



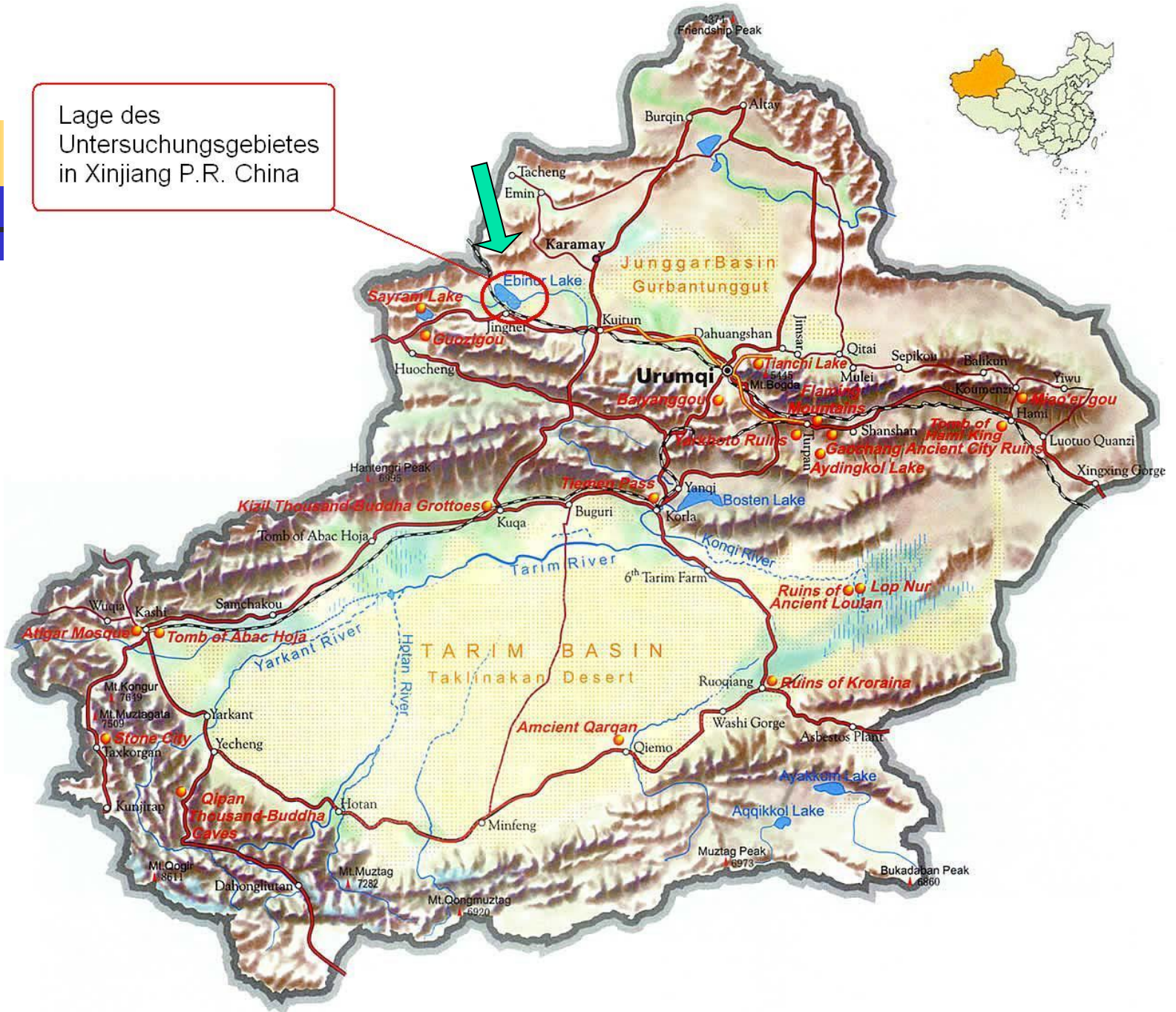
Impact of environmental changes on *Populus euphratica* forest in a semi-arid area of Xinjiang NW China

Ruide Yu

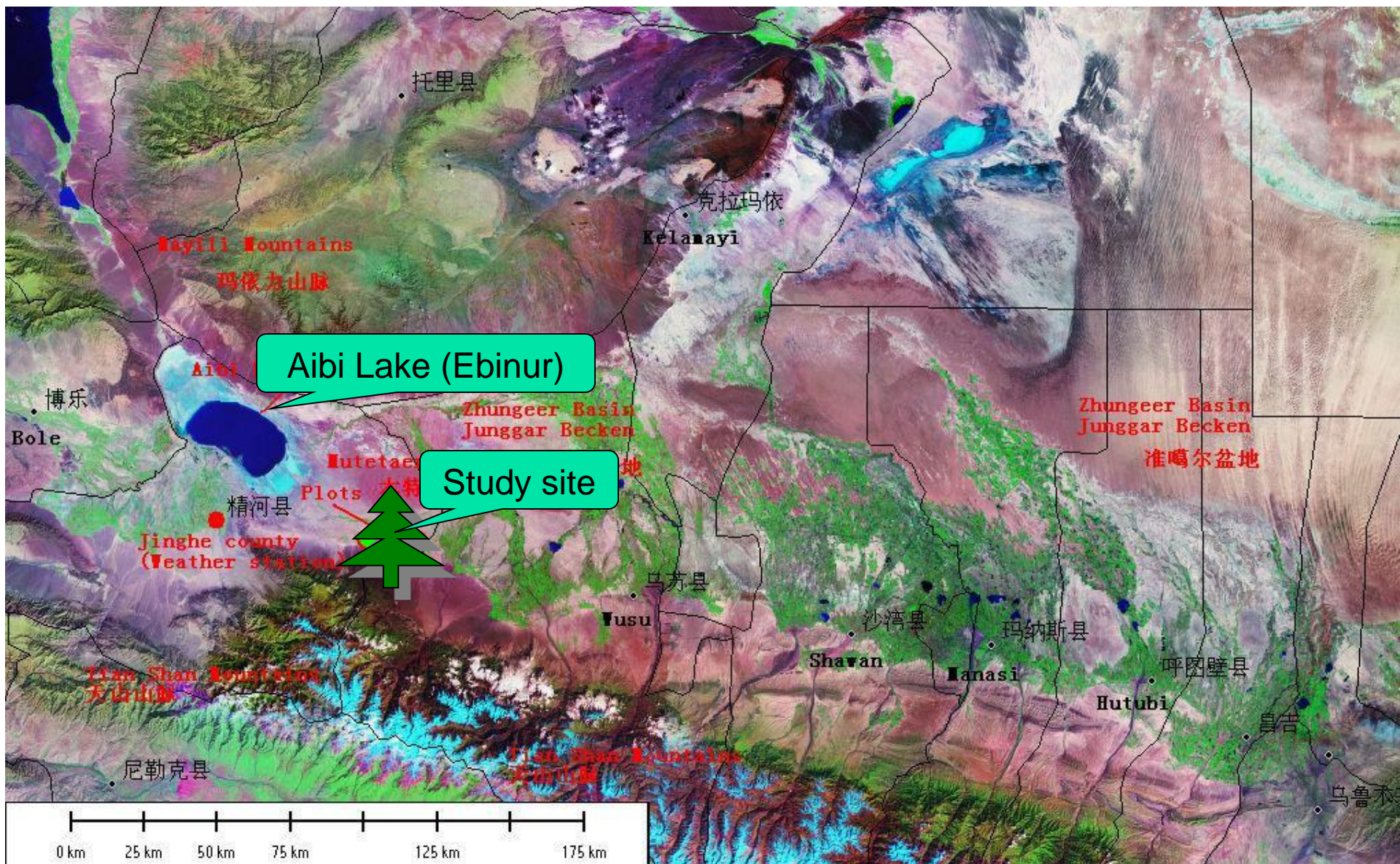
Xinjiang Institute of Ecology and Geography, CAS

