

Mitigating Impacts of Fuelwood Collection on Wildlife Habitat through Payments for Ecosystem Services

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Introduction

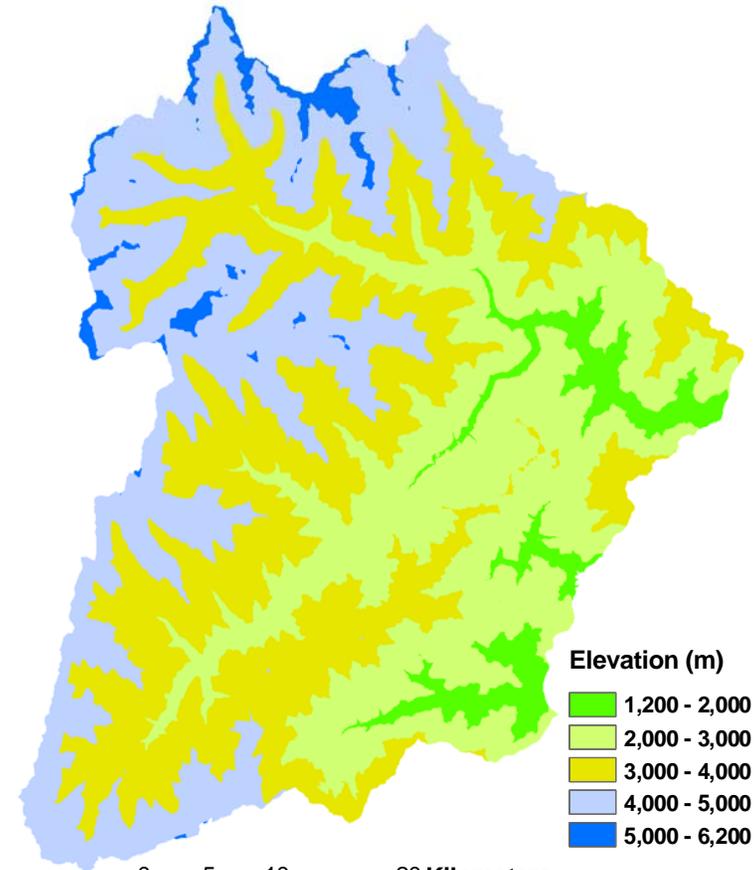
Conflicts Between Bioenergy and Biodiversity

- # Natural environment provides bioenergy to humans
 - In developing countries, about 30% of energy supplies come from fuelwood
 - # Natural environment also supports biological diversity and provides many other ecosystem services
 - # Excessive extraction of bioenergy (e.g., fuelwood) have resulted in ecosystems degradation, leading to biodiversity loss and deterioration of other ecosystem services
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Global Conservation Efforts

- Billions of dollars have been invested to conserve ecosystems globally
 - Conservation interventions
 - Stimulate community economies (e.g., ecotourism)
 - Provide social benefits (e.g., education)
 - Redirect labor and capital from harmful activities
 - Ecosystem degradation continues
 - Payments for Ecosystem Services (PES)
 - Provide incentives directly to ecosystem services providers to undertake actions desired for conservation
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Study Area - Wolong Nature Reserve, China

