



# Can remote sensing support forest management in China?

## A case study from Shitai county, Anhui province

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## Background and objectives

Project duration: 03/2012 - 31/2015

Objective: increased carbon sequestration by improved forest management

Information needs:

1. Area estimation

Forest area, Forest type

2. Changes of forest area over time („activity data“)

Deforestation  $\longleftrightarrow$  Forestation

3. Changes of „carbon density“ over time

Degradation  $\longleftrightarrow$  Enhancement of carbon stocks

Motivation:

Forest type classification using RapidEye satellite images.

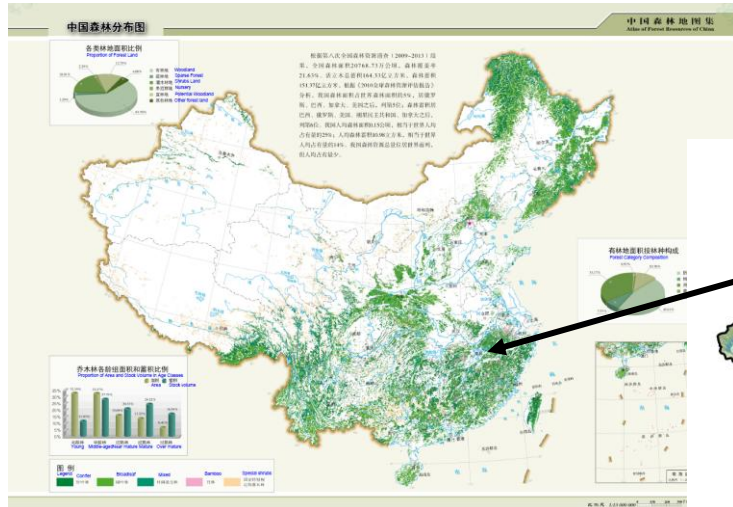
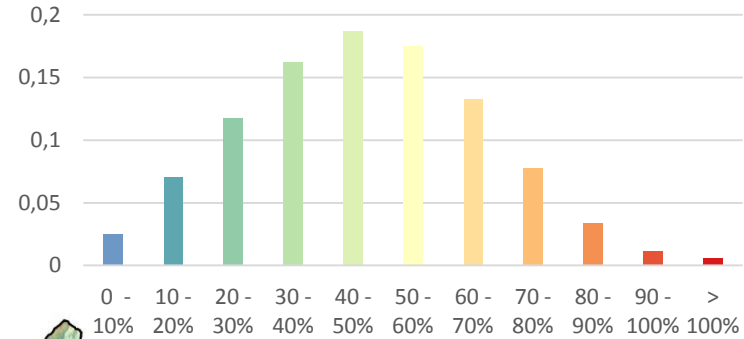
## Study site

Study area in county Shitai: 893 km<sup>2</sup>

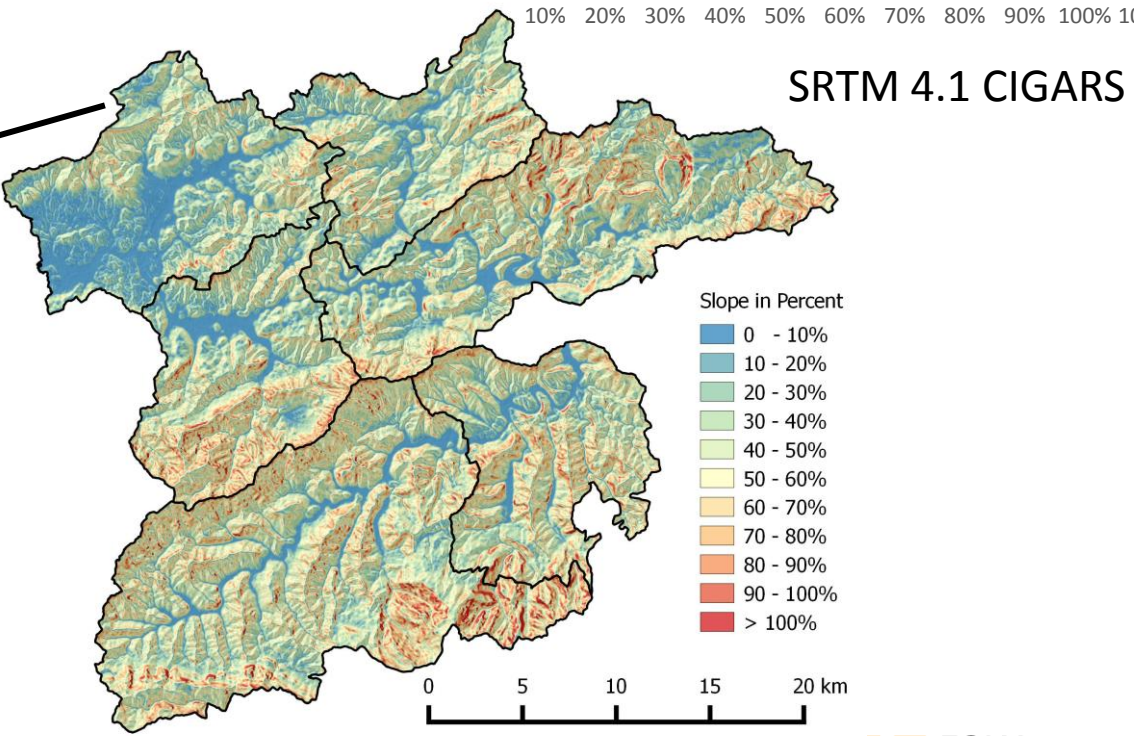
Altitude range: 27 – 1720 m.a.s.l.

