (pre-disaster)

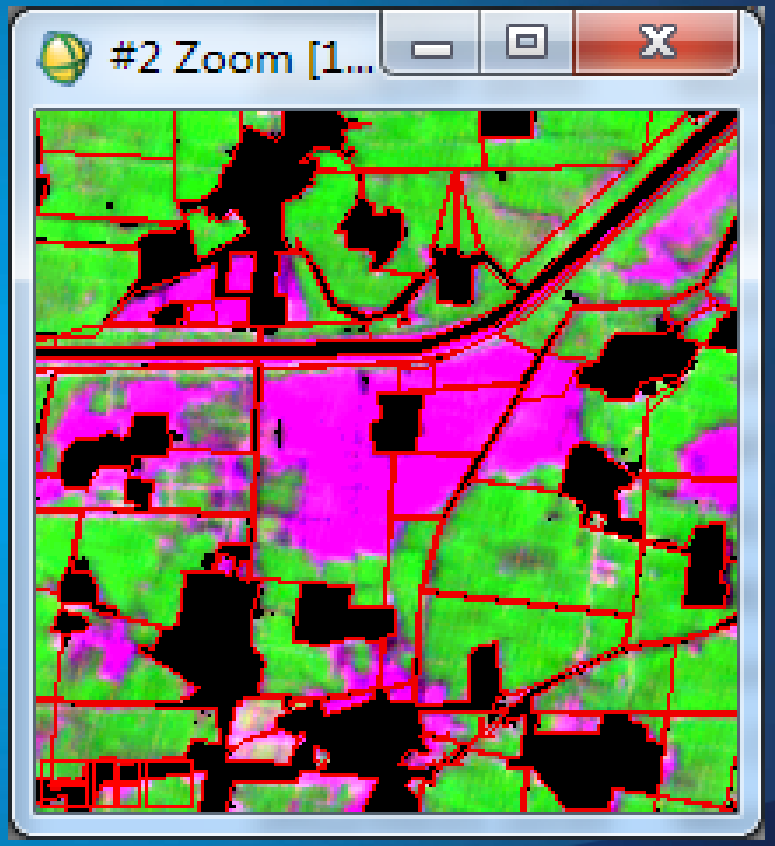
Corn spatial distribution was extracted based on HJ data (post-disaster)



