



# Impacts of climate change on highland pastorlism, China

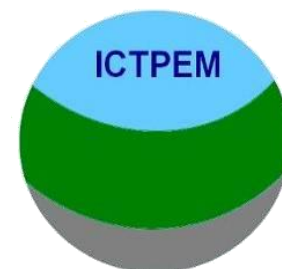
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**Lanzhou University, China**

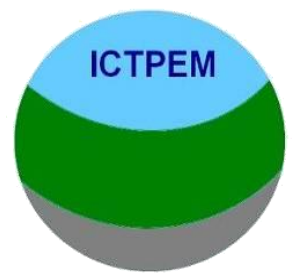
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**13 July 2019, Ormea Italy**



# Arid & Semiarid zones in China



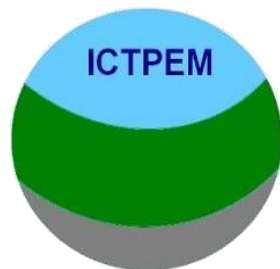


# Outline

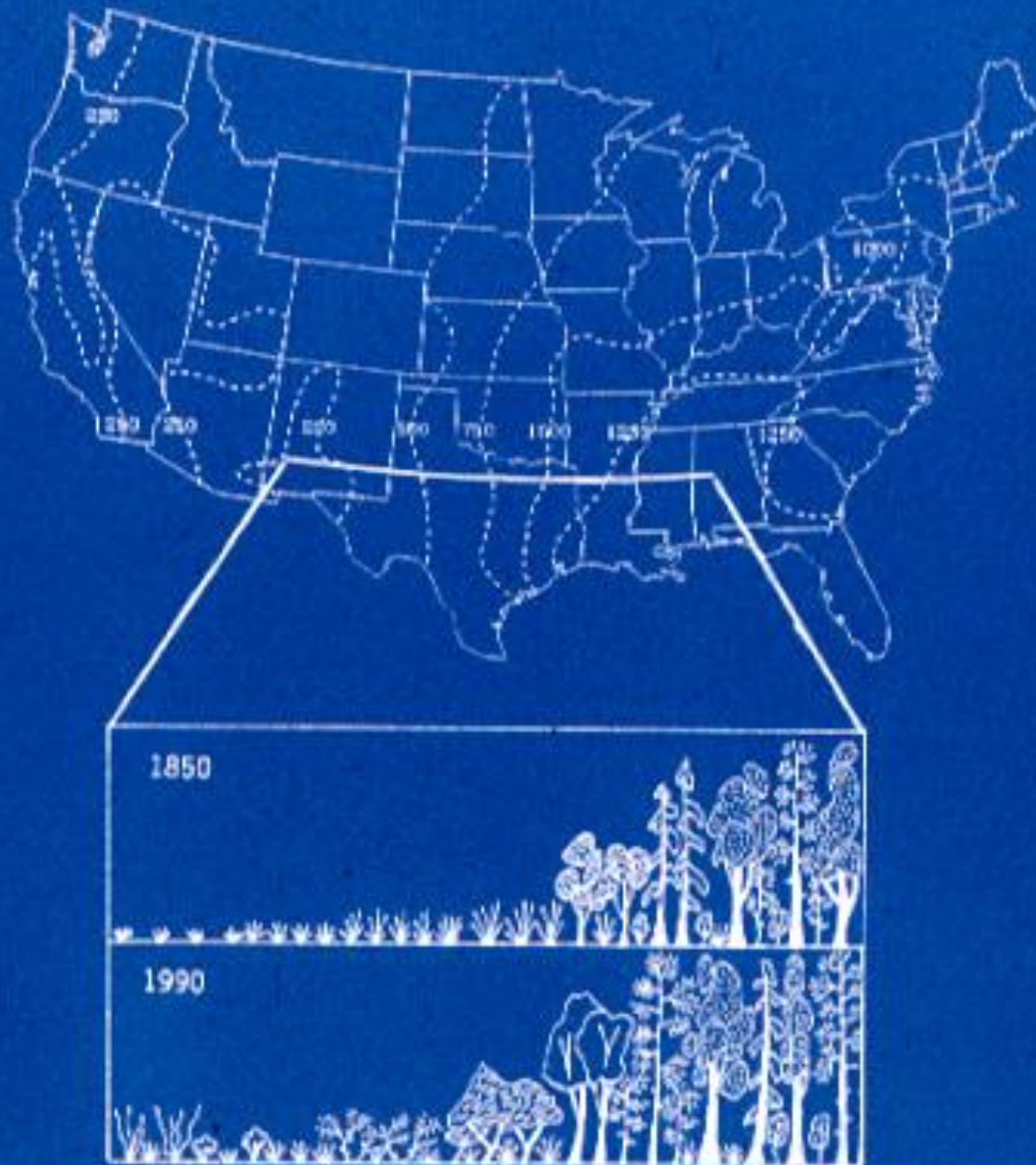
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- 1. Impacts of climate change on grazing systems**
- 2. Technical measurement in adaptation to landscape degradation on Tibetan farm level**

# Impacts of climate change on grazing system

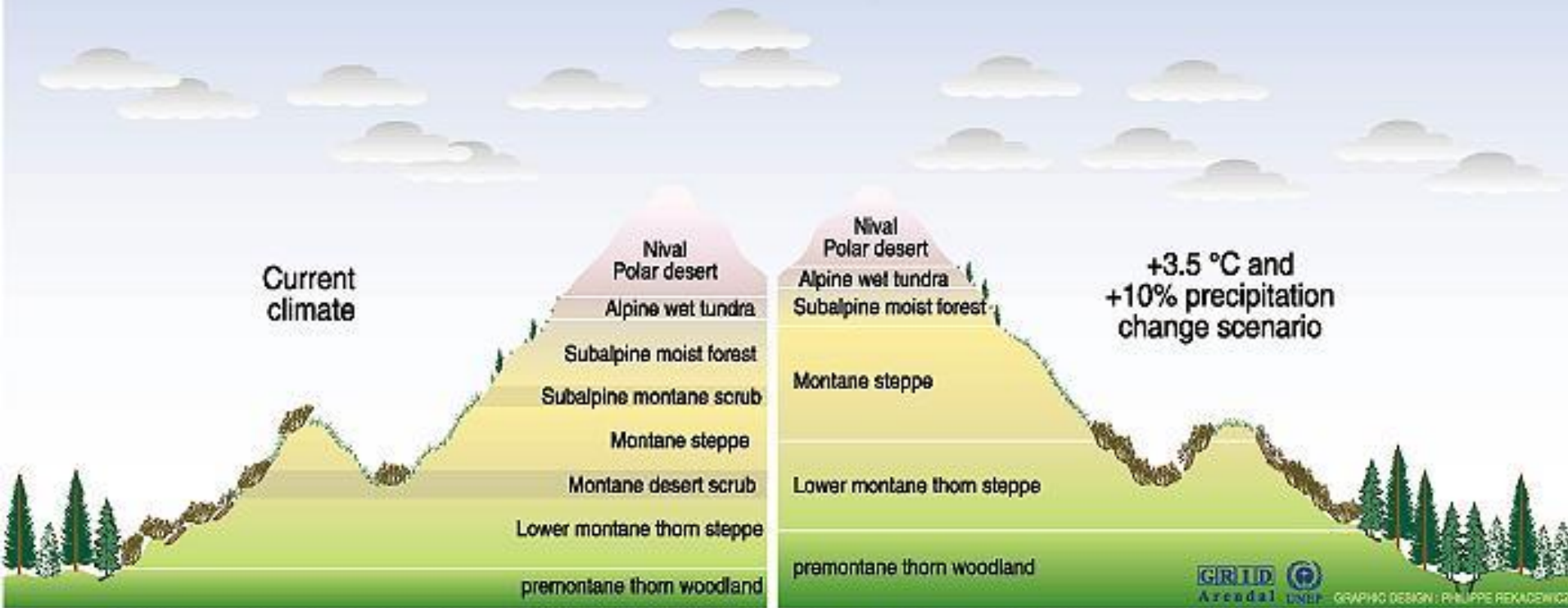






Effect of climate change on vegetation types in south coastal areas of US (*from Child, 2005*)

# Impact on mountain vegetation zones



Sources: Martin Beniston, Mountain environments in changing climates, Routledge, London, 1994; Climate change 1995, Impacts, adaptations and migration of climate change, contribution of working group 2 to the second assessment report of the Intergovernmental panel on climate change (IPCC), UNEP and WMO, Cambridge press university, 1996.

