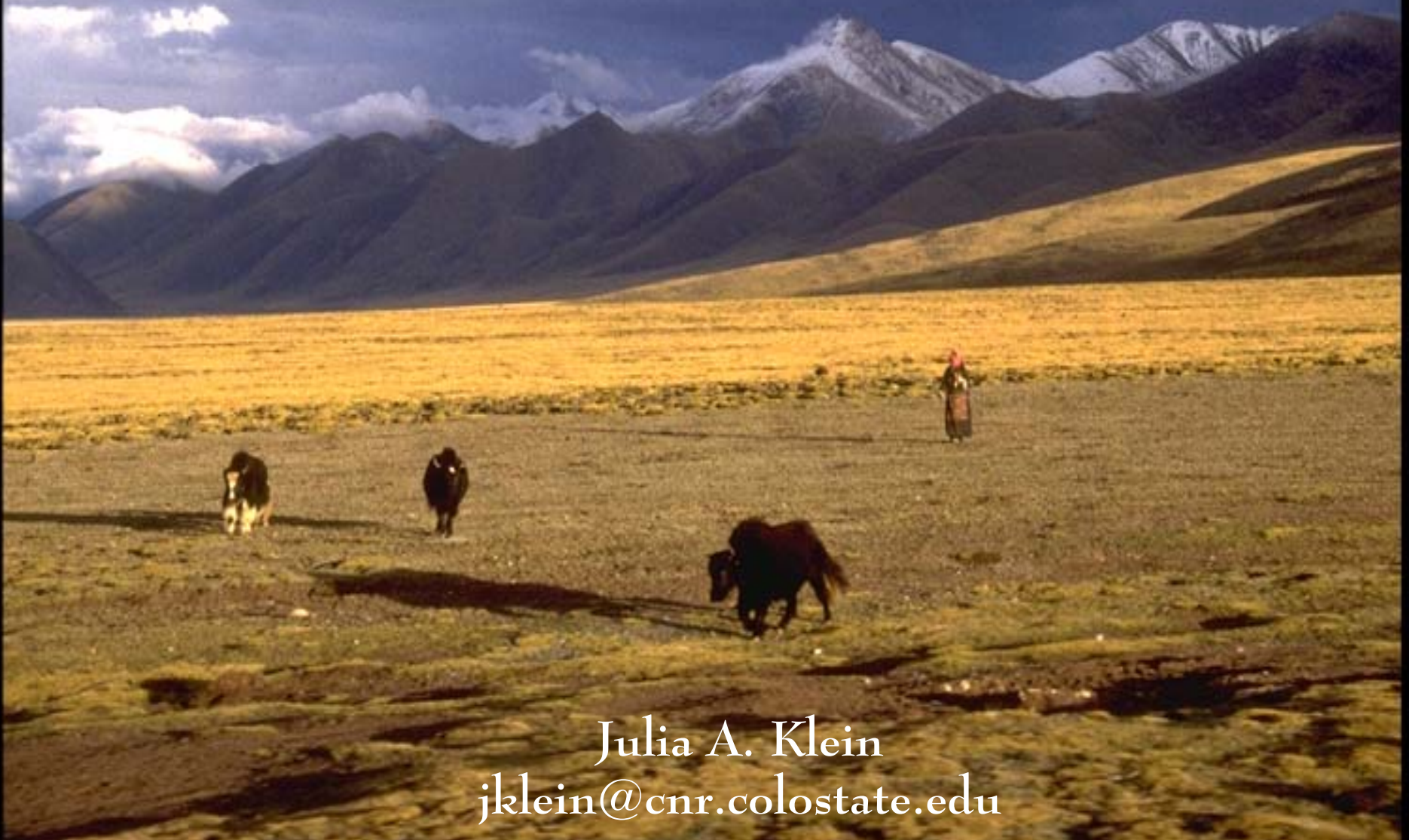


# Climate Change on the Tibetan Plateau: Ecological Effects & Implications for Pastoral Livelihoods



Julia A. Klein  
[jklein@cnr.colostate.edu](mailto:jklein@cnr.colostate.edu)

# Acknowledgements



Collaborators: J. Harte, UC Berkeley; K. Galvin, R. Boone, D. Ojima, Colorado State University; E. Yeh, CU Boulder; X.Q. Zhao, NW Plateau Institute of Biology; S. Kang, Tibet Plateau Institute.