13 Dec. 2015 München

Lage des
Untersuchungsgebietes
in Xinjiang P.R. China

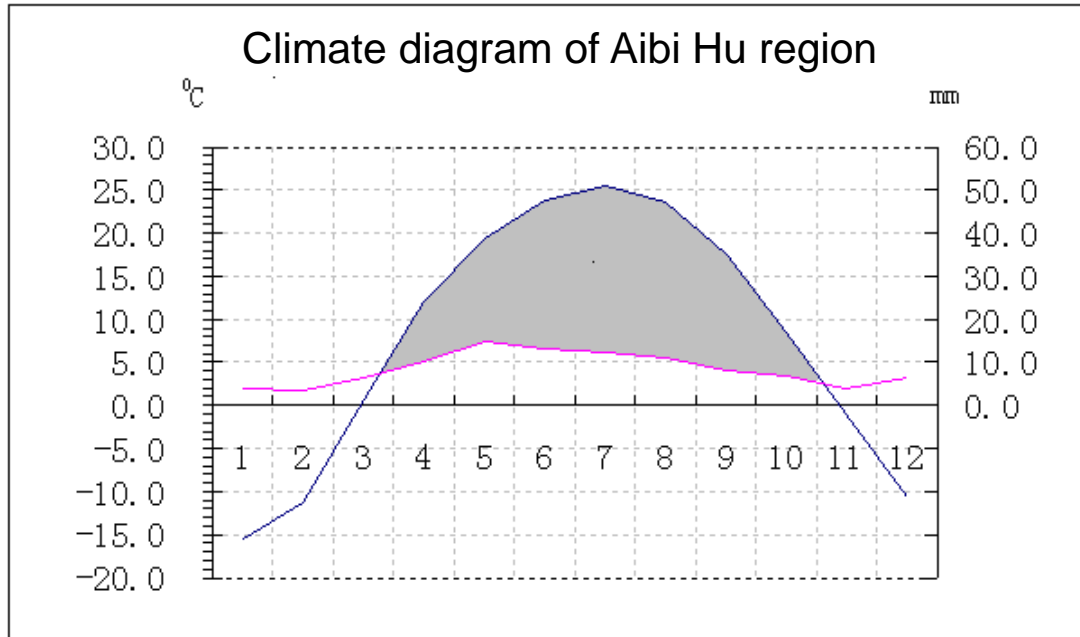


Geographical position of the study site in Aibi Hu region, Xinjiang China

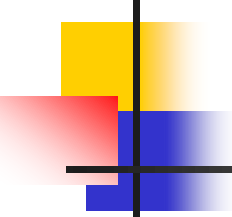


Impact of environmental changes

Climate

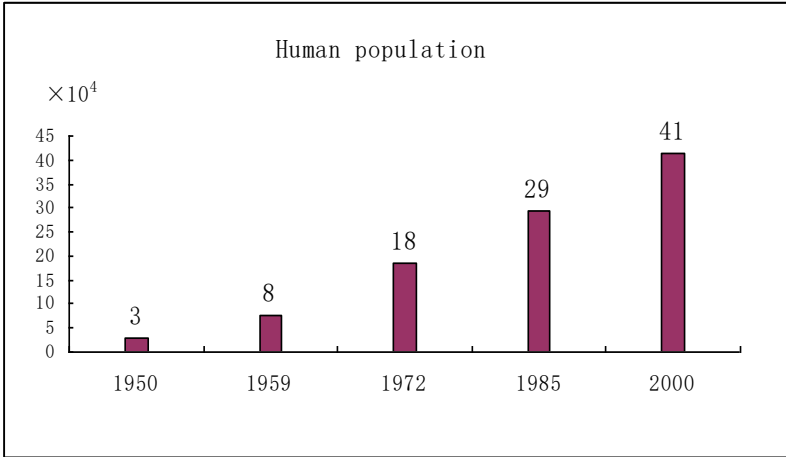


- Mean annual temperature 6.8°C
- Recorded lowest temperature -36.4 °C (January 3rd, 1955)
- Recorded highest temperature 41.3 °C (July 31st, 1987)
- Recorded maximum annual precipitation 163.9 mm (1958)
- Recorded minimum annual precipitation 28.5 mm (1957)
- Annually potential evaporation is 1662 mm (average)
- Annual days of wind velocity greater than 17 m s⁻¹ 165 days



Growing oasis population

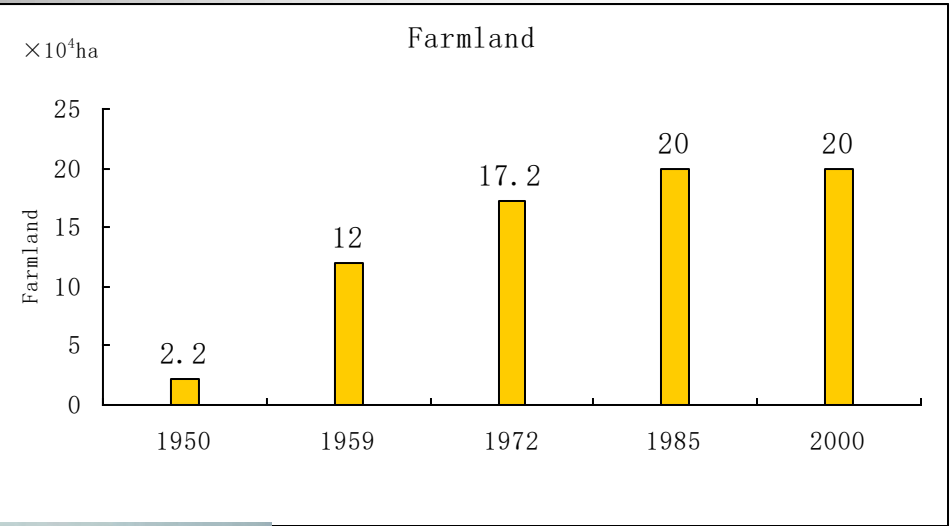
- In 1950, there were 37,800 people living in this region. In 1959, it increased to 77,800. Until 2010, the population in this region counted to 520,000



Impact of environmental changes

Farmland increment

Farmland area increased very quickly, from 2.2×10^4 ha in 1950 to 20×10^4 ha in 2014