Climate warming in the past has caused **vegetation zones to shift to higher elevations, resulting in the loss of some species and ecosystems.** Simulated scenarios suggest that continued warming could lead to species and ecosystems disappear and, volume of glaciers and the extent of permafrost and seasonal snow cover will be reduced.

*(From Child, 2005)*

# Impacts of climate change on grazing system

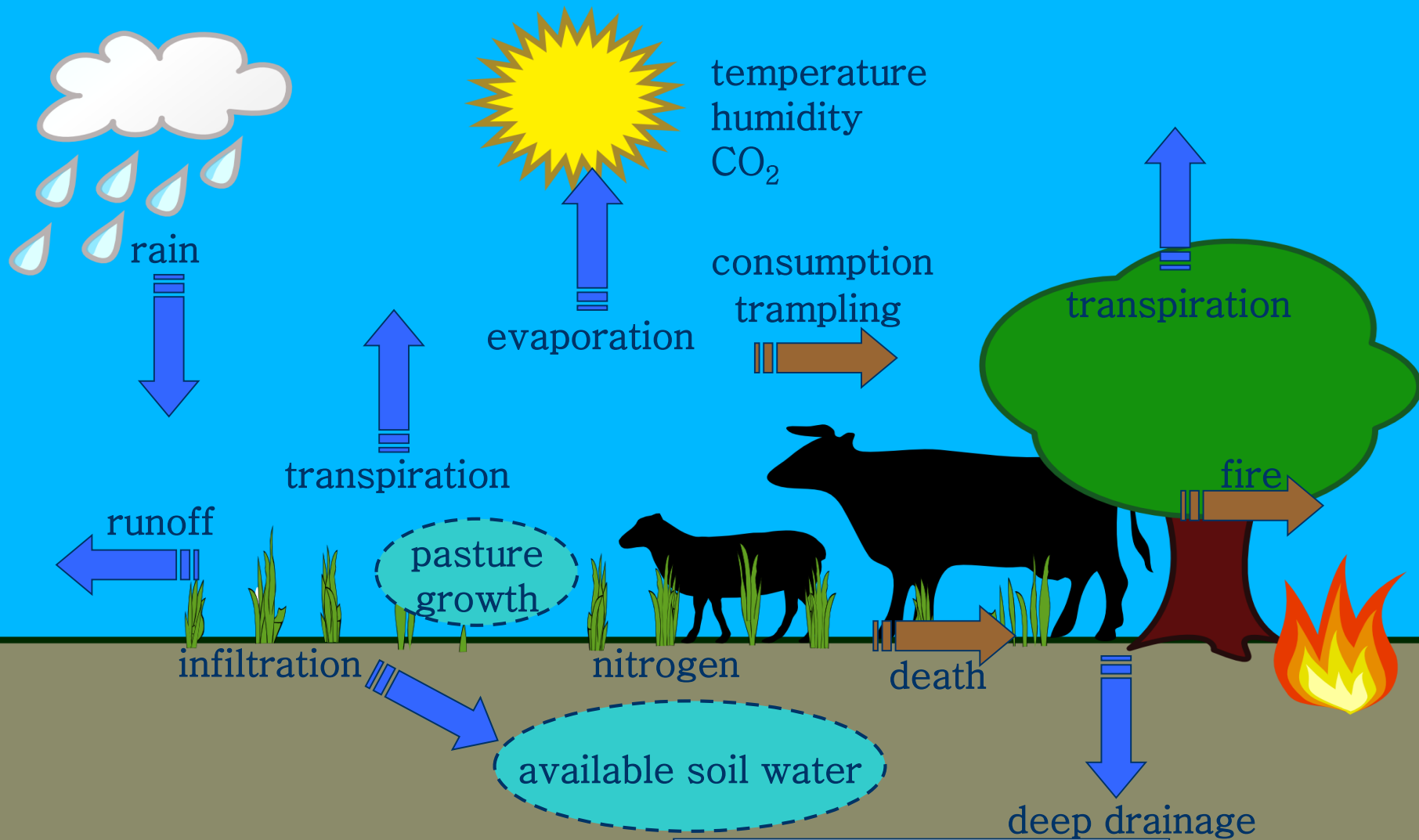
## Beneficial

- increased pasture growth in winter/spring
- fewer frosts
- reduced animal stress in winter
- different responses of pasture species

## Detrimental

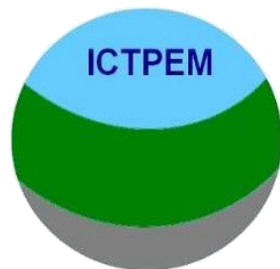
- increased rainfall intensity
- increased potential evaporation (depends on wind)
- increased soil evaporation
- decreased pasture growth in hot summers and reduced digestibility
- death of trees (cavitation) in drought
- increased animal stress in summer
- reduced on grazing time and increased water demand
- increase in disease and pests when hot and wet
- impact on human health