44% of the forest area with slopes > 50%

## Frequency of slope classes in forest area of West-Shitai



Atlas of forest resources in China (2012)



## Current use of remote sensing (RS) in Chinese forestry

### **NFI** (National Forest Inventory, Level 1)

Objective:

Information on forest resources on national and provincial level

Organization: State Forest Administration, SFA

RS: stratification, estimation of inaccessible regions, forest area  
(Zeng et al. 2015).

### **FMI** (Forest Management Inventory, Level 2)

Objective:

Classification and boundaries of forest management units

Organization: Forestry Department at provincial level

RS: stand mapping by visual interpretation (Spot-5, CBERS)  
scale 1:10,000 – 25,000

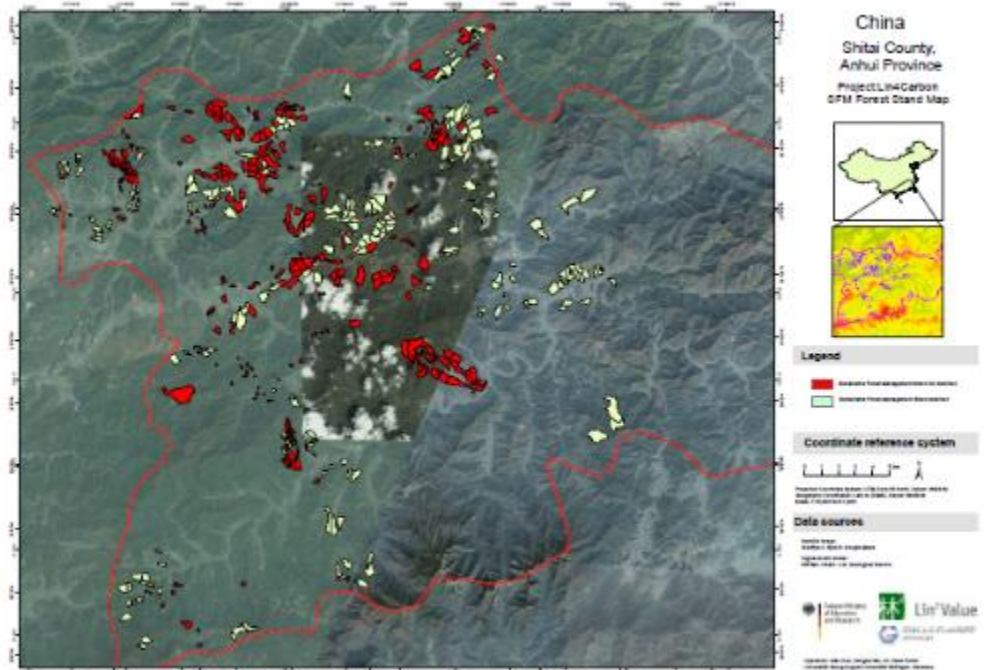