Students & Assistants: E. Betts, T. Dorje, K. Hopping, J. Hu, L. Jianshen, S. Kloss, S. Lippert, S. McCarthy, Y. Nyima, T. Thondup.



# Tibetan Plateau Rangelands



# Vegetation on the Plateau





# Pastoral Livelihoods





# Wildlife on the Tibetan Plateau



Photo credits: WCS, G. Schaller, FAO

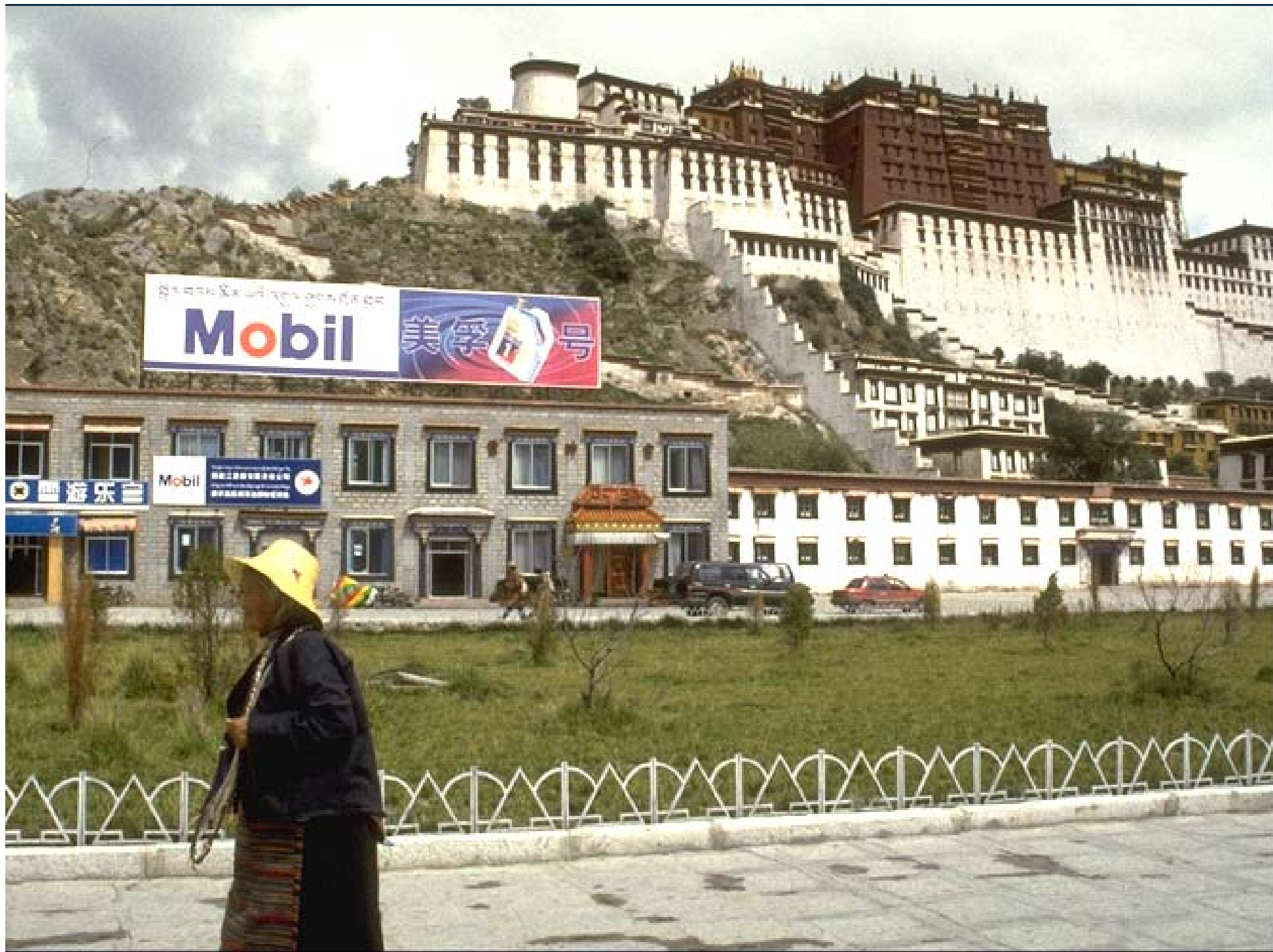
# Importance of the Tibetan Plateau

- Headwaters region
- Extensive rangeland system
- Important wildlife habitat
- Resource-dependent community

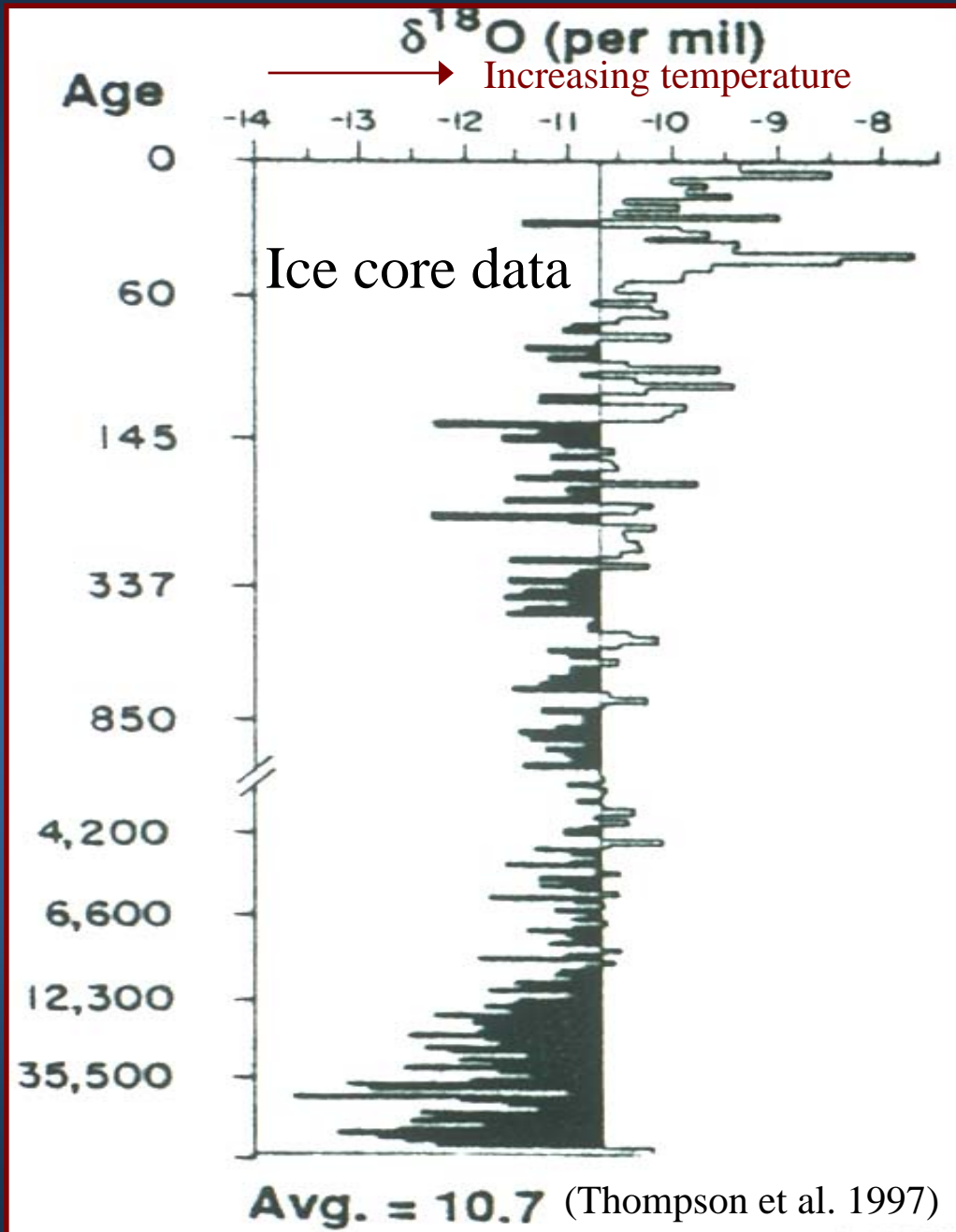
*Computer generated visualization of the Tibetan Plateau from satellite imagery.*