# Assessing impacts of climate change on grazing system: modelling approach





# Climate change *VS* highland pastoralism

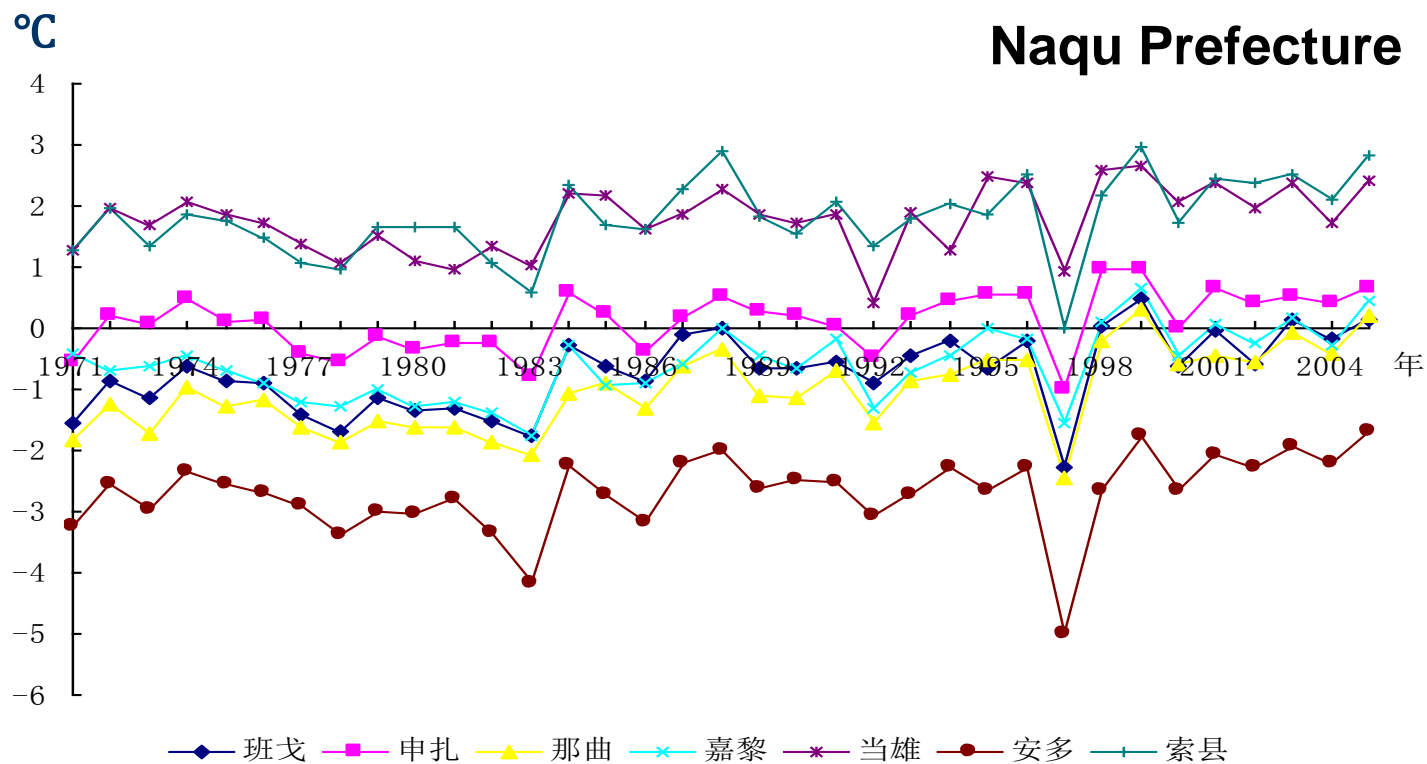


# Northwest Tibet

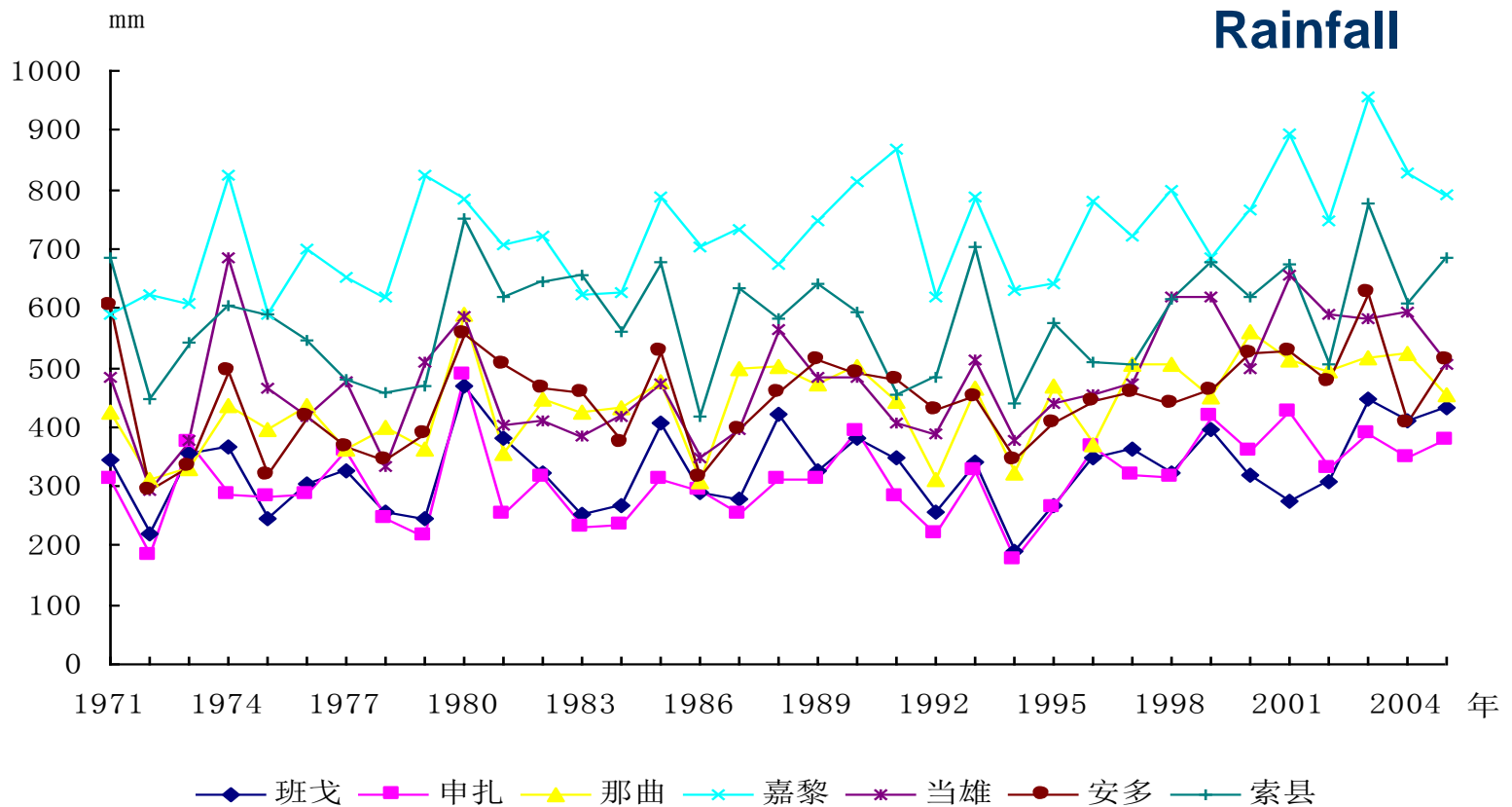
China map



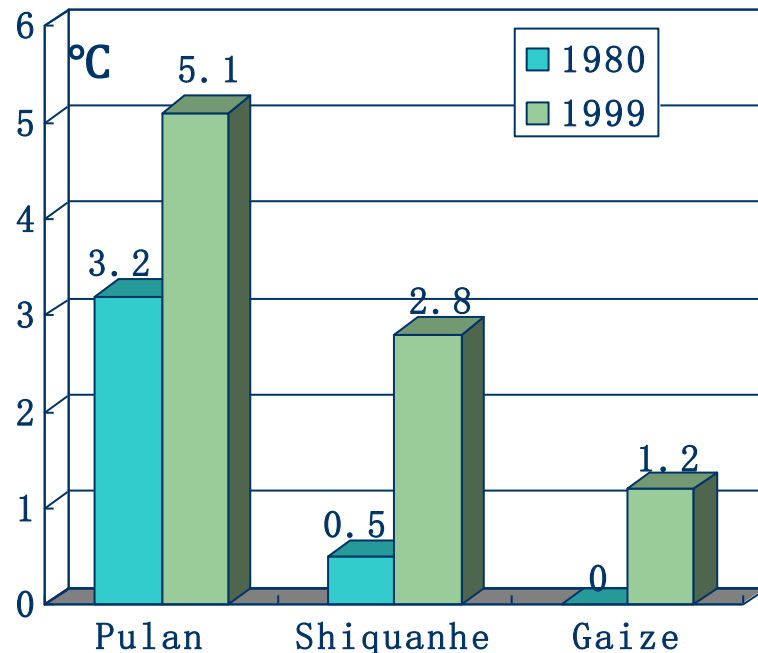
# Annual air temperature raising



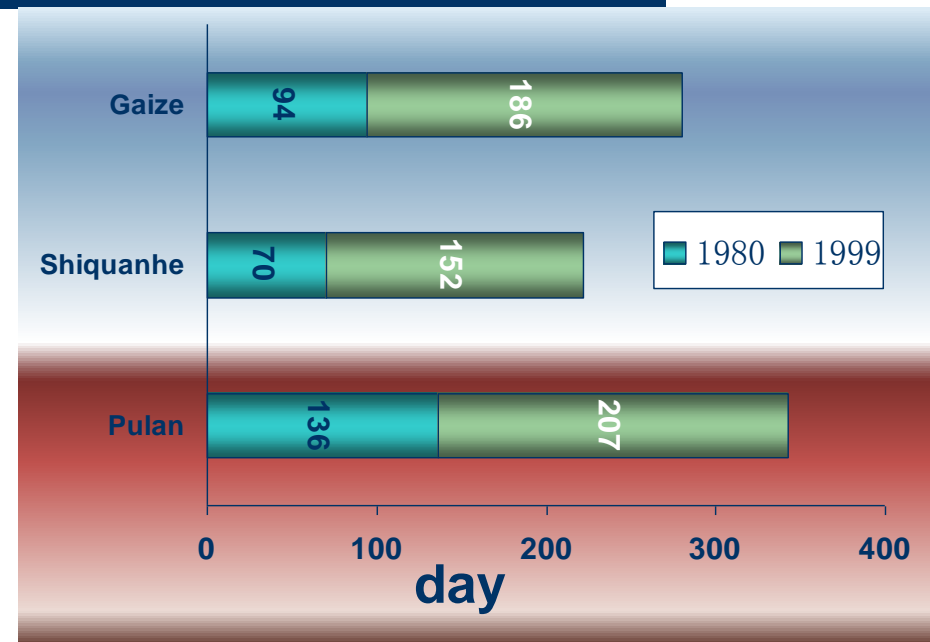
# Annual rainfall increasing in Naqu



# Annual air temperature raising in Ali



Annual average Temp raising  