New opened farmland in the upper reaches

Farmland increase in Aibi Hu region

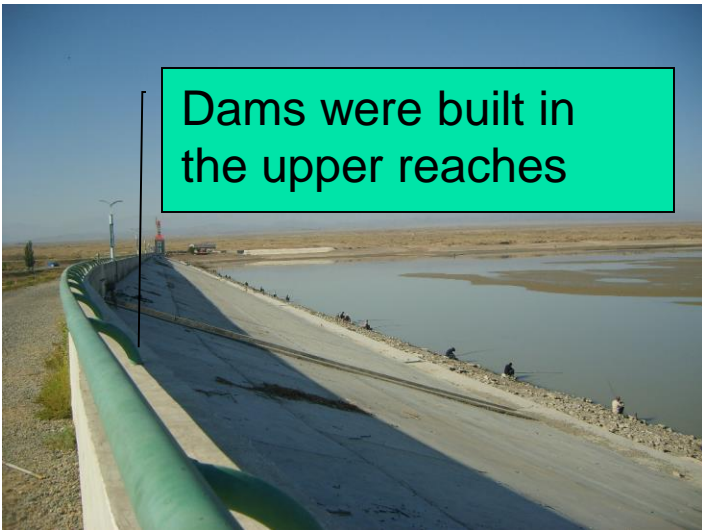
Impact of environmental changes

Water usage

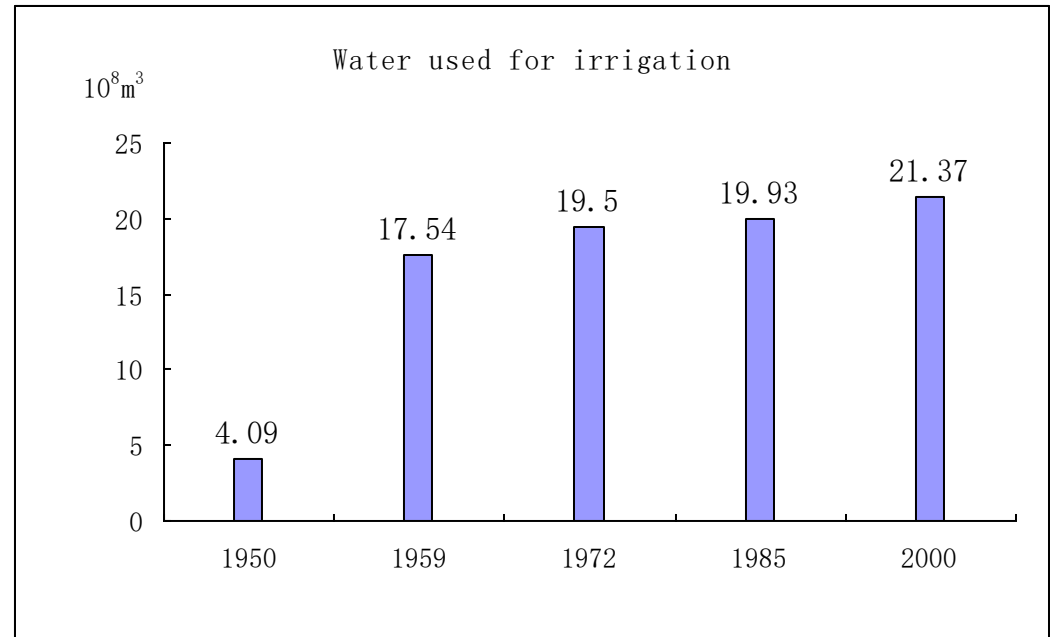
Underground water used for irrigation



Dams were built in the upper reaches



Total water use for irrigation from $4.09 \times 10^8 \text{ m}^3$ in 1950 to $21.37 \times 10^8 \text{ m}^3$ in 2010



Aibi Lake (Ebinur)

At present, only 3 of the former 7 rivers are supplying water to the lake.

Surface area

1200 km² (1950)

550.6 km² (Aug. 22, 1996)

The former lake-bed



Low water level of Aibi Lake (Ebinur)

29/08/2007

Vegetation

- It is recorded that before 1950, Aibi Hu region was very rich in vegetation. It was called 'green labyrinth in arid area'.
- Vegetation in this region is protecting the hazardous environment.
- *Haloxylon ammodendron*
- *Populus euphratica* Oliv.
- *Phragmites communis*
- *Tamarix spec.*
- *Halostachys caspica*
- *Halocnemum strobilaceum*
- *Salicornia europaea*
- *Kalidium foliatum*
- *Aeluropus pungens*
- *Salicornia europaea*
- Species: 380





Forest in Aibi Hu region

- **Forest in this region is protecting the hazardous environment. It provides a natural defense by preventing sand movement.**
- **It plays a very important role in keeping this region free of desertification.**

Total area

182,625.29 ha

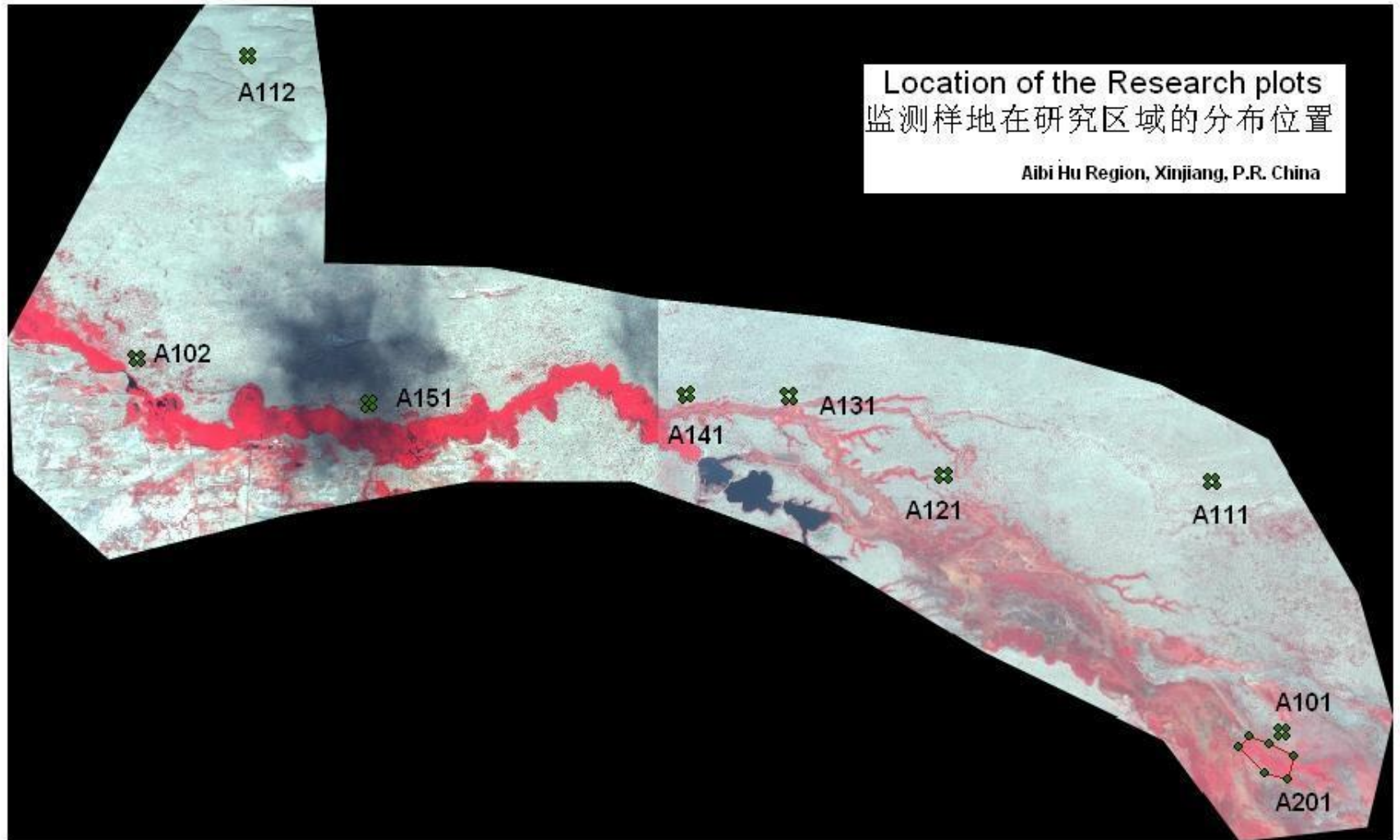
Major species

Populus euphratica Oliv.