## Stand maps of the Sustainable Forest Management (SFM) project



Sketch of boundaries on  
analogue topographic map  
1:10,000

Digitization

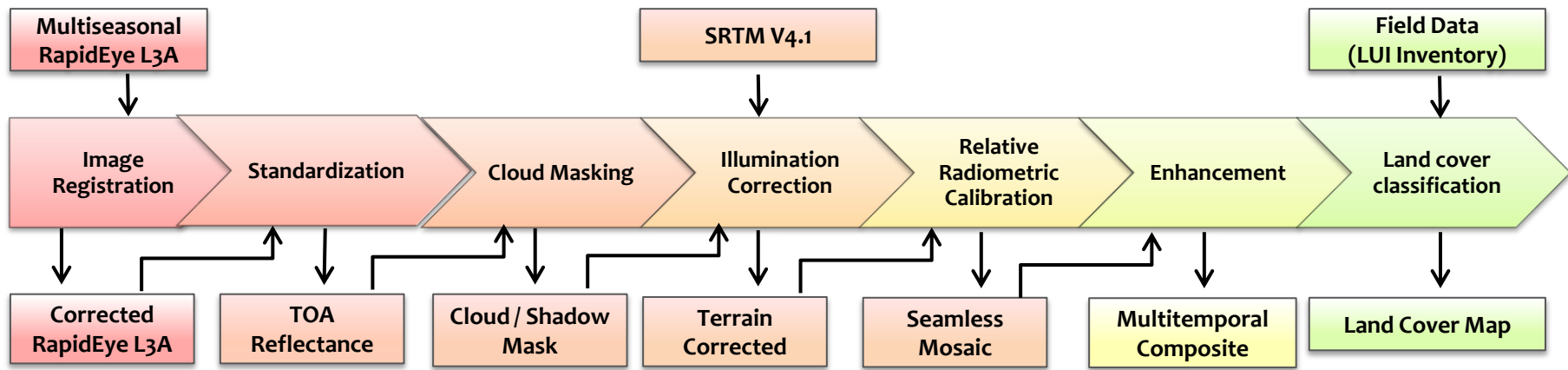


Large and inhomogeneous compartments



# Processing Workflow

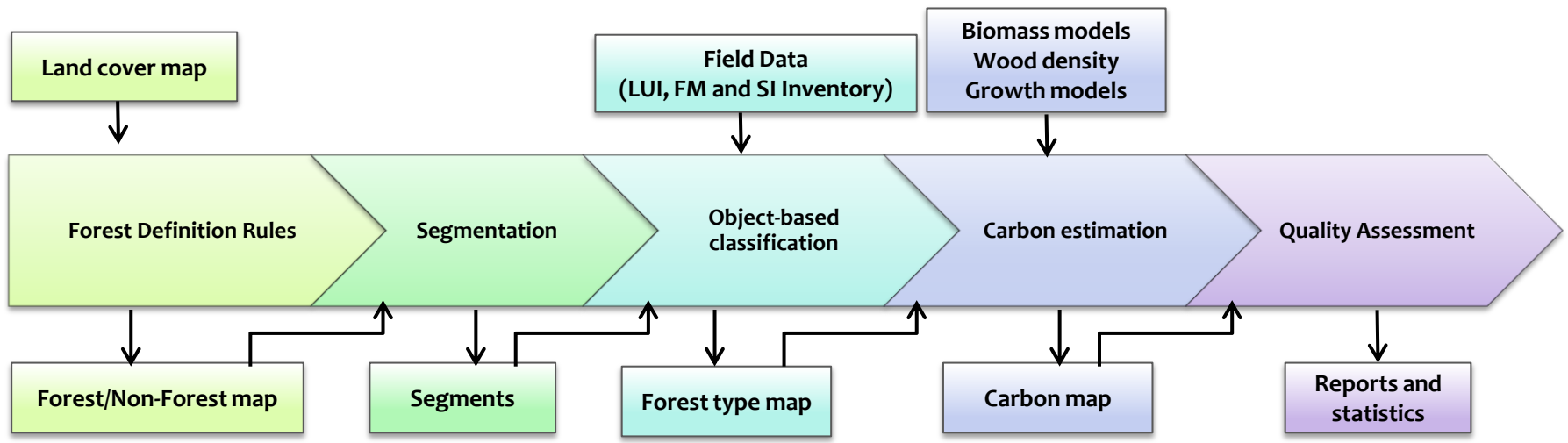
using the ForestEye Processor (FEP)





# Processing Workflow

## using the ForestEye Processor (FEP)

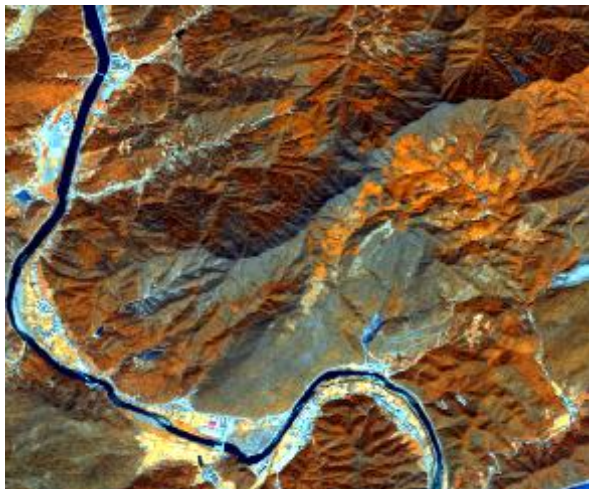




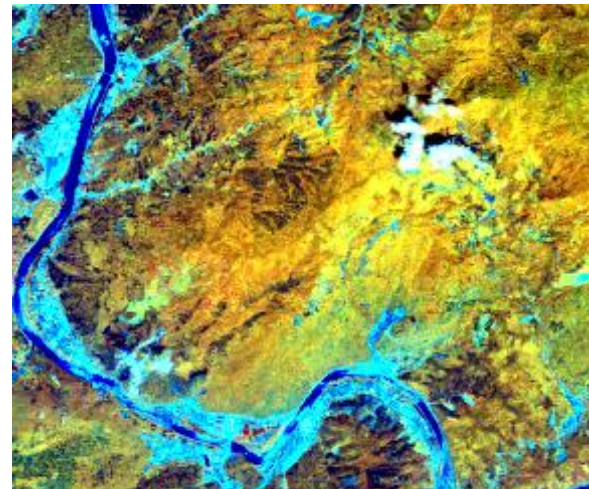


# RapidEye Multiseasonal L3A Standard Product

SE = sun elevation



Spring 01.04.2012 (RGB=543, SE 64.2°)



Summer 28.05.2013 (RGB=543, SE 80.6°)



Autumn 17.10.2010 (RGB=543, SE 50.5°)

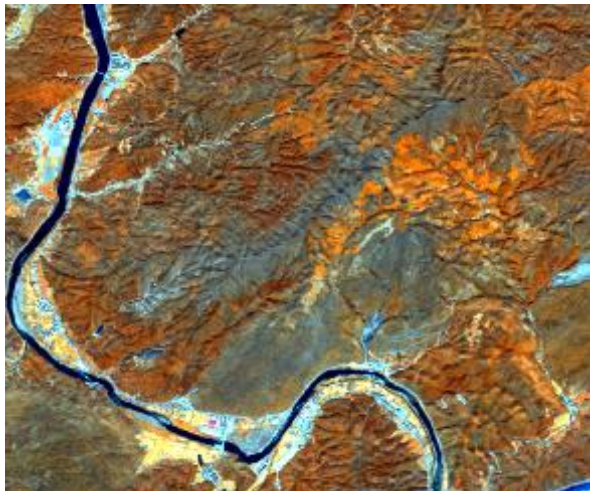


Winter 27.12.2010 (RGB=543, SE 36.5°)