Damage Threshold： no harvest corn

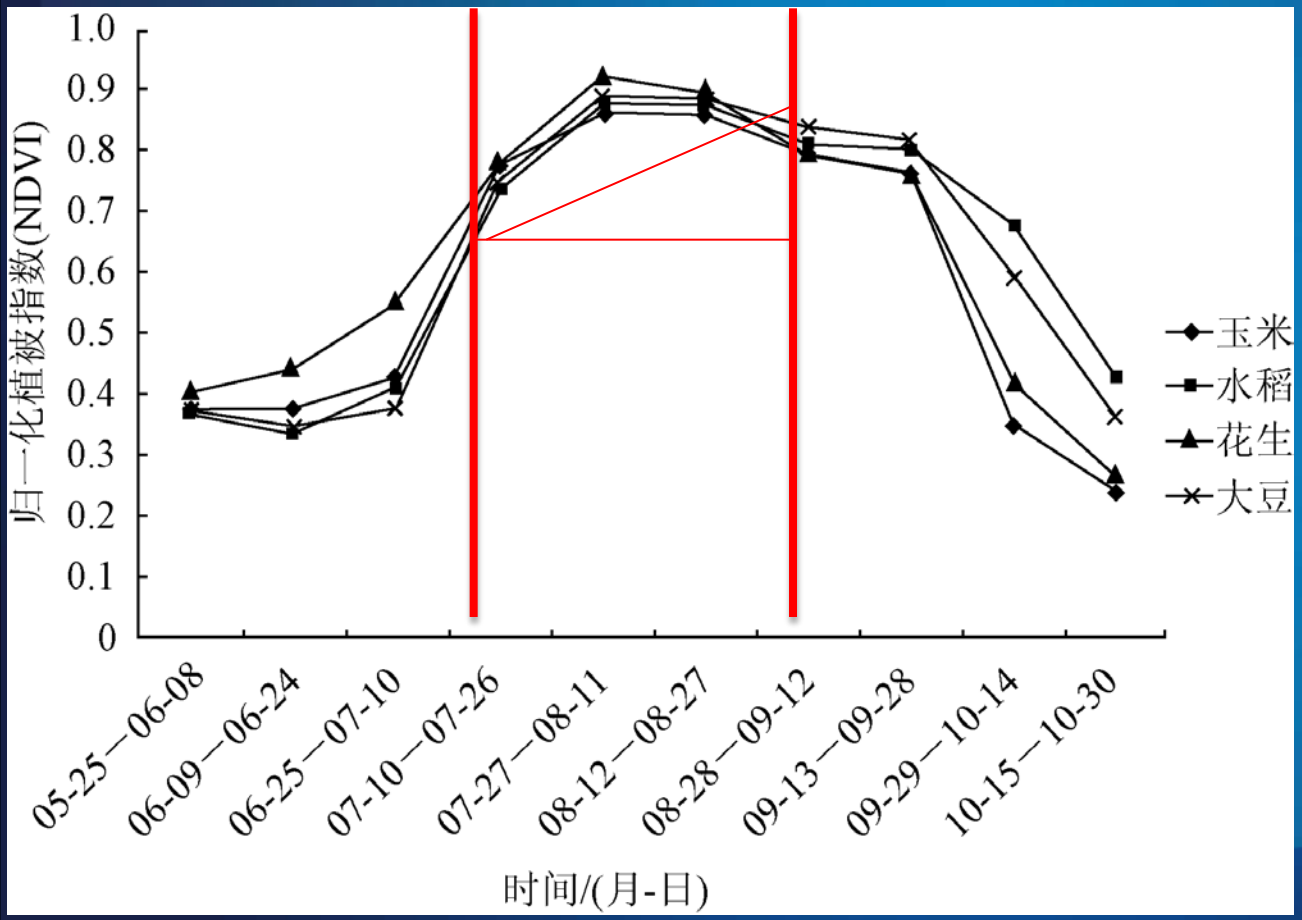


Vegetation



Bare land

Damage Threshold： portion harvest(damage) corn Using crop growth rate



The crop growth rate can reduce the impact of crop phenology

The greater the growth rate, indicating that the crop, the better!

$$\text{Growth rate} = \frac{NDVI_{post} - NDVI_{pre}}{NDVI_{pre}}$$

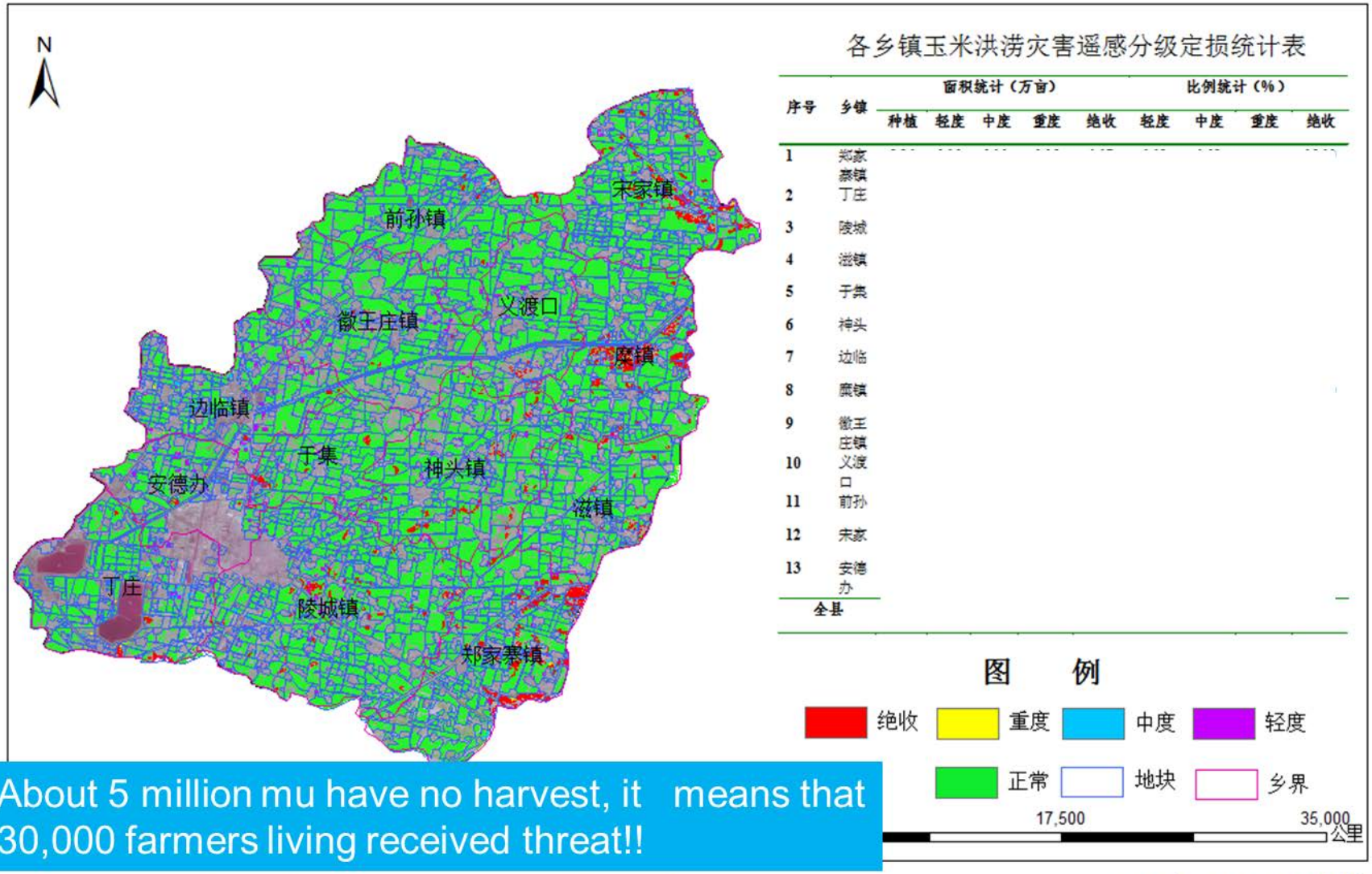
Damage:

$$\frac{\text{Growth rate (this year)}}{\text{Growth rate (Historical years)} - \sigma} < 1$$

No damage:

$$\frac{\text{Growth rate (this year)}}{\text{Growth rate (Historical years)} - \sigma} \geq 1$$

The thematic map of maize loss by floods



About 5 million mu have no harvest, it means that 30,000 farmers living received threat!!

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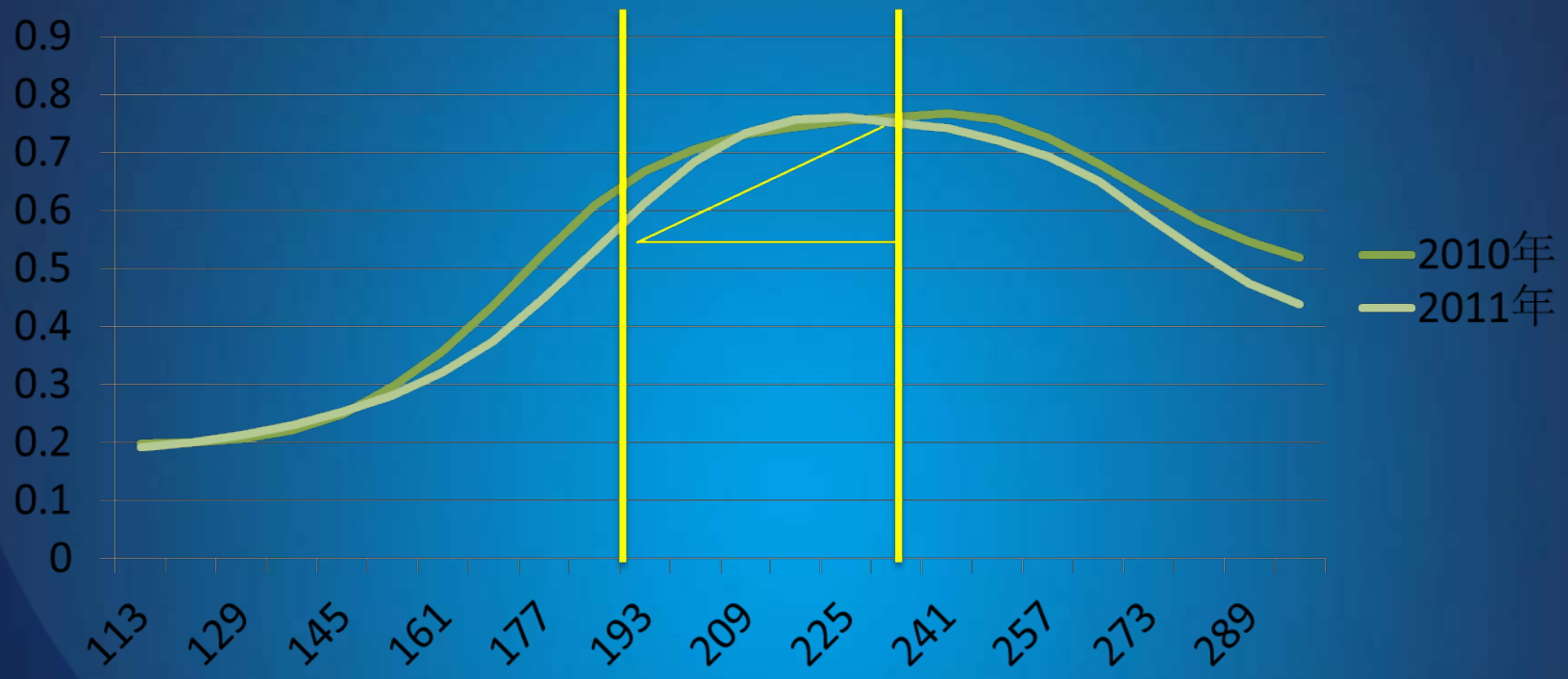