NASA  
Image from D. Miller









# Climate Warming on the Tibetan Plateau



Photos: L. Thompson

# Climate Warming on the Tibetan Plateau



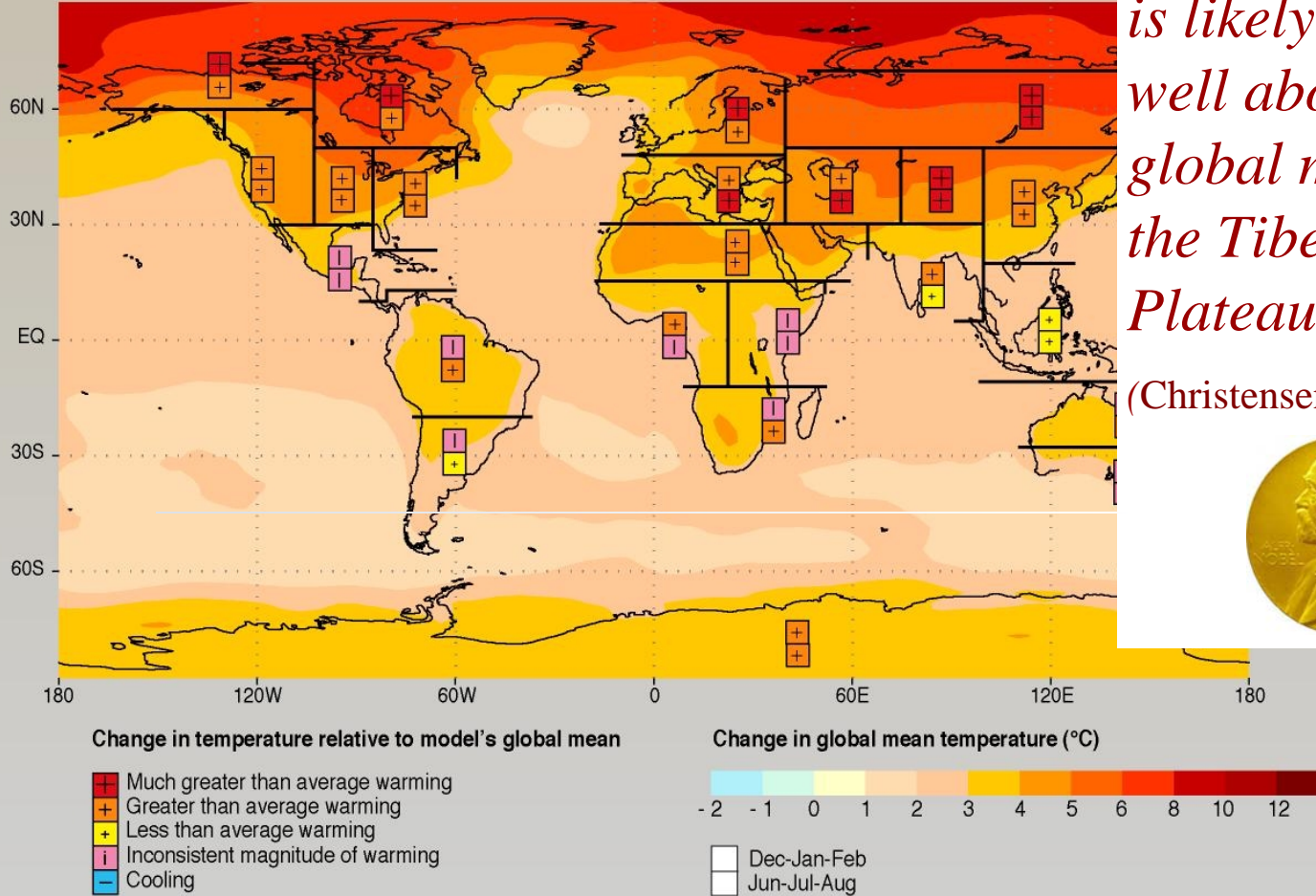
## Local Observations:

*“It used to be really, really cold here. The mountains used to be covered with snow year-round.”*

*– local herder*



## Change in temperature for scenario A2



*“...the warming is likely to be well above the global mean on the Tibetan Plateau”*

(Christensen et al. 2007)

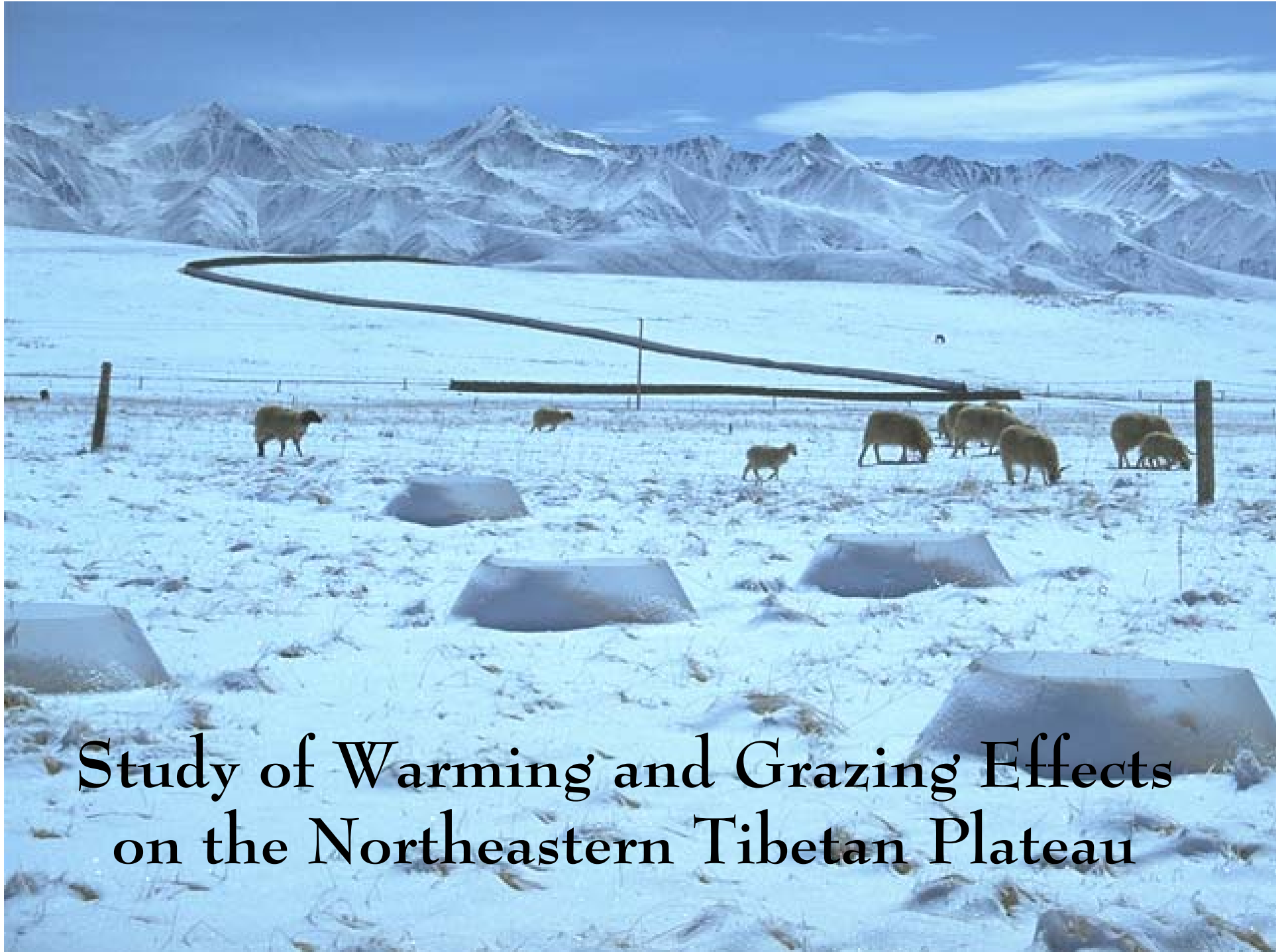


SYR - FIGURE 3-2

# Changes to the Traditional Grazing System







**Study of Warming and Grazing Effects  
on the Northeastern Tibetan Plateau**