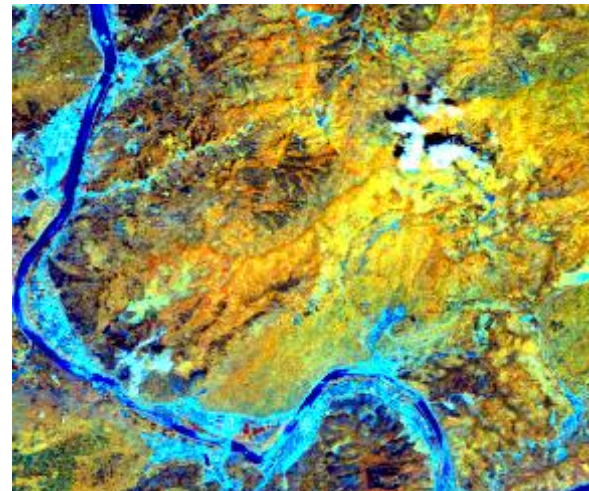




## Illumination Corrected Images (SRTM 30m) Rotation model (Tan, B. et al. 2013)



Spring 01.04.2012 (RGB=543, SE 64.2°)



Summer 28.05.2013 (RGB=543, SE 80.6°)



Autumn 17.10.2010 (RGB=543, SE 50.5°)



Winter 27.12.2010 (RGB=543, 36.5°)

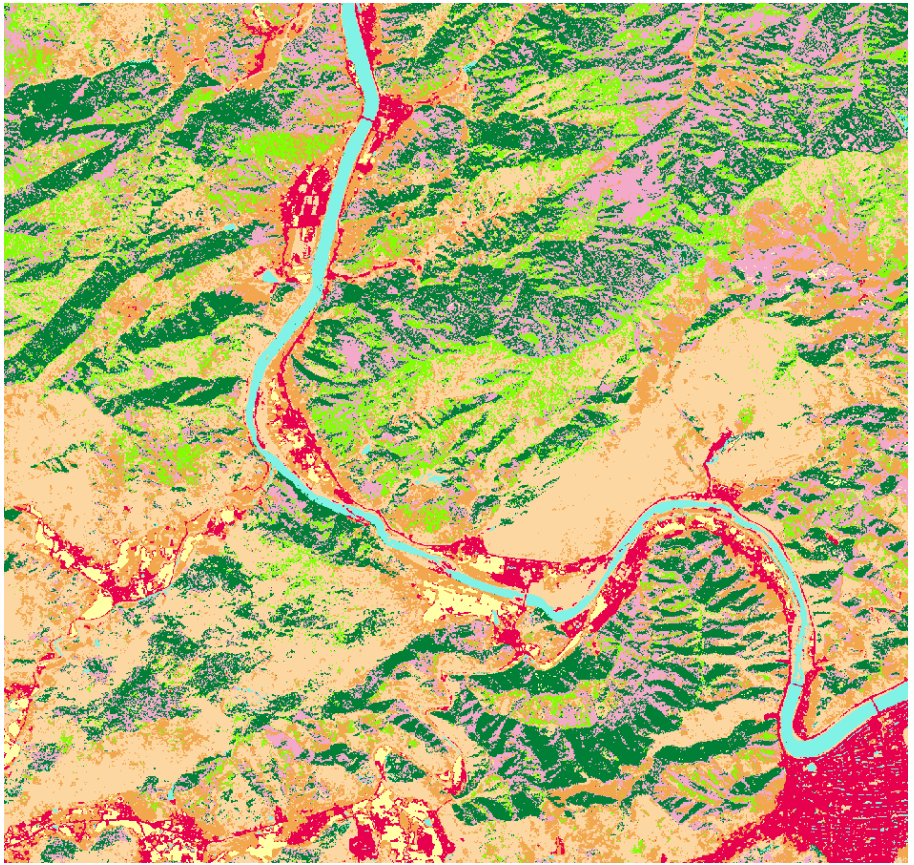




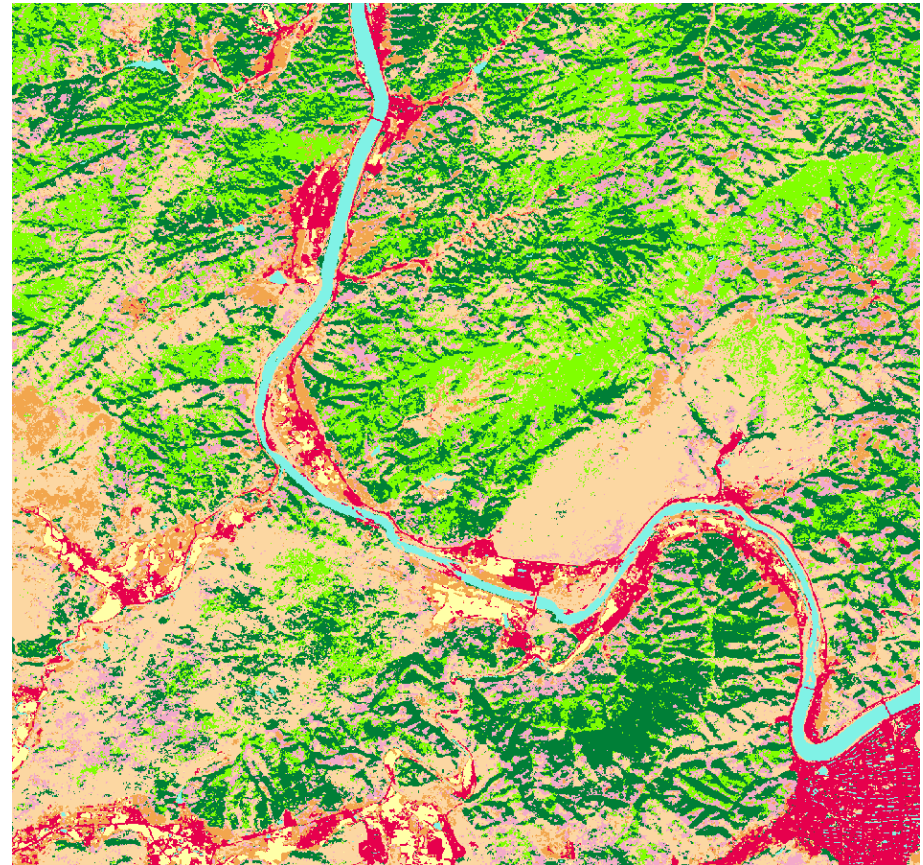
# Land cover classification (Spring & Autumn RapidEye images)