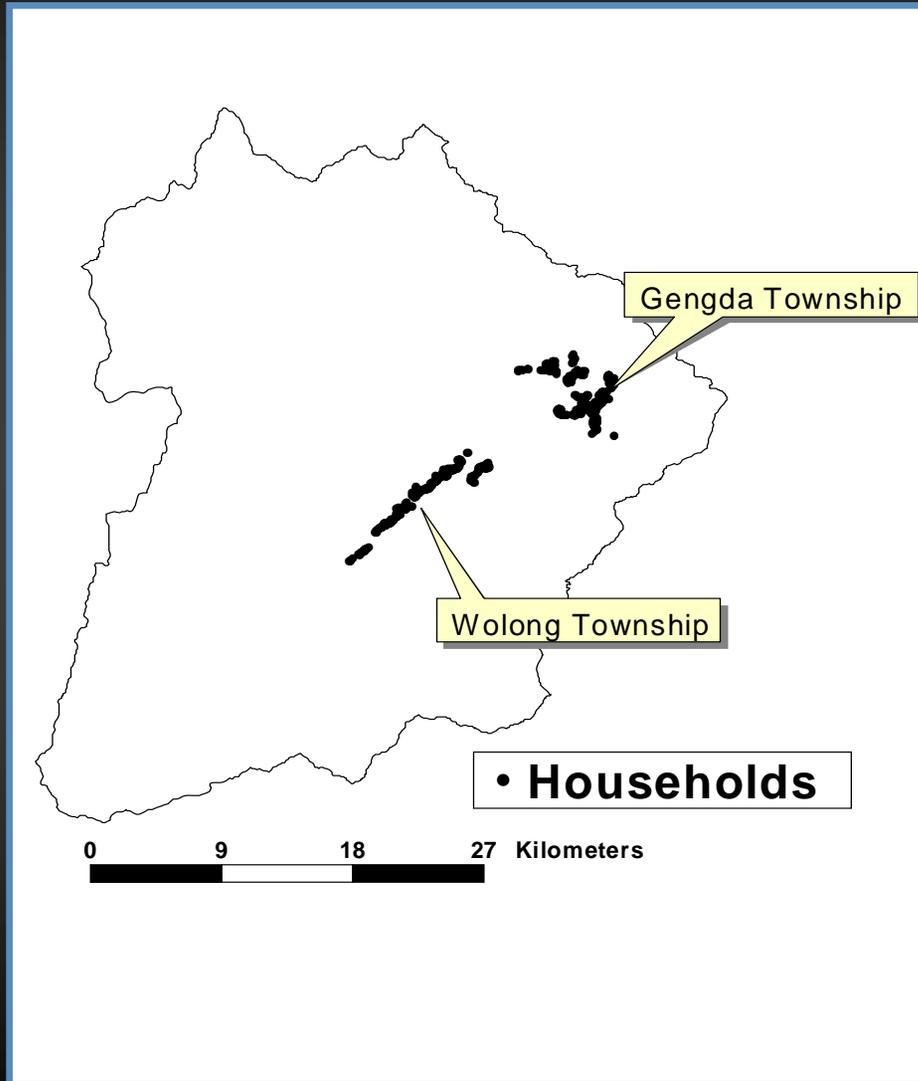


Wolong Nature Reserve

- # Founded in 1963- one of the largest reserves in China
- # Current size (2000 km²)
- # Habitat to about 10% of wild pandas and over 6000 plant and animal species