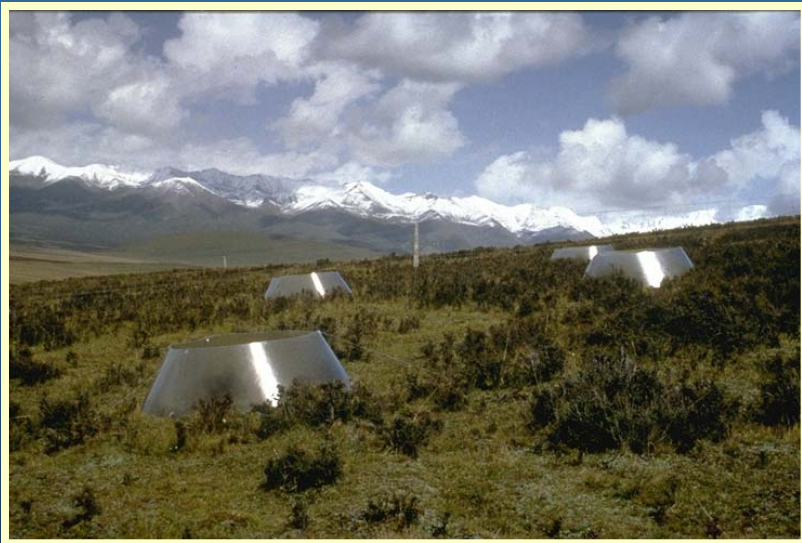
# Study Sites

## Shrubland Habitat

*(colder, moister)*

*Potentilla fruticosa*

summer pasture



## Meadow Habitat

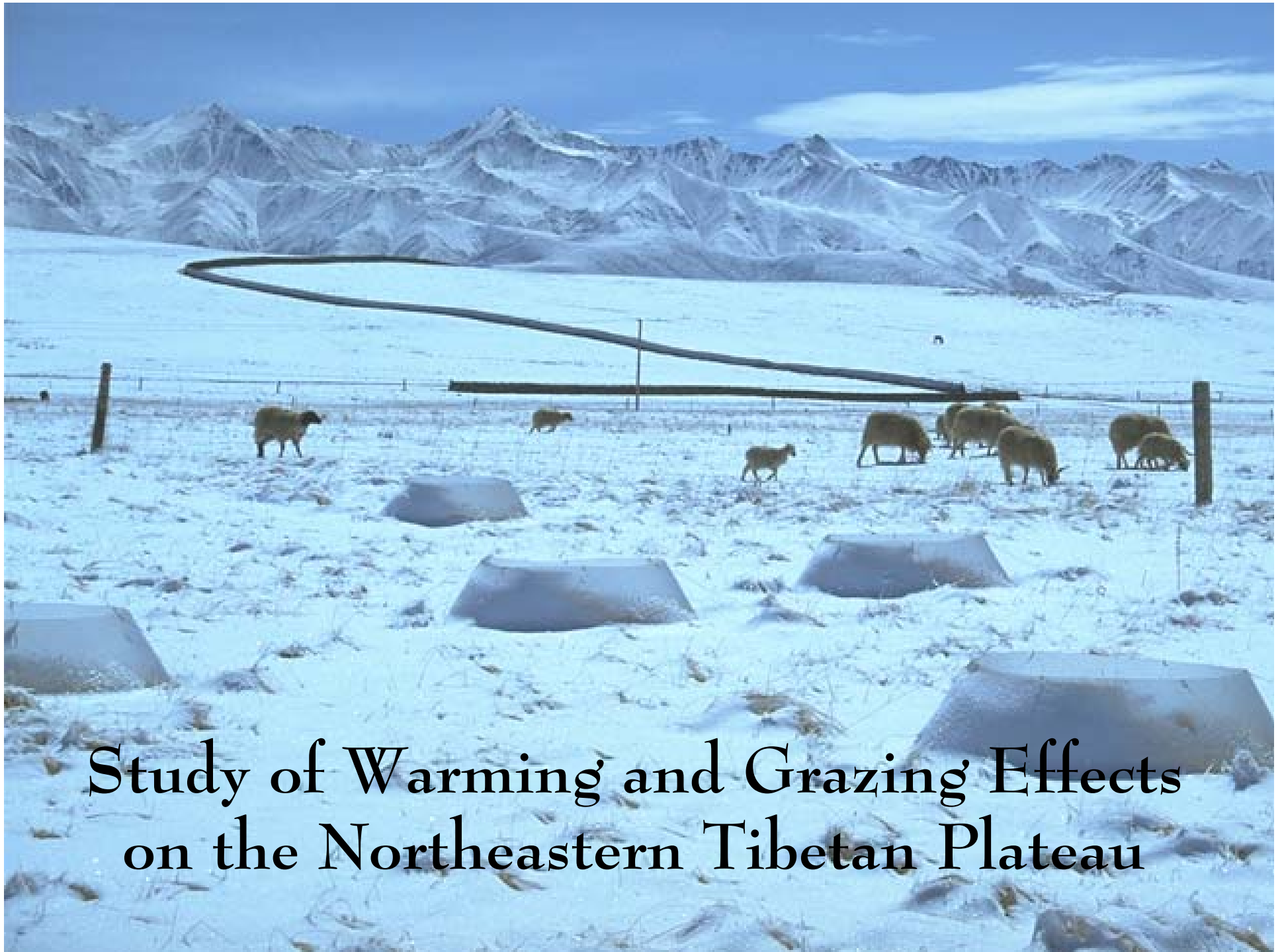
*(warmer, drier)*

forbs and graminoids

winter pasture







**Study of Warming and Grazing Effects  
on the Northeastern Tibetan Plateau**