- 13 Coniferous tree cover
- 14 Broadleaved tree cover
- 15 Bamboo
- 21 Shrub / grass
- 22 Open spaces
- 31 Annual crop
- 32 Tea
- 41 Built-up area
- 51 Water

Land cover Map  
(without illumination correction)



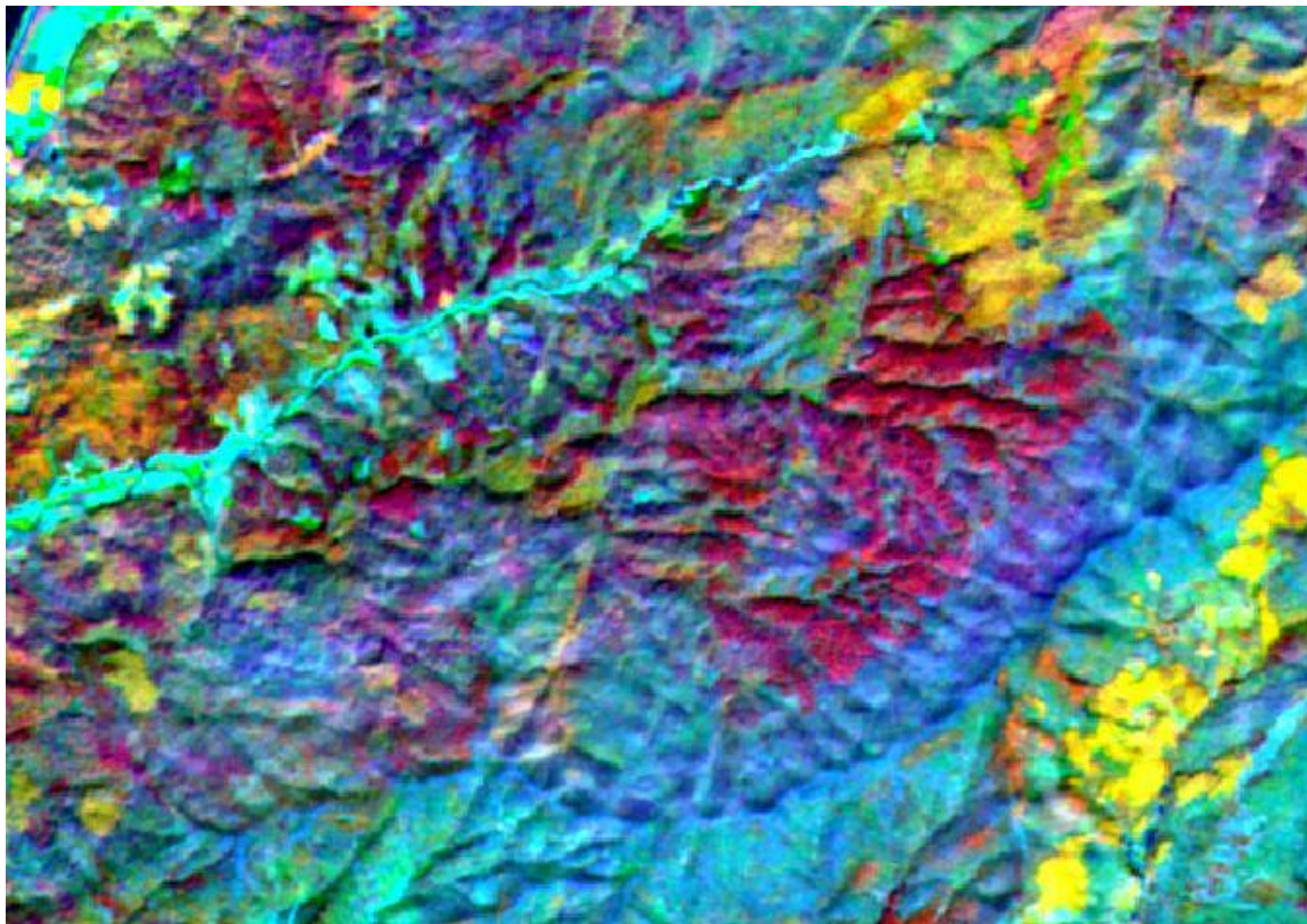
Land cover Map  
(illumination corrected using SRTM 30m)