Willows and birch etc.



Location of the research plots on the Quickbird image



Plot A101



Plot A111



Plot A121



Plot A141



2007/08/14 18:21

Plot A112





Data collection and analysis



Tree parameters

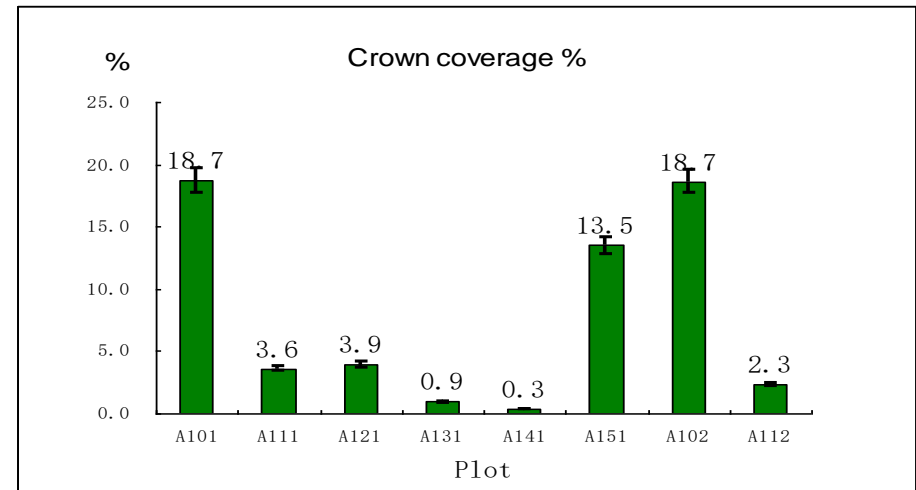
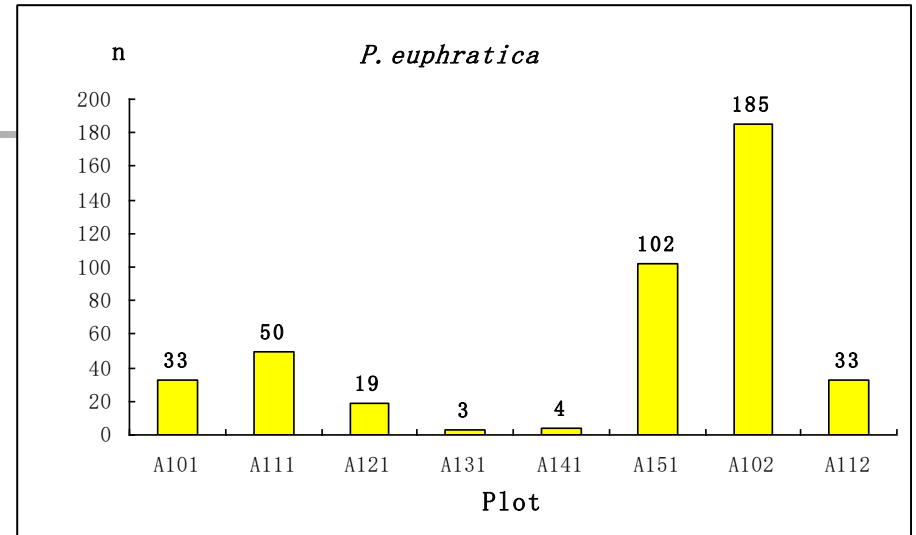
- Height
- Diameter at breast height (DBH)
- Crown forms
- Biomass

- Soil analysis
- Microclimate
- Ground water level
- Tree ring analysis
- Growth measurement
- Harvest of the trees

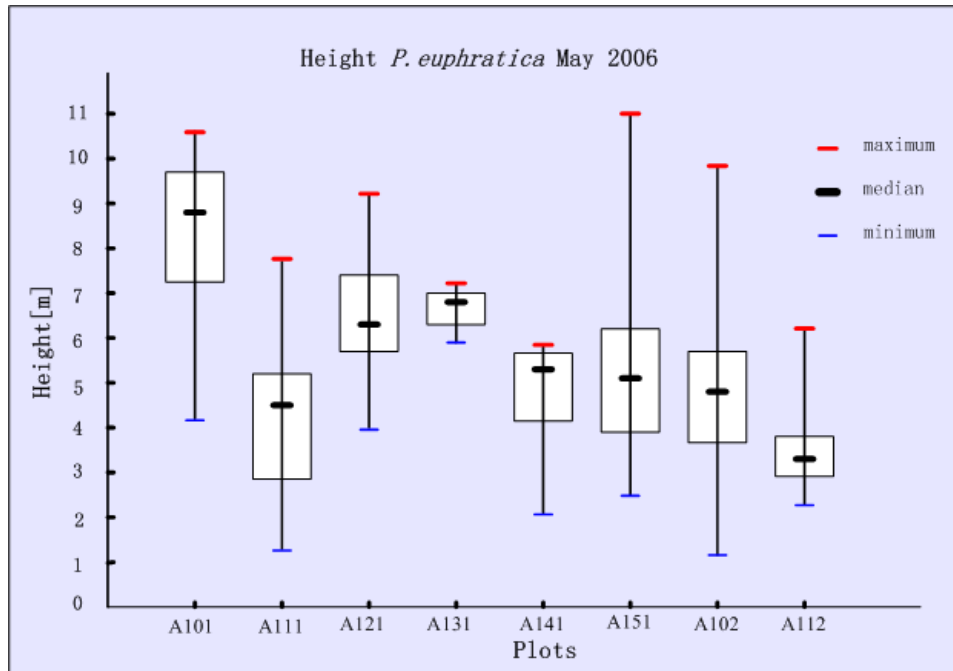


Criteria of the plots

Plot 样地	ALT 海拔高度	Surface form 地表结构	Area 面积	Tree number s 立木株数
A101	346	Level	1 ha	33
A111	369	Slightly concave	1 ha	50
A121	326	Slightly convex	1 ha	19
A131	320	Slightly convex	1 ha	3
A141	312	Slightly convex	1 ha	4
A151	299	Level	1 ha	102
A102	289	Slightly concave	1 ha	185
A112	288	Irregular	1 ha	33