# Warming Negatively Affected the Vegetation

- Warming in meadows decreased the overall production of the system
- Warming led to expansion of the shrublands at the expense of the meadow vegetation
- Warming decreased overall plant diversity

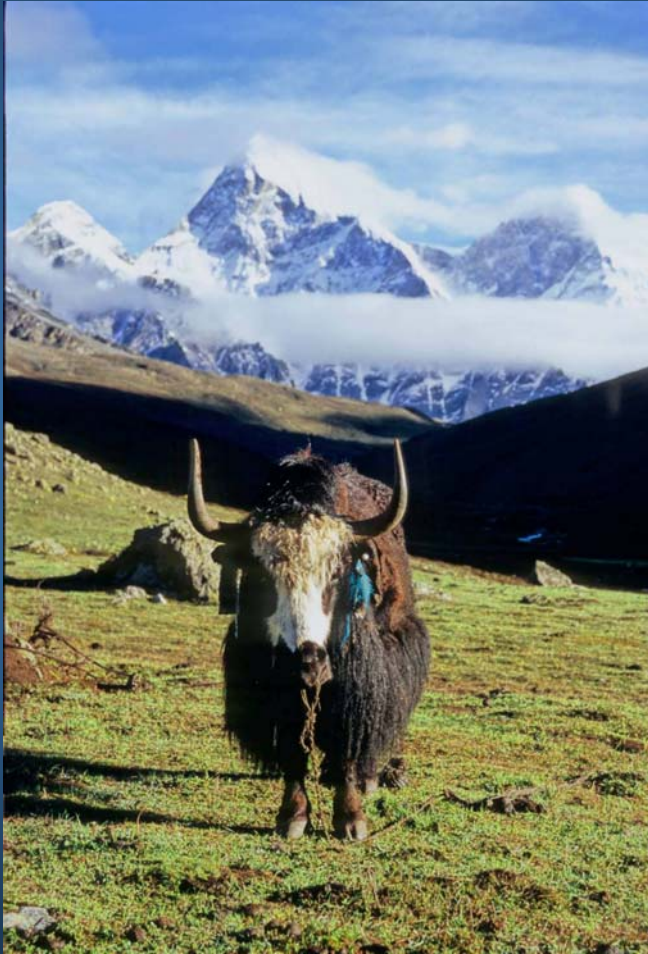


# Warming Negatively Affected the Vegetation

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# Implications of Shrubs Replacing Grasses with Warming