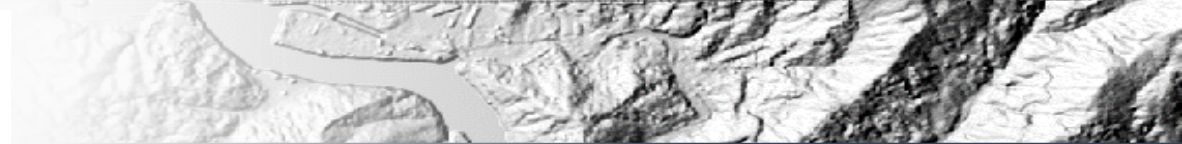




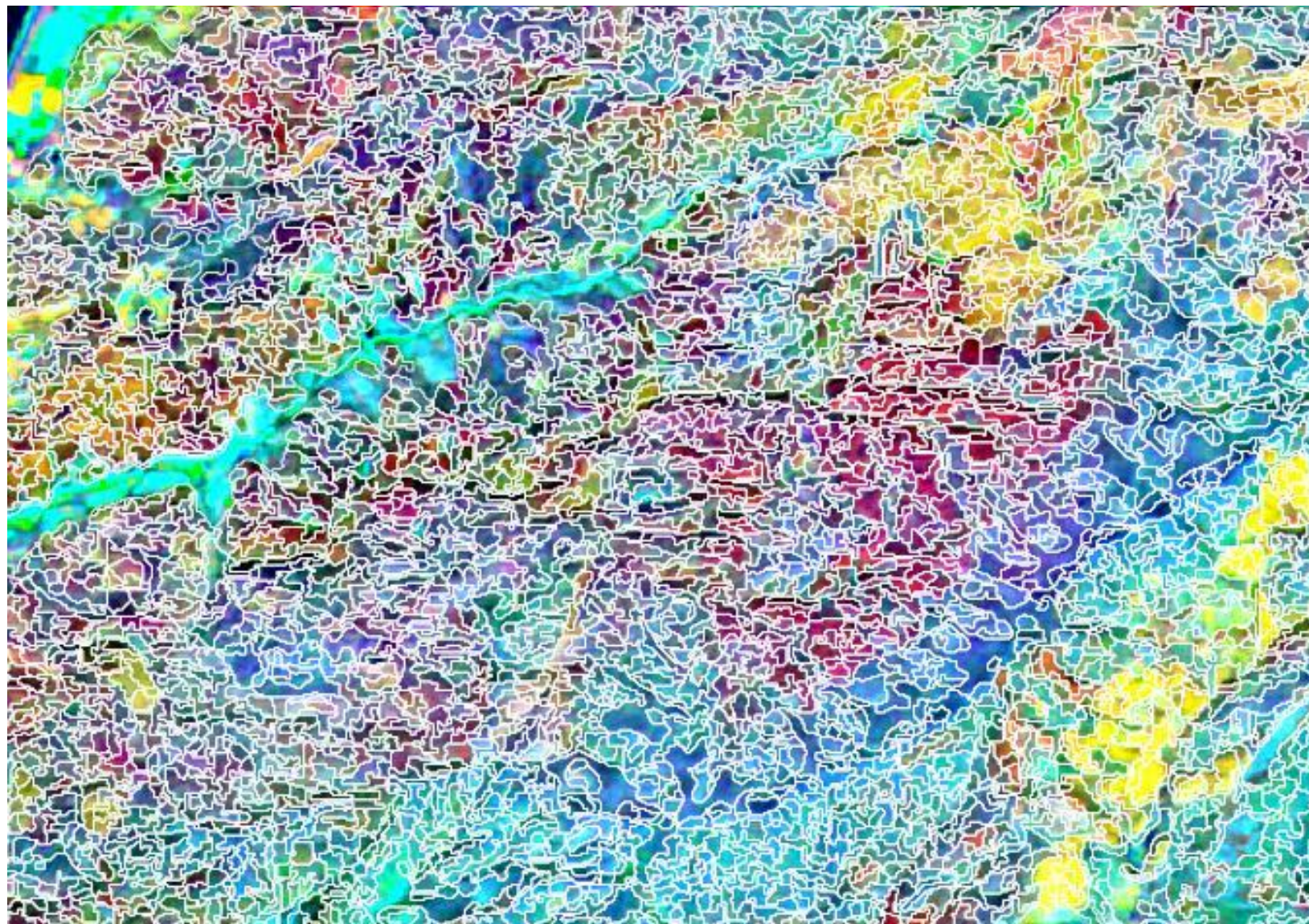
## Two-Seasonal PCA-Composite (Spring & Summer RapidEye images)