Height distribution

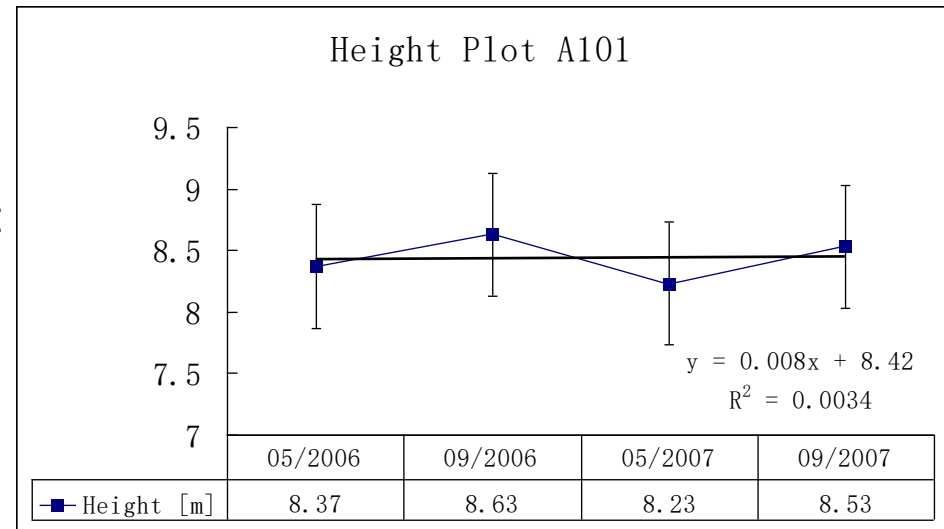


Ranged from 1.1 to 11 m, not regularly
The average height was much lower than the healthy forest

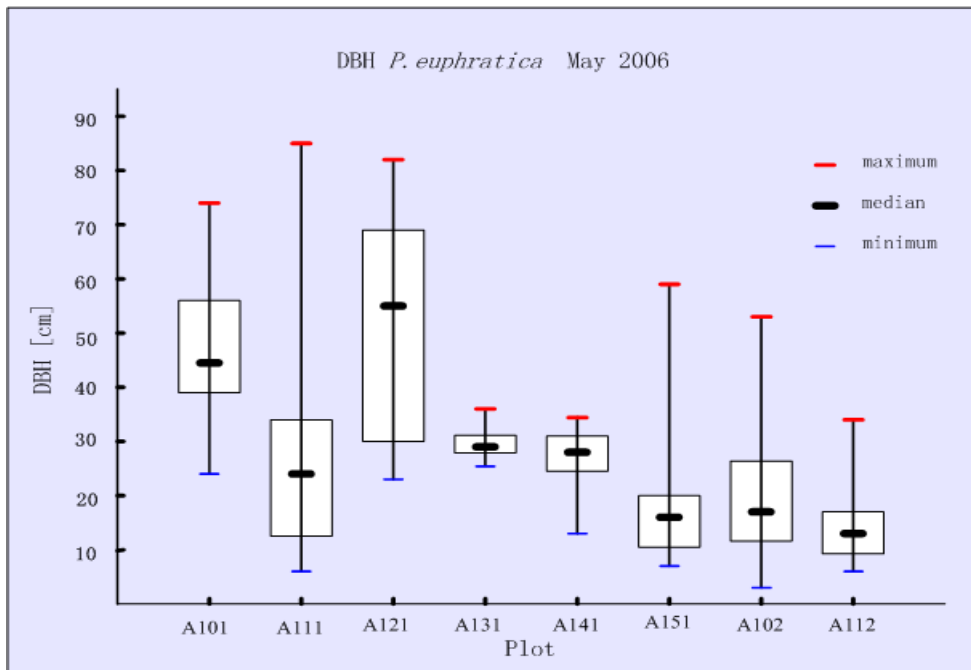
Growth of *P. euphratica* over two years

Growth–Height

- The maximum average absolute growth rate was 0.27 m per year (Plot A 111 and A102)
- The minimum average absolute growth rate was between 0.08 m per year (Plot A 101)
- The average absolute growth rate was smaller compared to the *P. euphratica* forest in other similar semi-arid area in Xinjiang (0.25 – 0.30 m)



Diameter distribution

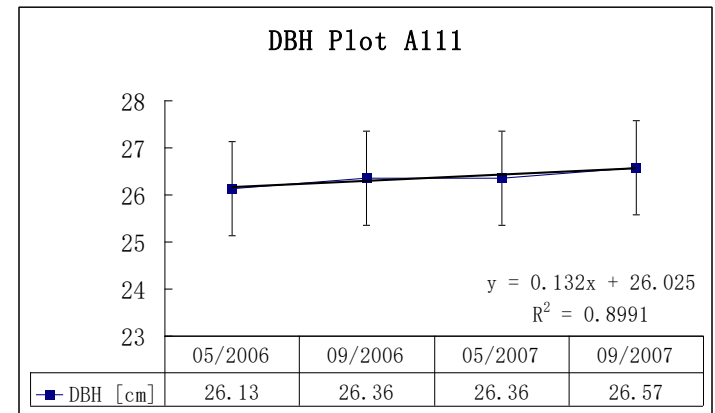


Maximum DBH:
85.2 cm (A111, tree No. 52)
Minimum DBH:
2.7 cm (A102, tree No. 91)
Distribution was very irregular

Growth of *P. euphratica*

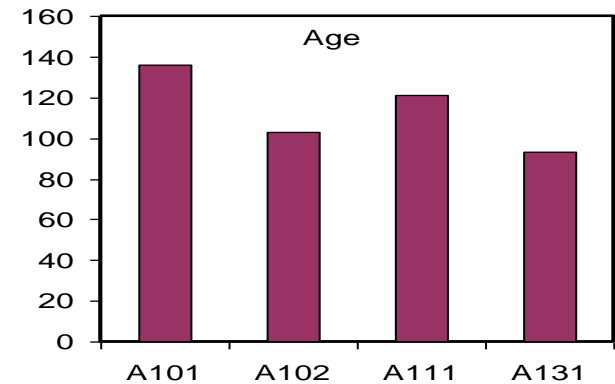
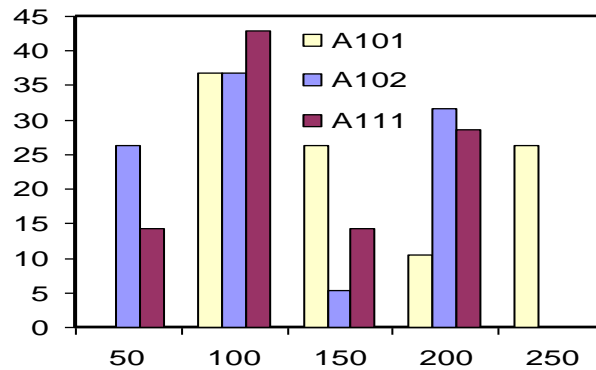
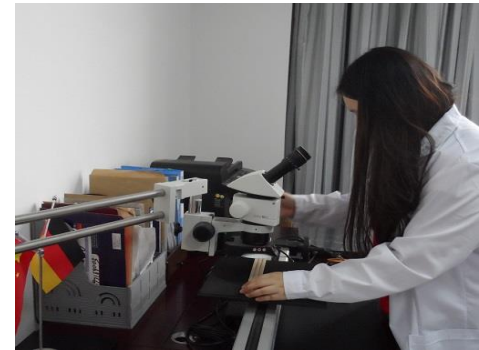
Growth -Diameter (DBH)

- The maximum average growth rate was 0.45 cm per year (Plot A 121)
- The minimum average growth rate was 0.22 cm per year (Plot A 111)
- The absolute growth rate was much smaller compared to the average growth rate of *P. euphratica* forest in the other similar area in Xinjiang which was 0.56 – 0.85 cm per year