Human Activities

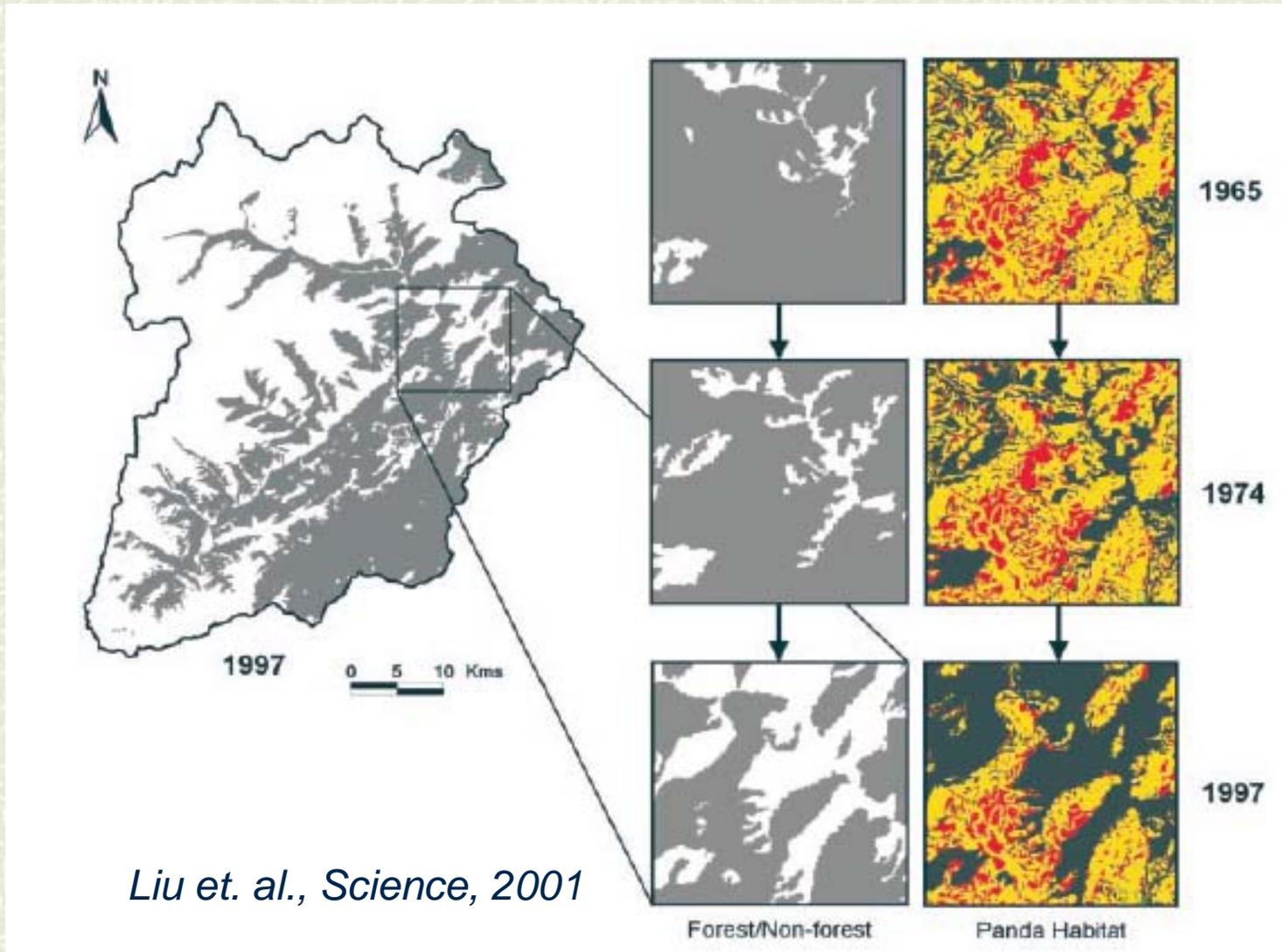


Timber Harvesting



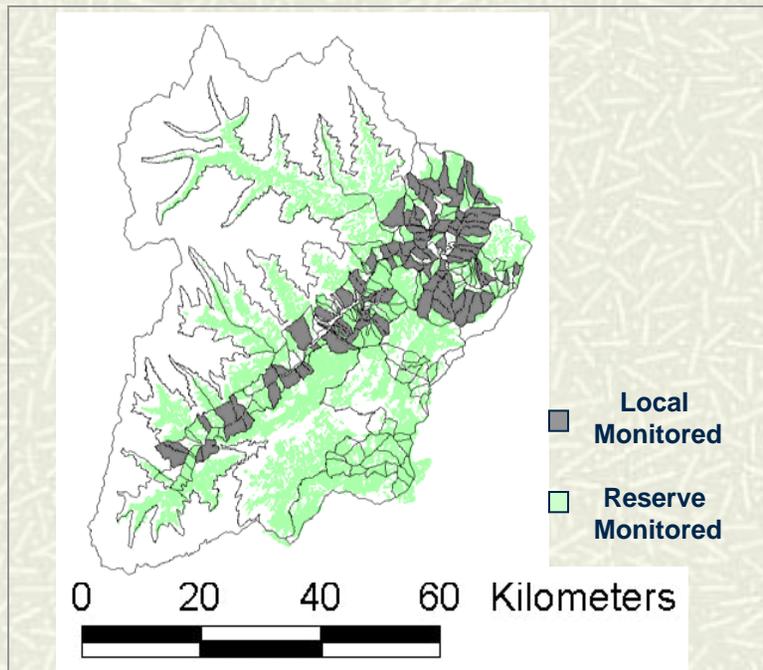
Fuelwood Collection

Degradation in Panda Habitat



Liu et. al., Science, 2001

Natural Forest Conservation Program



- Nation-wide conservation program in China since 2001
- 5~10 households monitor a forest parcel to prevent illegal timber harvest
- 850 yuan/year/household (1 USD=8 yuan as of 2006)
- Participants lose the payment if trees in their monitoring plots get harvested
- Participants are encouraged to purchase electricity with the payment to replace fuelwood

Methods

Detect Changes in Forest and Panda Habitat

■ Forest cover change detection

- Landsat Thematic Mapper images (1994, 2001, and 2007)
- Pre-policy forest cover change (1994 - 2001)
- Post-policy forest cover change (2001 - 2007)