The average growth rate in 2010：13.91%
The average growth rate in 2011：22.46%
The average growth rate in past two years ：18.18%

Cotton Damage Threshold by remote sensing

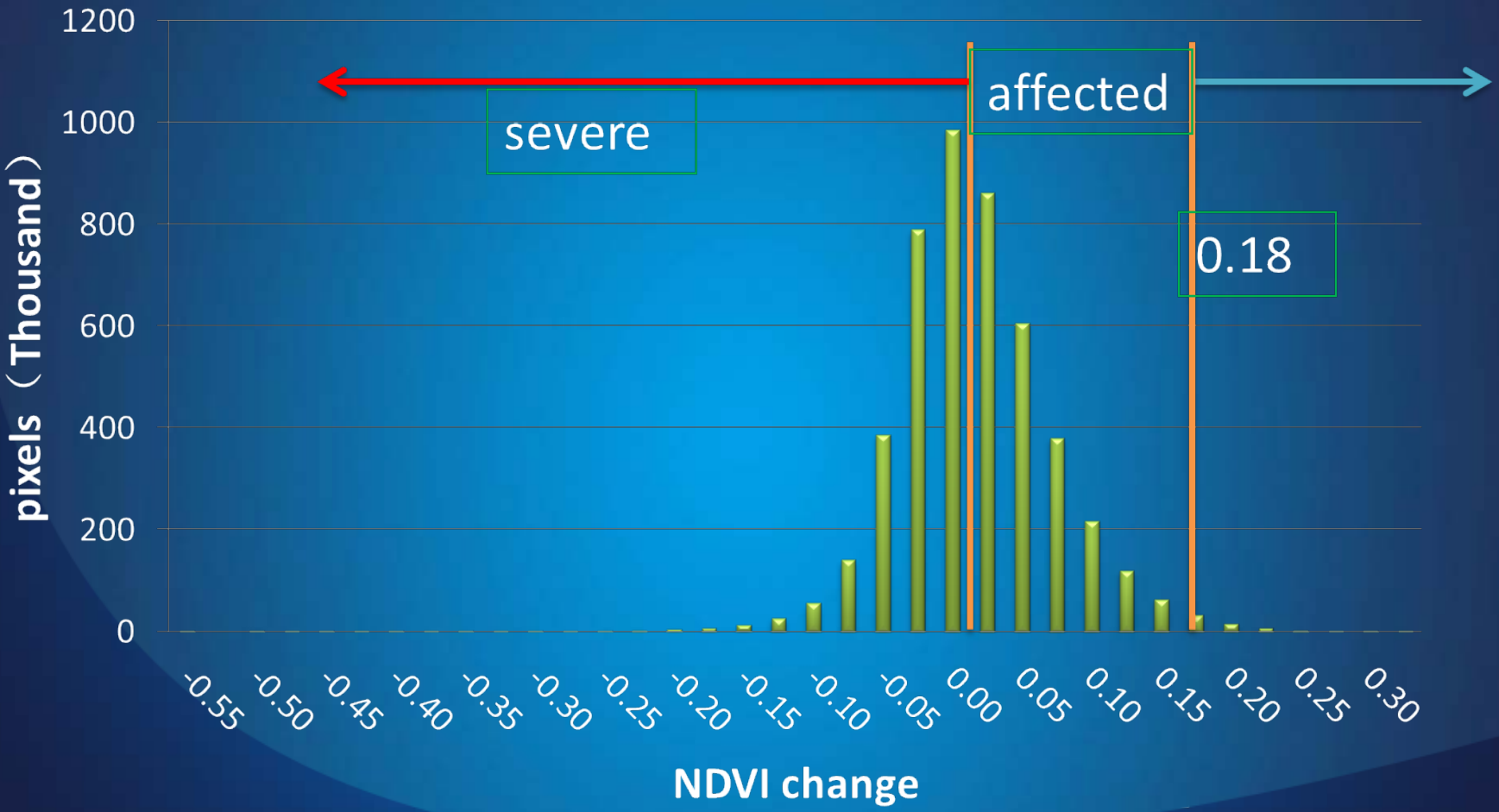
normal, slightly affected, severe affected , and no harvest

no harvest：The cotton fields were vegetation before flood and in the end of September is bare land or water.