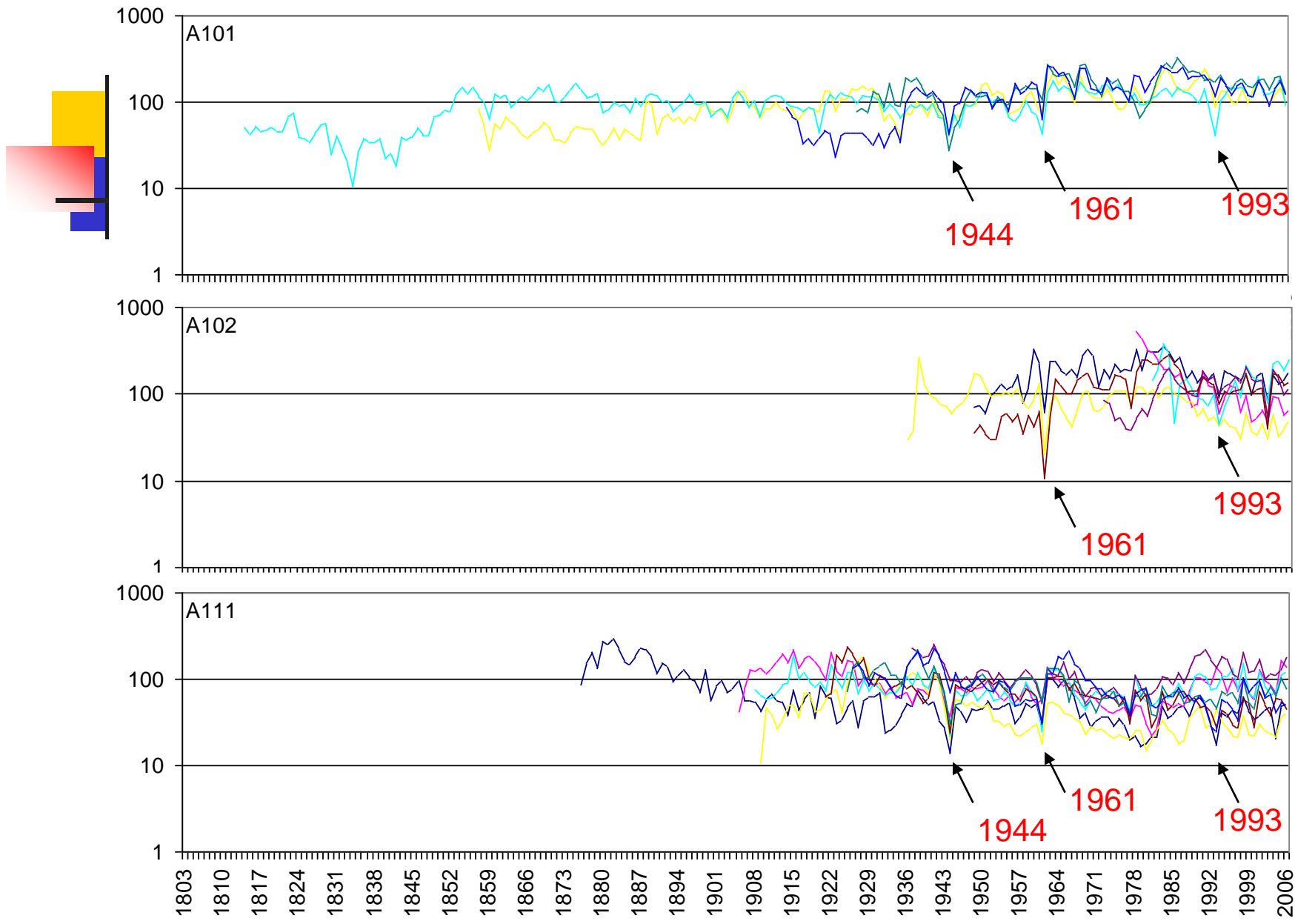


Tree ring analysis

Age structure showed there was less young trees
The increment of the last ten years is smaller than the last 50 years
The event of the negative influences in 1944, 1961 and 1993



Tree ring analyses of *Populus euphratica* trees in the Aibi Hu region



Harvest

Location of the harvested trees.

Number 编号	Latitude N 纬度	Longitude E 经度
No.1	N44° 37'09.26"	E83° 33'39.28"
No.2	N44° 37'10.27"	E83° 33'41.44"
No.3	N44° 37'11.46"	E83° 33'43.74"

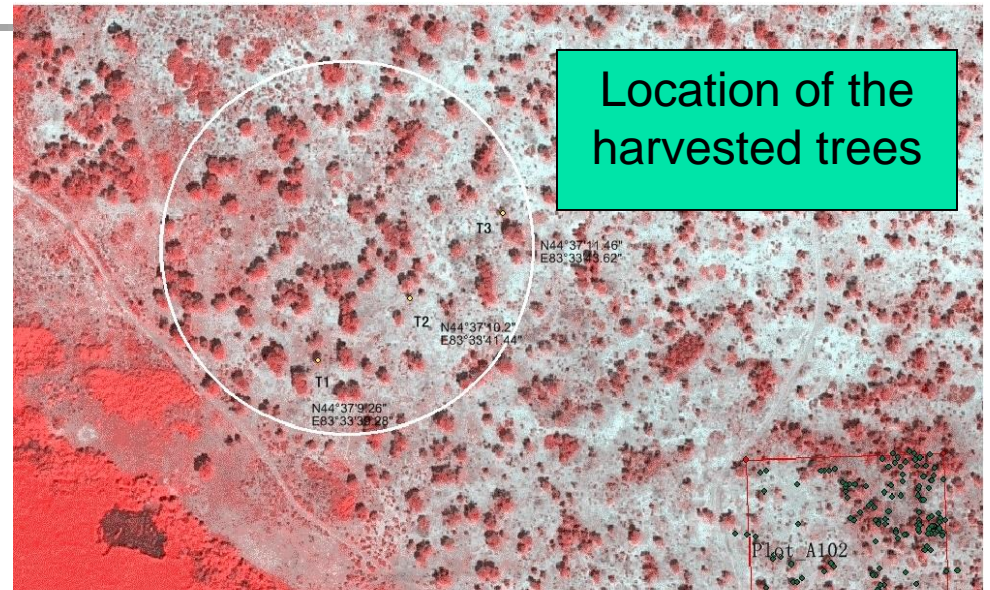


Table : Wooden parts of the three harvested trees.