in **Ali prefecture** (Dong, 2003)



Free-frost period in Ali  
prefecture (Dong, 2003)

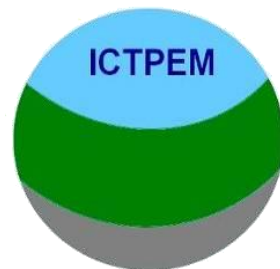
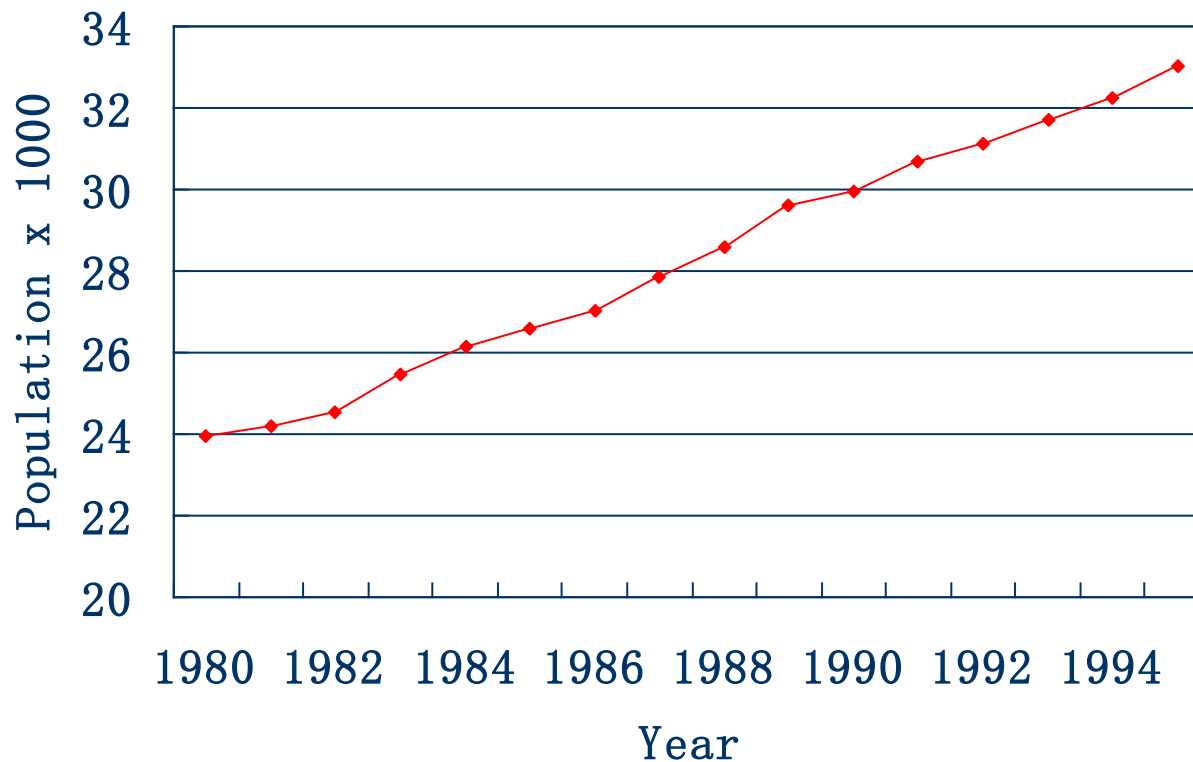


# Annual rainfall decreasing in Ali

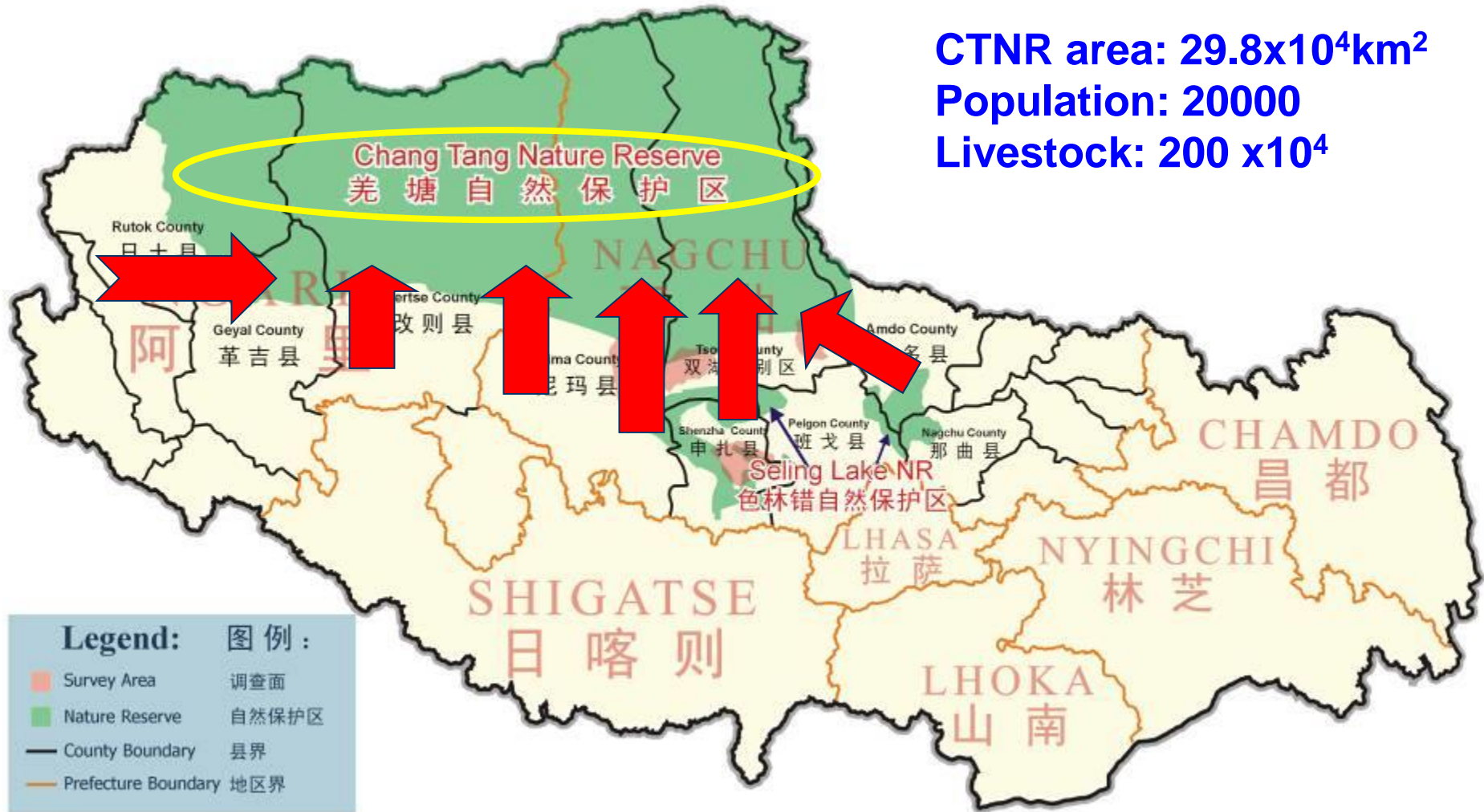
<b>Year</b>	<b>Pulan (mm)</b>	<b>Gaize (mm)</b>
<b>1980</b>	<b>208.8</b>	<b>254.6</b>
<b>1999</b>	<b>101.3</b>	<b>116.4</b>