Severe ： **NDVI(in boll peak period) < NDVI (in blooming period).**

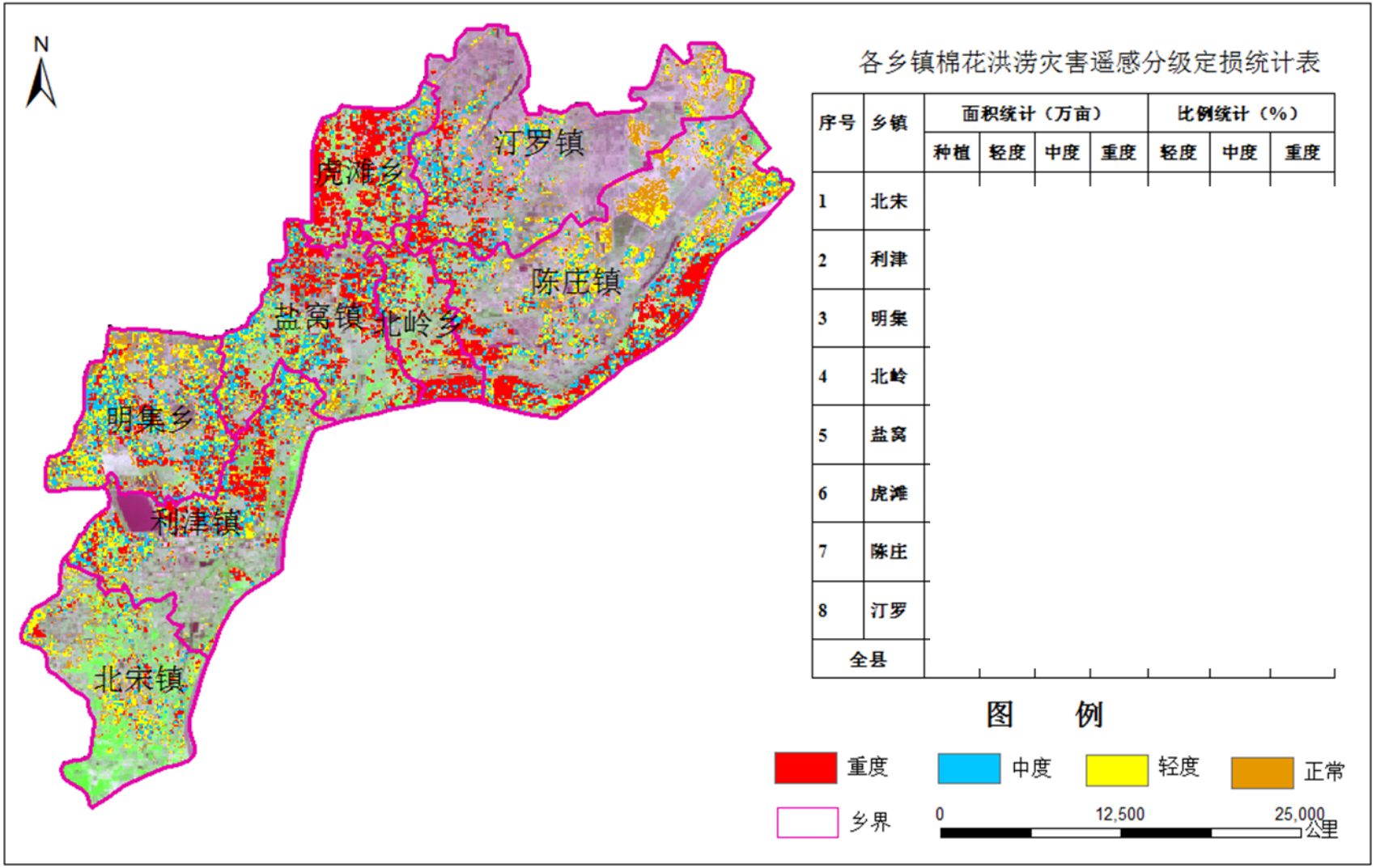
affected：the growth rate in 2012 is less than the mean for the past 2 years (excluding severe and no harvest).

The statistical histogram of cotton growth rate



The thematic map of cotton loss by floods

山东省东营市利津县棉花洪涝灾害遥感分级定损图



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Conclusion

- crop phonology is very important !
- Remote sensing information will facilitate fair negotiations.

Questions?

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