Tree No. 编号	Height 高度[m]	DBH 胸径[cm]	Stem Weight 树干 [kg]	Living branch 活枝 [kg]	Dead branch 死枝 [kg]	Total mass 总质量 [kg]	Total wood volume 总材积 [m ³]
T 1	7.4	24.31	80.2	41.7	14.3	136.2	0.298
T 2	5.45	21.34	25.8	12.6	23.2	61.6	0.135
T 3	6.15	25.74	70.4	48.3	15.9	134.6	0.294

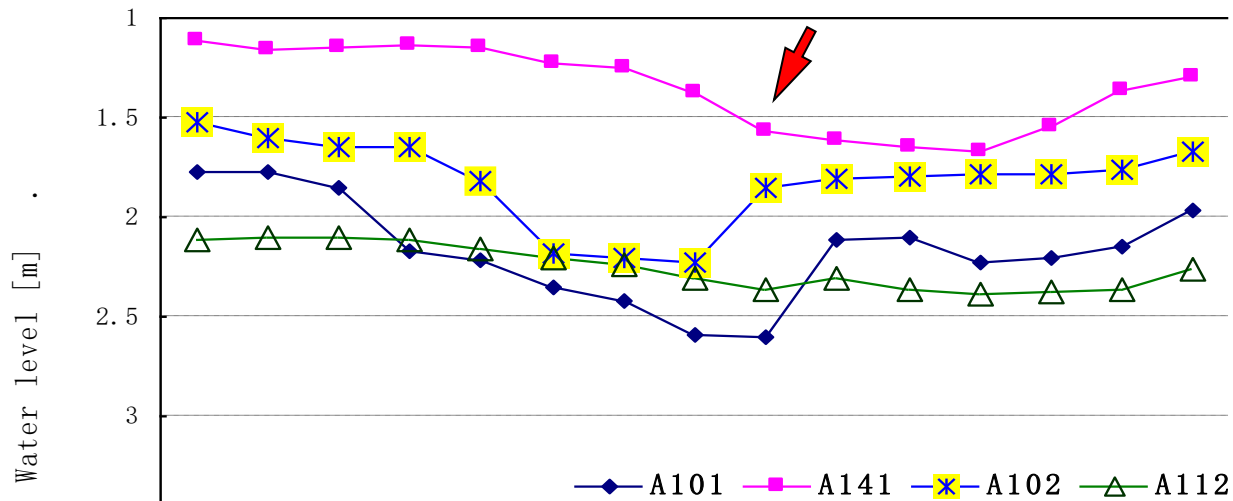
Results

- Growth of *P. euphratica* over two years was slower compared to the similar Tujai forest in Xinjiang (Tarim) .
- The forest in this region was not normally distributed and it was in a poor growth situation.
- There was a lack of regrowth and the forest has a tendency to deterioration.