*From Dong, 2003*

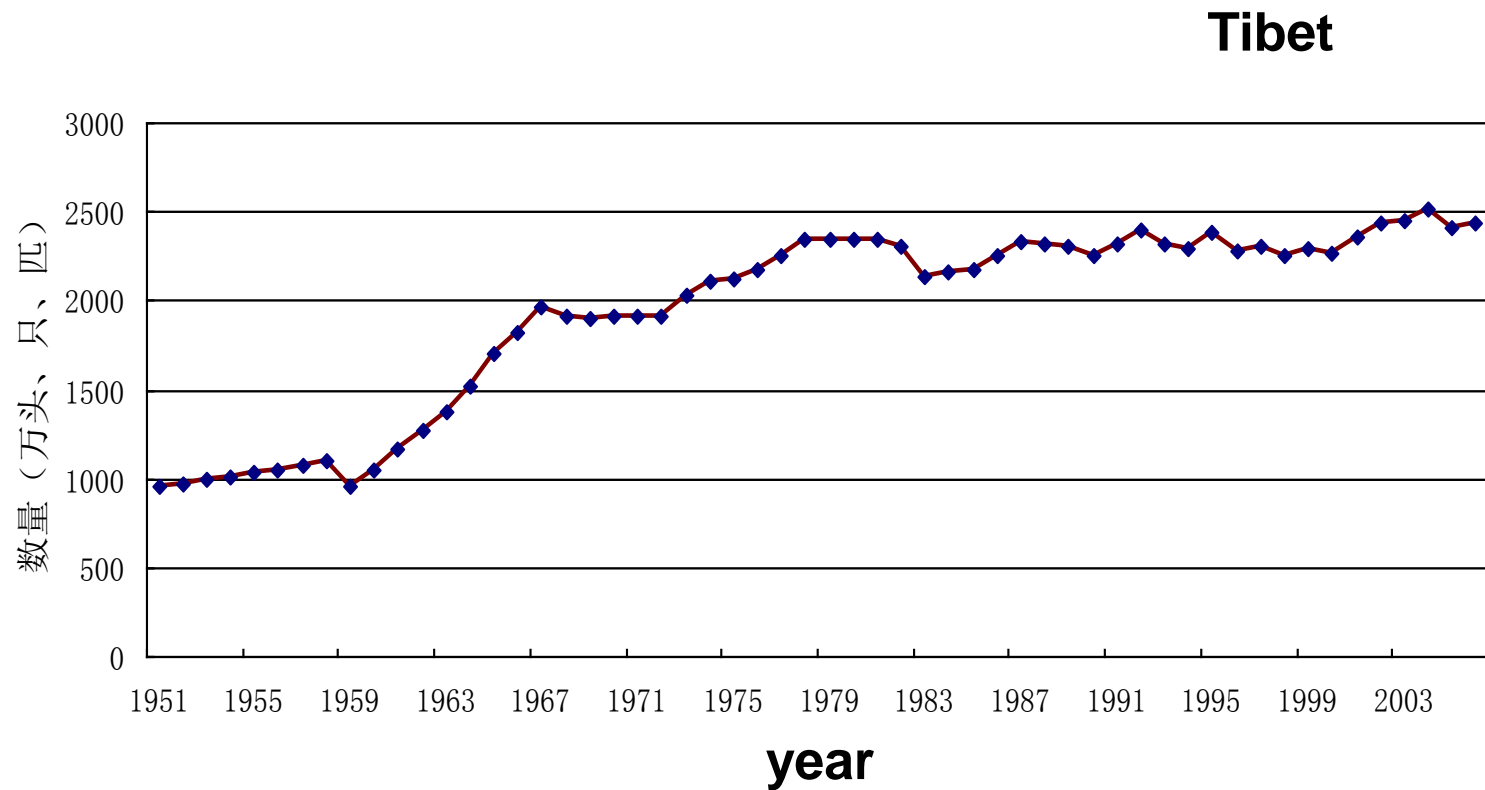
# Human population raising in Naqu



# Population pressure + Temperature raising



# Livestock population raising



# Wildlife population raising



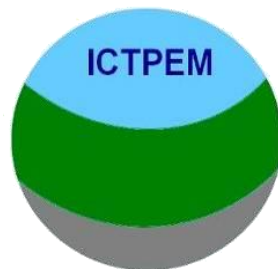
Ali:  $20 \times 10^4$

Naqu:  $100 \times 10^4$



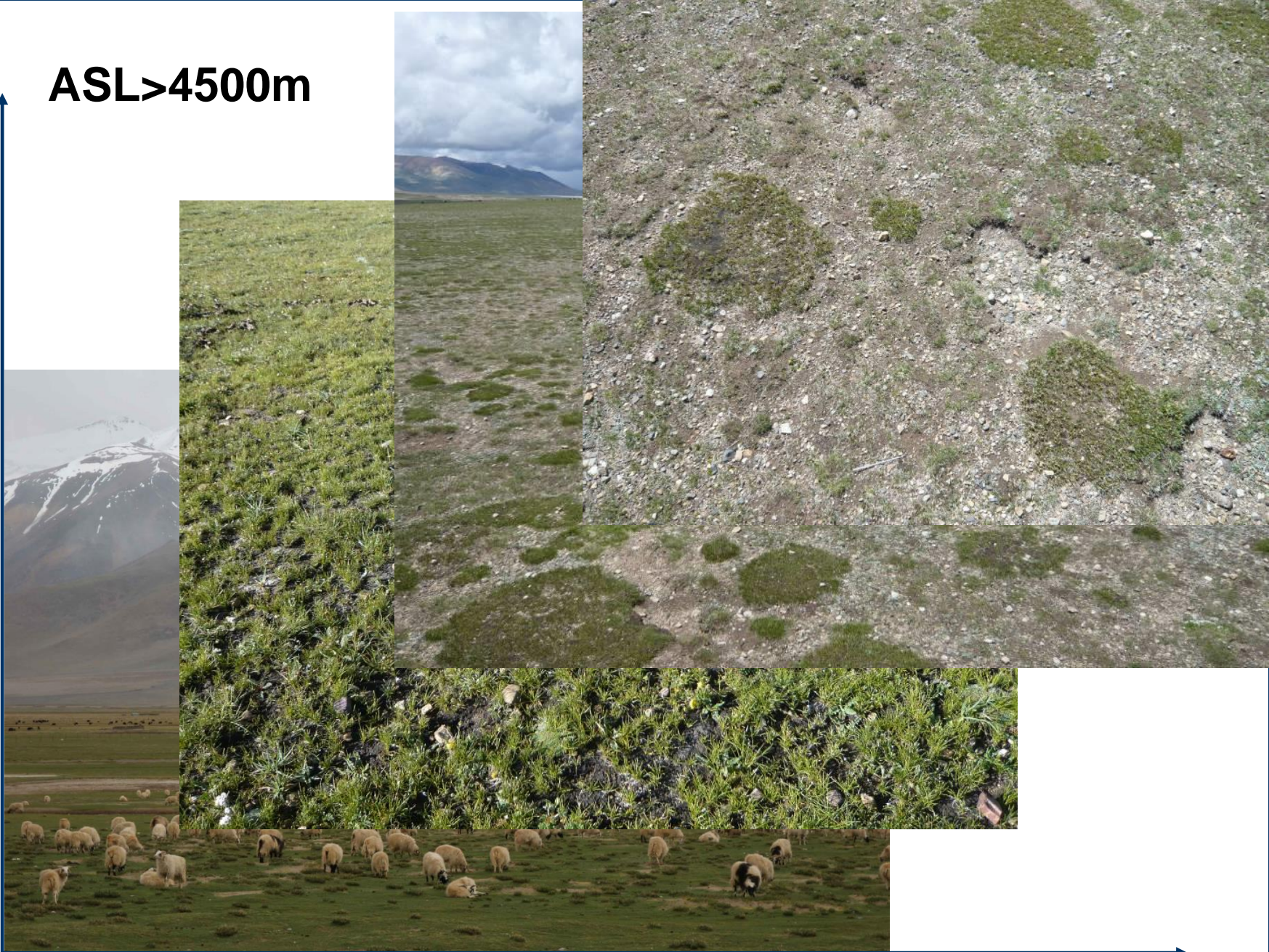


# **Consequences of natural factors and human activities**



Overgrazing + climate change