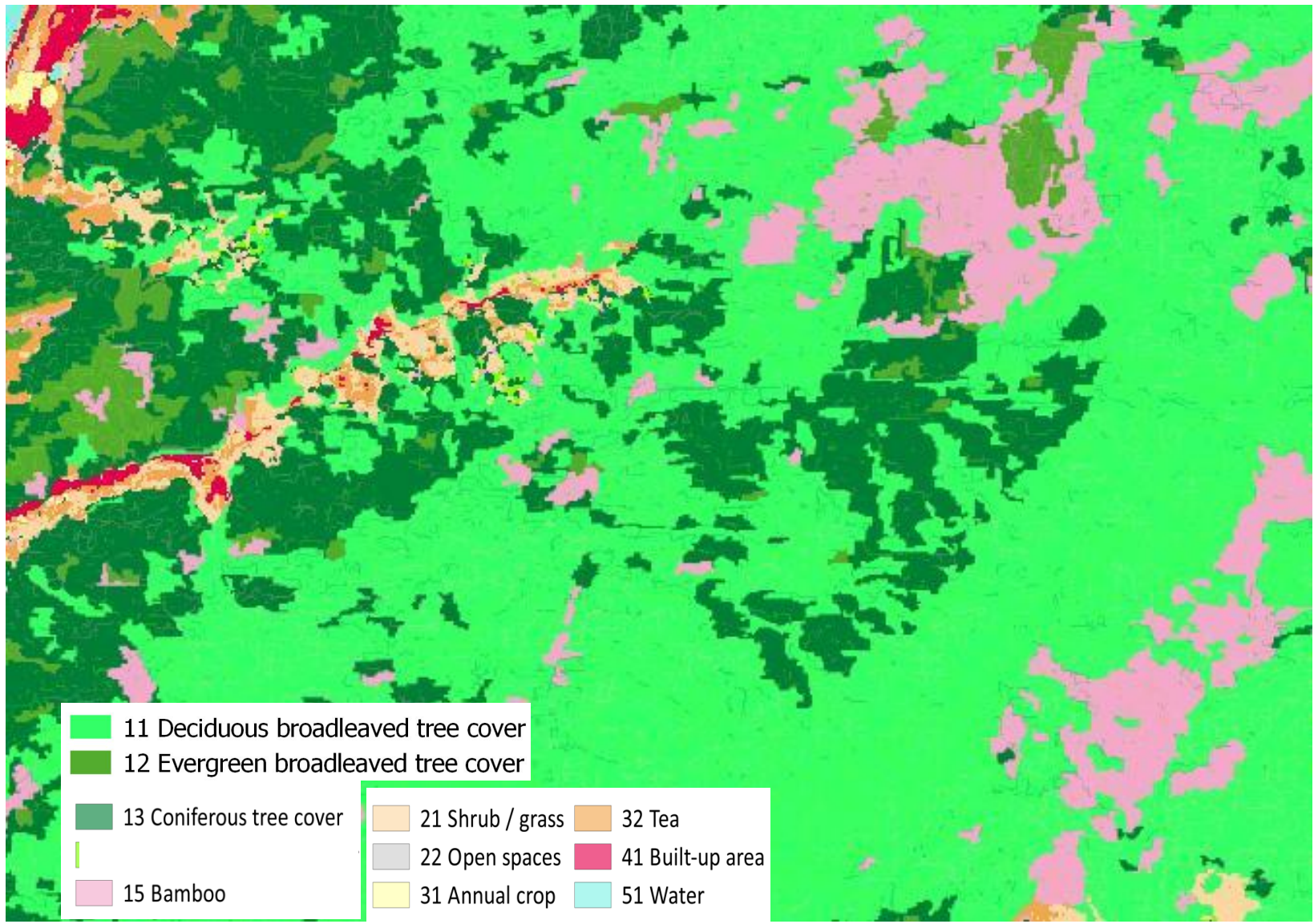
## Segmentation (Spring & Summer RapidEye images)







## Object-based forest type classification (Spring & Summer RapidEye images)







# Two-Seasonal PCA Composite (Spring & Summer RapidEye images)

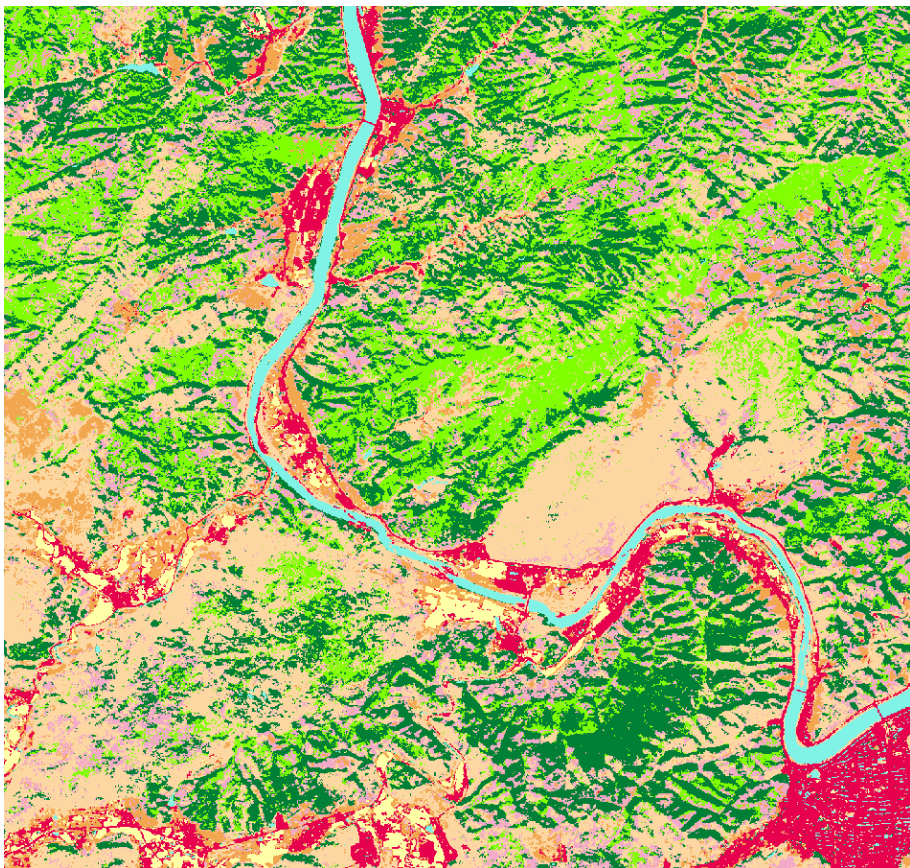
- 13 Coniferous tree cover
- 21 Shrub / grass
- 32 Tea
- 11 Deciduous broadleaved tree cover
- 22 Open spaces
- 41 Built-up area
- 12 Evergreen broadleaved tree cover
- 15 Bamboo
- 31 Annual crop
- 51 Water