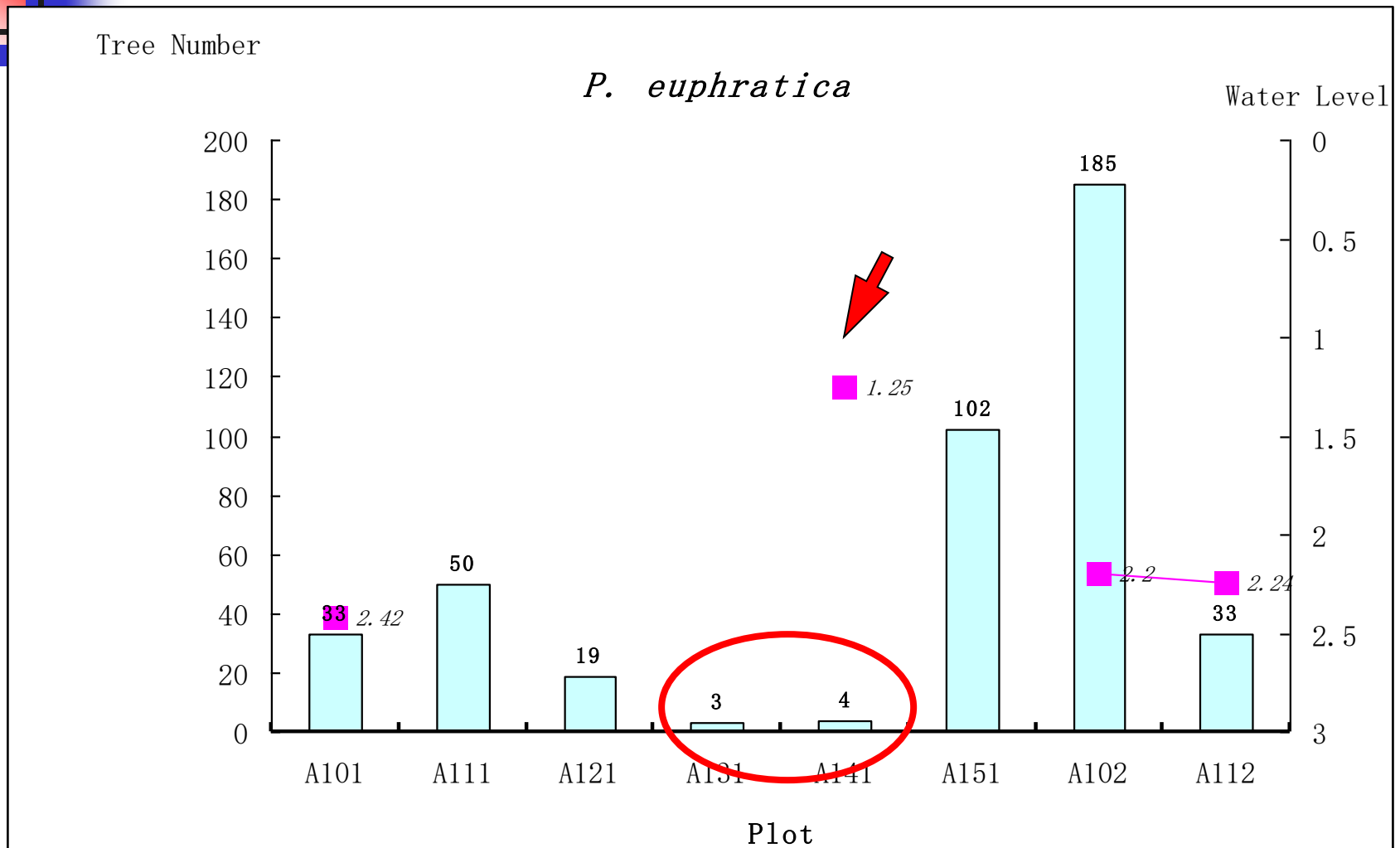
Ground water level

Ground water level on the selected plots (B) 2007

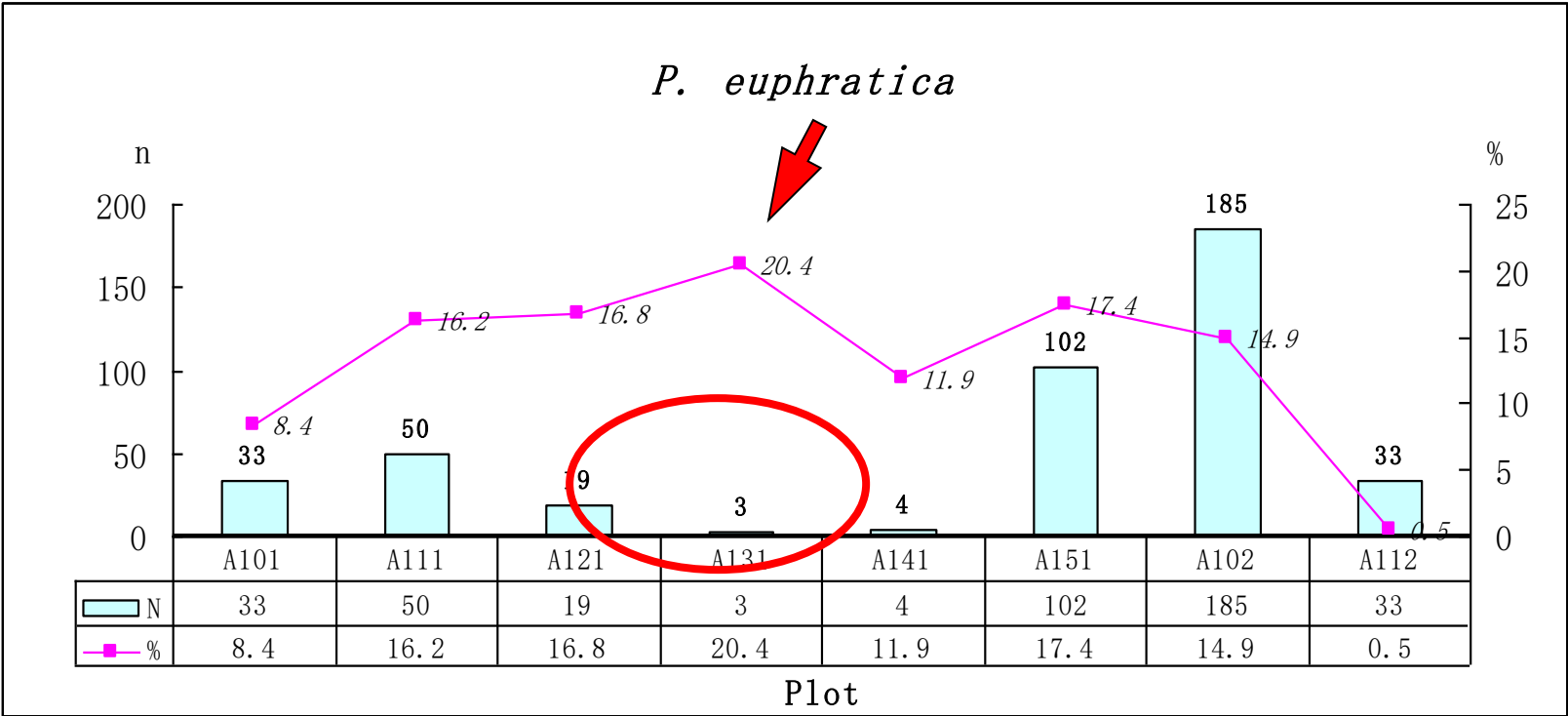


	25- Apr	9- May	23- May	30- May	13- Jun	27- Jun	11- Jul	25- Jul	8- Aug	22- Aug	5- Sep	19- Sep	3- Oct	17- Oct	31- Oct
◆ A101	1.77	1.77	1.85	2.17	2.22	2.35	2.42	2.59	2.6	2.11	2.1	2.23	2.2	2.15	1.97
■ A141	1.11	1.16	1.15	1.14	1.15	1.23	1.25	1.38	1.57	1.61	1.65	1.67	1.55	1.36	1.29
✕ A102	1.52	1.6	1.65	1.65	1.82	2.18	2.2	2.23	1.85	1.81	1.79	1.78	1.78	1.76	1.67
△ A112	2.11	2.1	2.1	2.11	2.16	2.2	2.24	2.31	2.36	2.31	2.36	2.39	2.38	2.36	2.26

Ground water influence



Soil influence

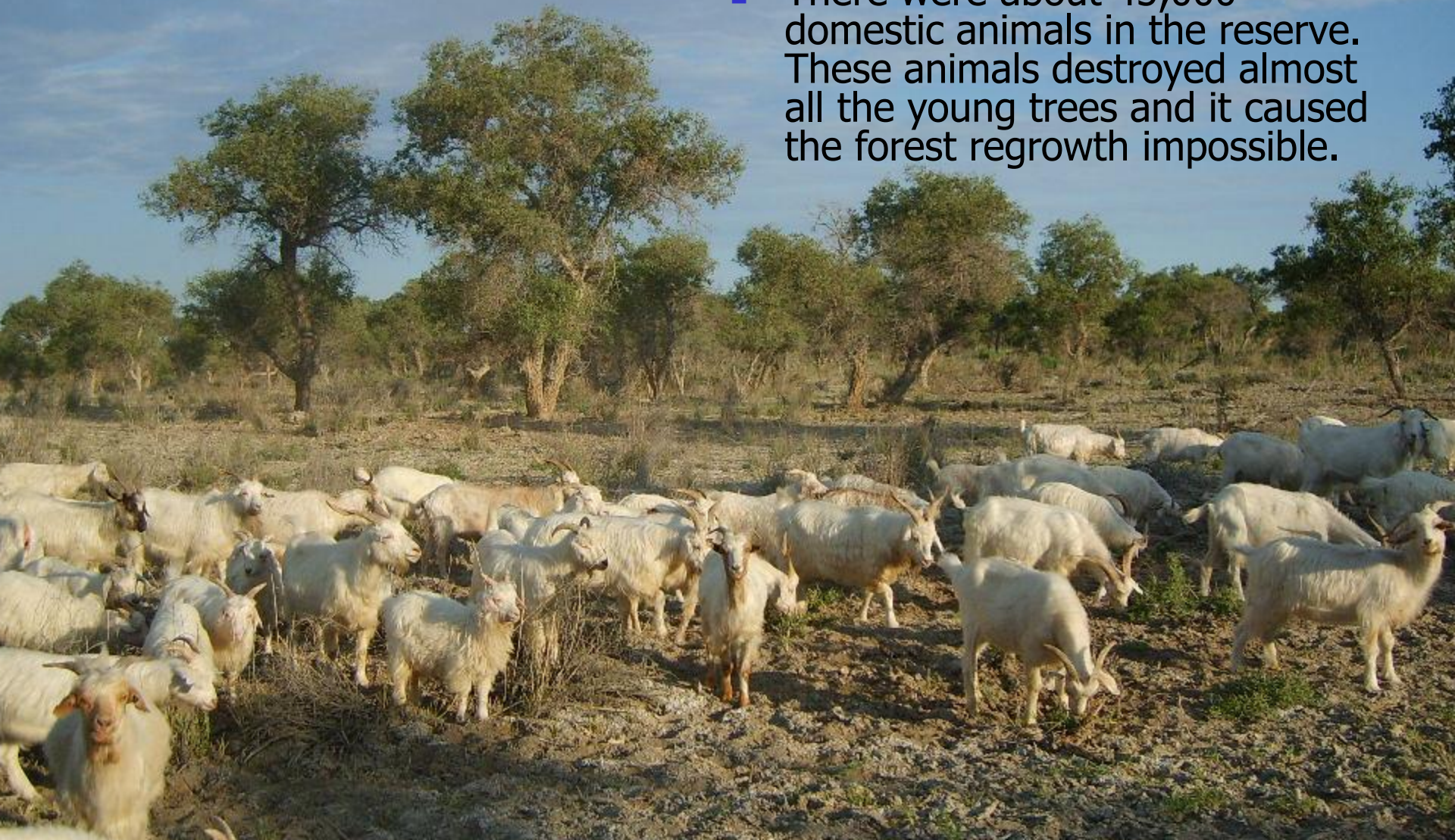




Soil salinization

Over grazing

- There were about 45,000 domestic animals in the reserve. These animals destroyed almost all the young trees and it caused the forest regrowth impossible.





Conclusion

- Forest in this region has a tendency to deterioration, this area is in danger of desertification.
- Impacts of climate change and climatic variability is not the major reason for the forest deterioration.
- Shortage of water was not the major reason for *P. euphratica* trees death in this region.
- Human impacts have the negative influences on the forests in this region.
- Hydrology situation changes caused the salinization of the soil is the major reason for the forest deterioration in this region.



Danke schön!

Thank You 谢谢!

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