ASL>4500m

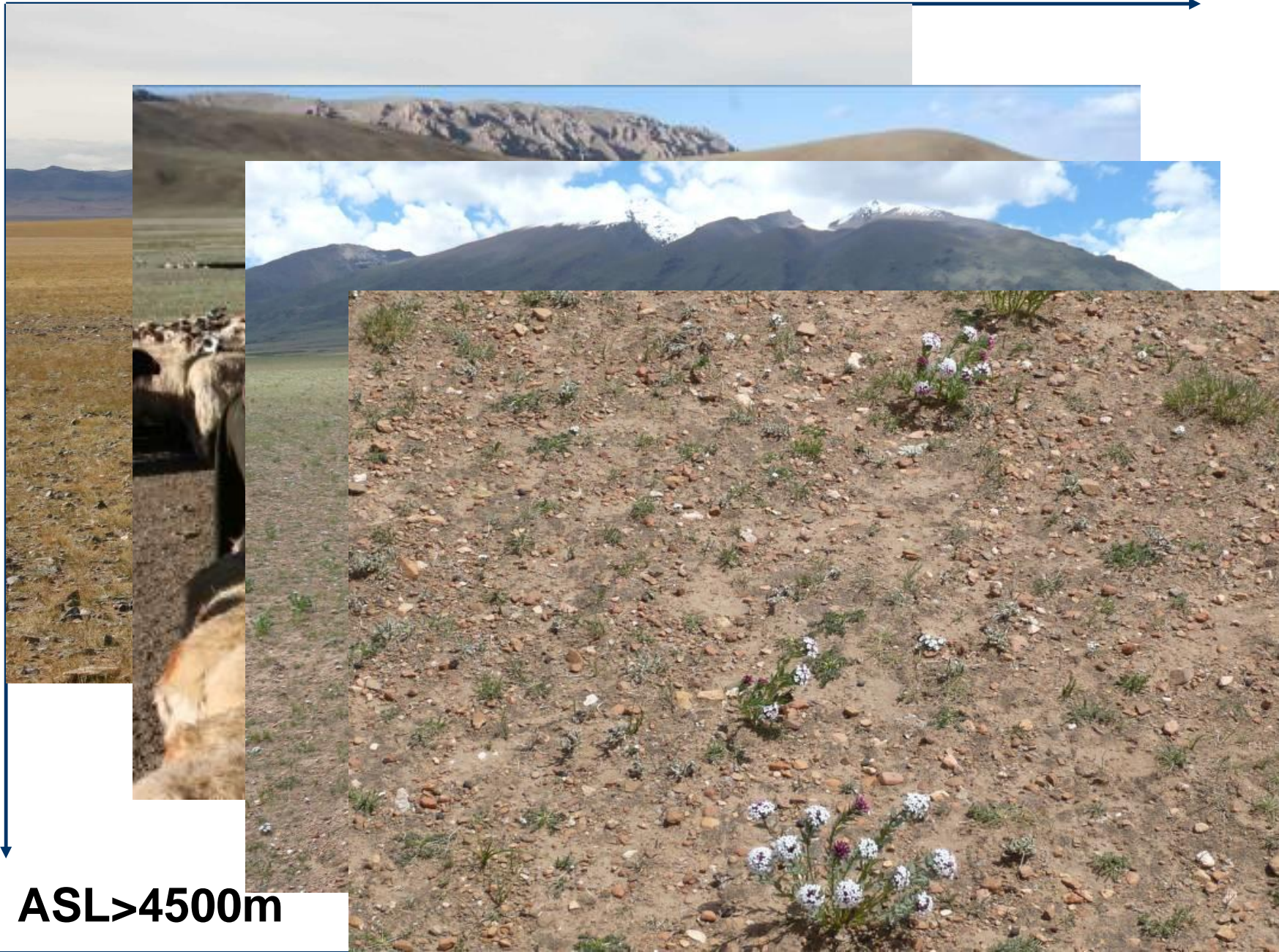


*Succession of degradation on alpine meadow in Naqu*



# *Succession of degradation on alpine steppe **in Ali***

Overgrazing + climate change



ASL > 4500m



# *Desertification of alpine rangelands **in Ali***

Overgrazing + climate change





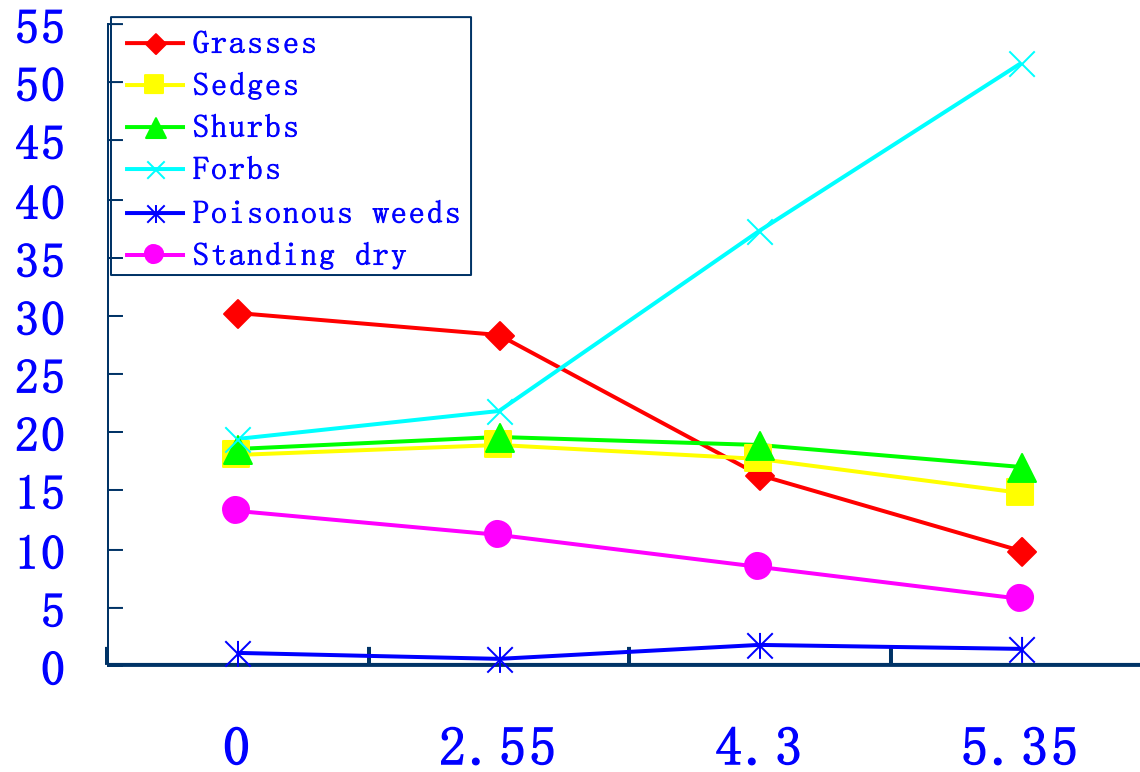
# *The rodents damage to alpine rangeland **in Naqu***