Land cover Map

(illumination corrected using SRTM 30m)

Land cover and forest type map

(two-seasonal and object-based)





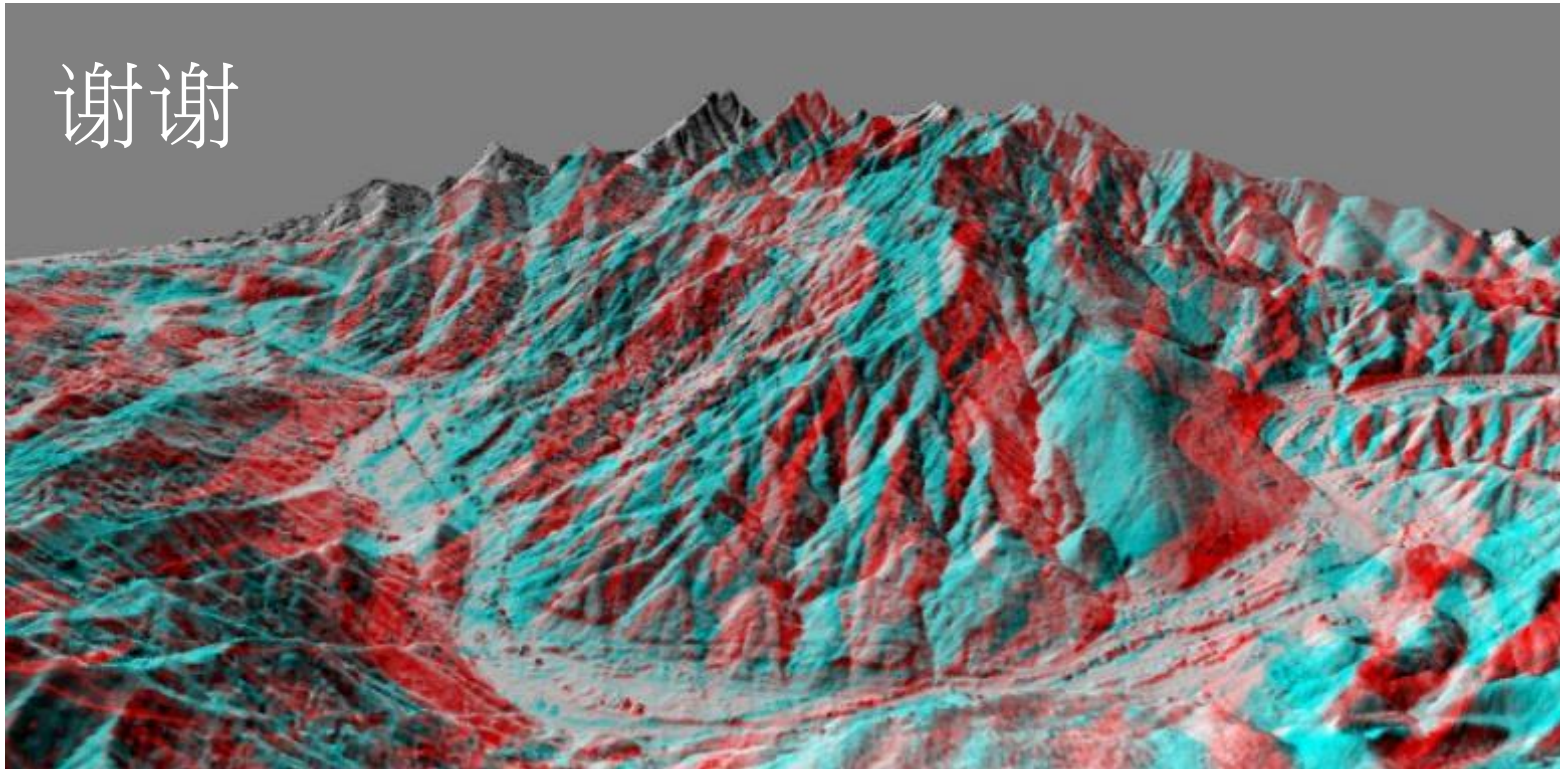


## Conclusions

- Two-seasonal satellite images were successfully used for object-based forest type classification.
- Pay attention to sun elevation at acquisition time and illumination correction in mountains.
- Forest type map is an intermediate product on the way to an operational stand map: in addition, accurate mapping of land use rights is needed.
- Lack of access to RS products and maps and lack of capacity on local level (forest administration and farmers) are constraints for improving SFM in China.



谢谢



## Acknowledgements

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## References

Tan, B., Masek J.G., Wolfe R., Gao F., Huang C., Vermote, E.F., Sexton, J.O., Edere, G., 2013. Improved forest change detection with terrain illumination corrected Landsat images. *Remote Sensing of Environment* 136: 469-483.

Zeng et. al. 2015. The national forest inventory in China: history - results - international context. *Forest Ecosystems*, 2:23. DOI 10.1186/s40663-015-0047-2



# Shitai county forest resource map