*Bos grunniens*

*Change in Herd Composition???*



# Changing Ecosystem Services with Warming

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Ecosystem services are the benefits people obtain from ecosystems



**Millennium Ecosystem Assessment**

Strengthening Capacity to Manage Ecosystems Sustainably for Human Well-Being

[www.millenniumassessment.org](http://www.millenniumassessment.org)

# Warming Effects on Ecosystem Services

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Medicinal plant and palatable forage species declined with warming

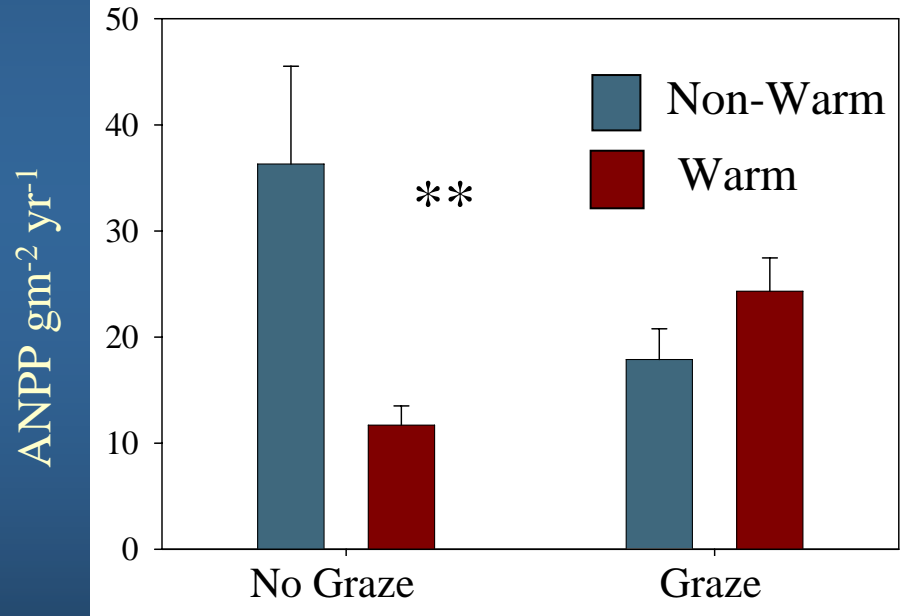


# Grazing Reduced Losses due to Warming Alone

- Grazing reduced overall production losses, the species diversity losses, the shrub expansion and decline in ecosystem services that resulted from warming.

# Grazing Buffered Against Losses Due to Warming

*Gentiana straminea* (medicinal plant)





# Rangeland Policies may Reduce Adaptive Capacity of Rangelands to Respond to Climate Warming



A wide-angle photograph of a vast, rocky landscape under a dramatic, stormy sky. The foreground is a dark, rocky plain. In the middle ground, there are low, rounded hills and a small, dark structure. The sky is filled with heavy, dark clouds, with a bright blue patch of sky visible through a break in the clouds. The overall mood is one of power and intensity.

# New Project

Ecosystem & Herder Vulnerability to Extreme  
Weather Events, Climate Warming & State  
Policies on the Tibetan Plateau

Ecologists, Anthropologists, Geographers, Modelers



# Snow Disasters on the Tibetan Plateau



# How Does this Relate to Water?

- Not enough water
  - warming can lead to too little soil moisture
- Too much water at once
  - extreme weather events (snowstorms)



climate-water-vegetation-livestock-herders



# Responding to Climate Change

Need to increase the resilience and the adaptive capacity of ecological and social systems to climate change