Overgrazing + climate change



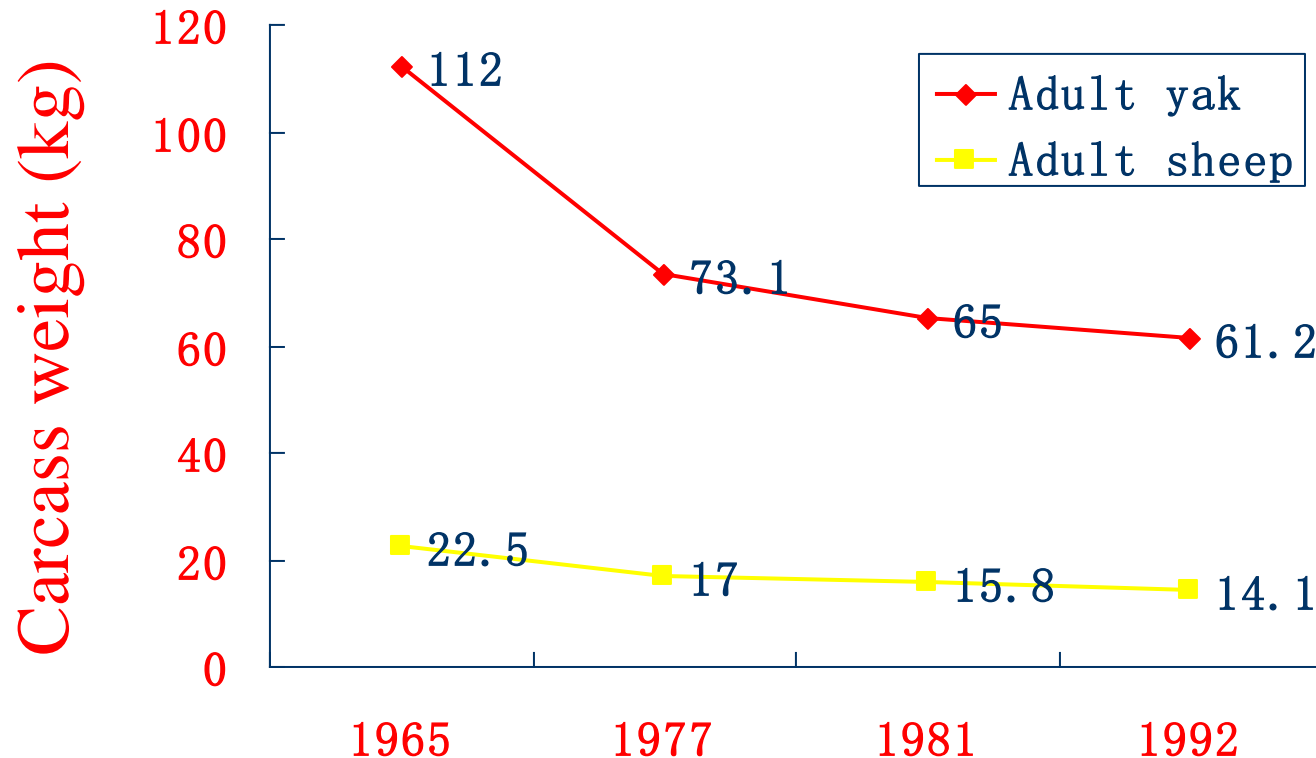


# Pasture above-ground biomass decreasing as biodiversity changing



The variation of dry-mass proportion (%) of different plant groups under different stocking rates (SU/hm<sup>2</sup>) (3-year data)

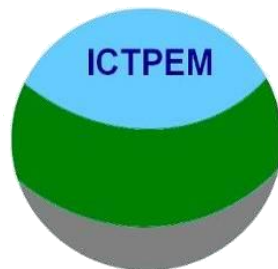
# Animals suffer from malnutrition and carcass weight decrease



# Summary

1. Alpine rangeland degradation major caused by climate change and overgrazing
  - ◆ **Production overgrazing**—in decreased animal productivity
  - ◆ **Landscape overgrazing**—poor landscape function
2. Livestock carrying capacity are likely to be large
  - ◆ **Summer pasture**-- used by more months
2. Alpine rangeland ecosystem dysfunction
  - ◆ **Loss** of self regulation
  - ◆ **Leakiness** of water and nutrients as an absence of perennial vegetation and much bare ground appeared
  - ◆ **Livestock** production is more variable (less milking)
3. Livelihood is more hard (healthy issues)

# **Technical measurements in adaptation to landscape degradation on farm level**



# Tibetan Dangxiong Rangeland Experimental Station (ASL: 4300m)



In-door feeding

21 9:20PM





**Fodder production within greenhouse during growth period and keep animals in winter in cold desert, Tibet, ASL:4500m**



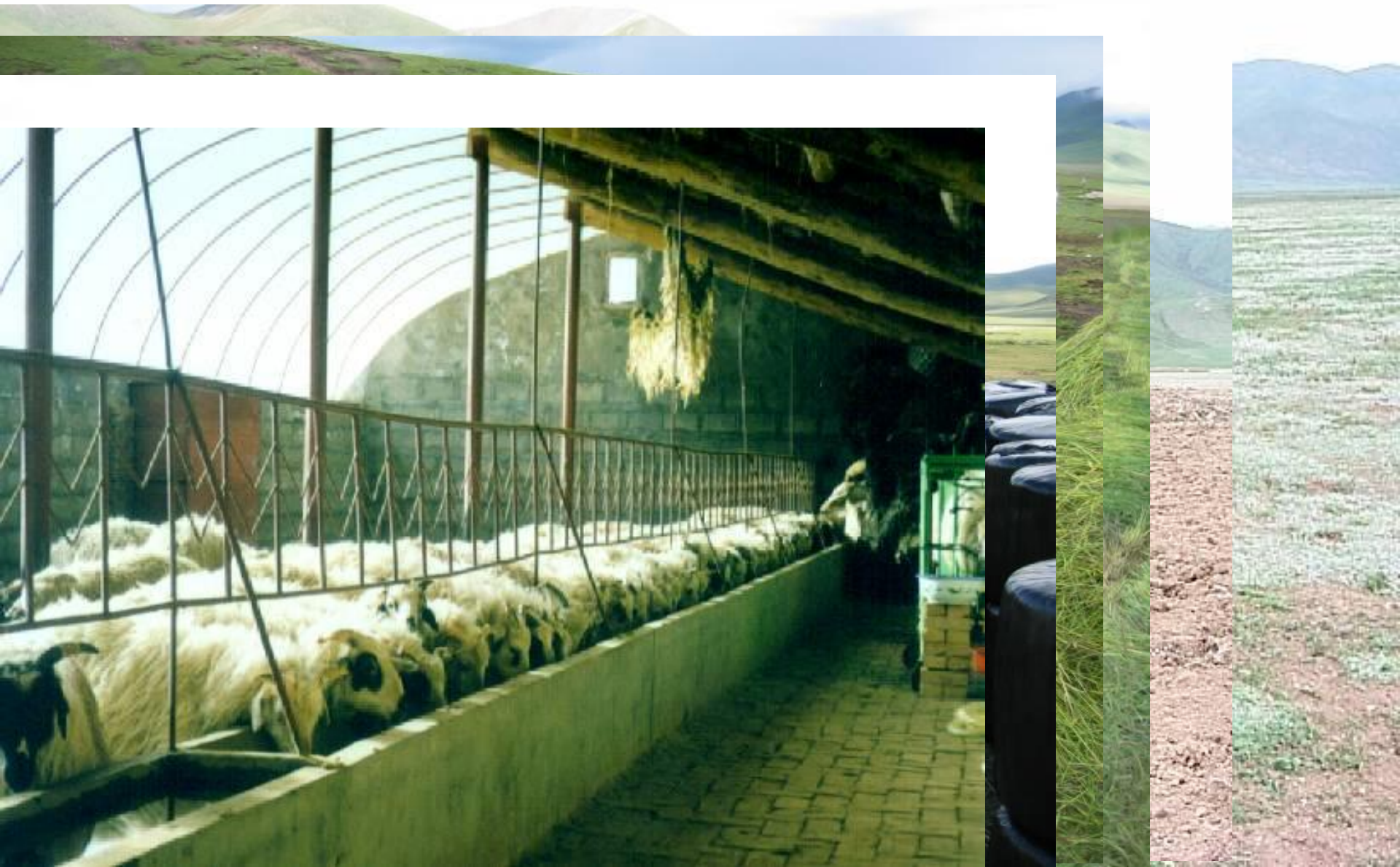


# Forage production on Farm level





# Intensive forage production & use on farm level



## **Sowing pasture:**

- Ecosystem functions improved
- Income increased
- Tibetan herders with better livelihood

**Herder: Zhanuo**





# Vegetables production in Ali prefecture

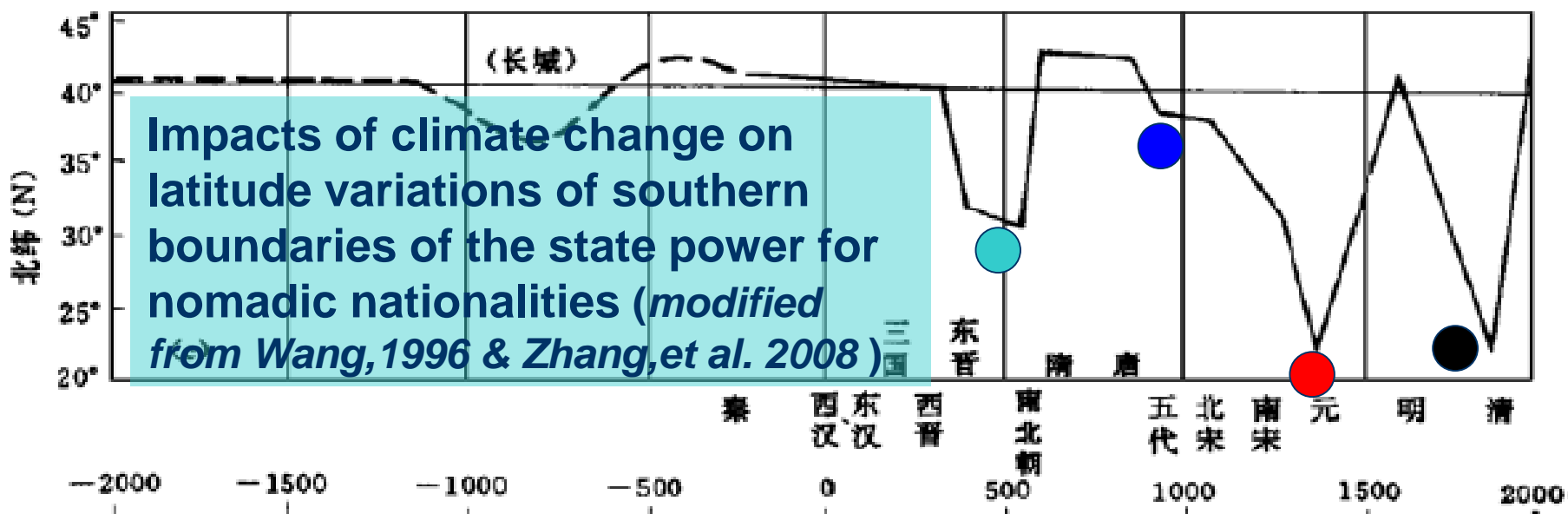
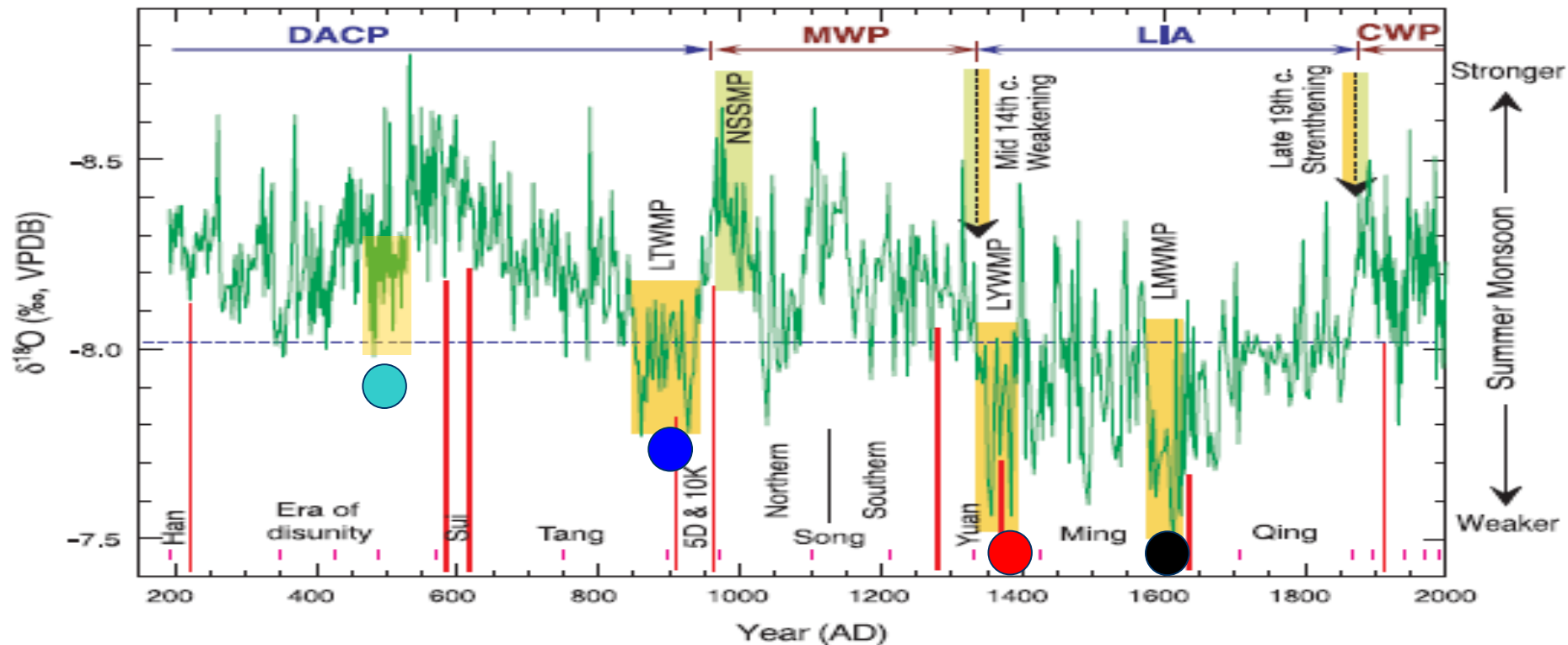
## ASL4500m



# Summary

- ◆ **Sowing pastures or over-seeding on the fields and forage in greenhouses**
- ◆ **Reduction of livestock number**
- ◆ **Livestock in-door or greenhouses feeding**
- ◆ **Alternative livelihood-- Vegetable production in greenhouse in Ali prefecture**







Thank you