■ Panda habitat change detection

- Forest cover
 - Elevation and slope generated from a digital elevation model dataset
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Human Activities and Socioeconomic Conditions



Interviews with 305 households

26% of all households in the reserve

- Timber harvest
- Fuelwood collection
- Socioeconomic conditions

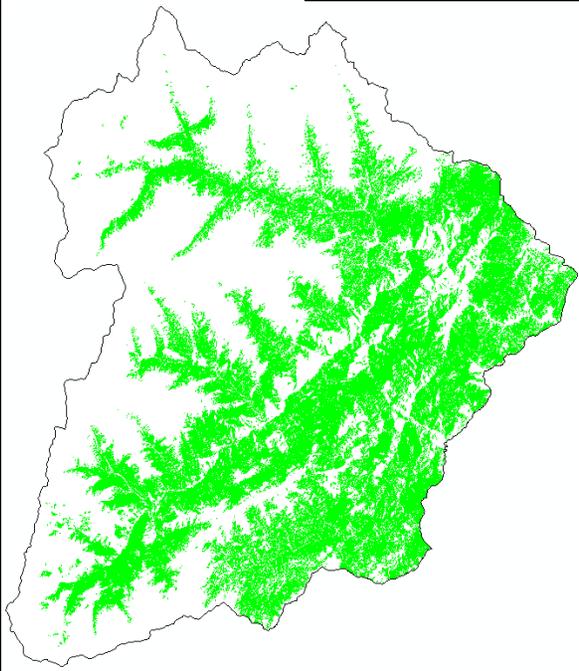
Results

Forest Cover

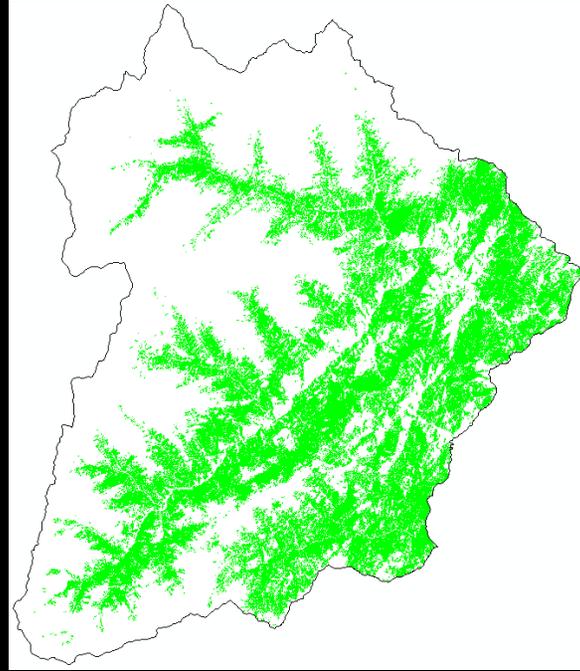
Legend

 Forest

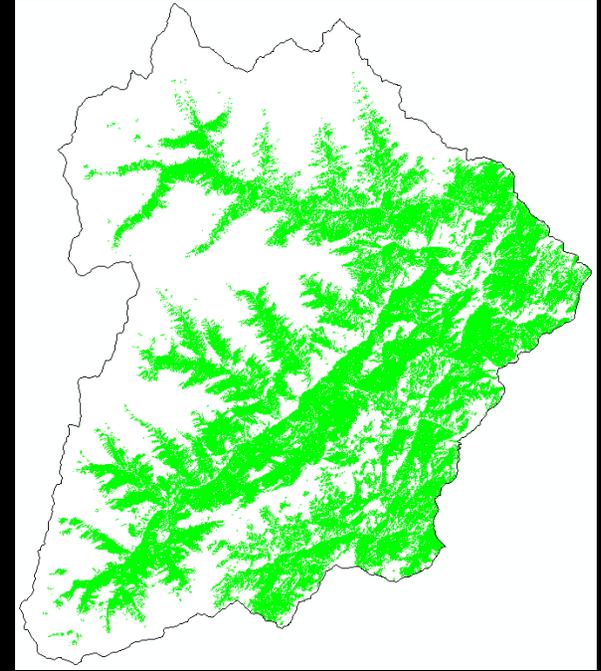
 Non-forest



1994

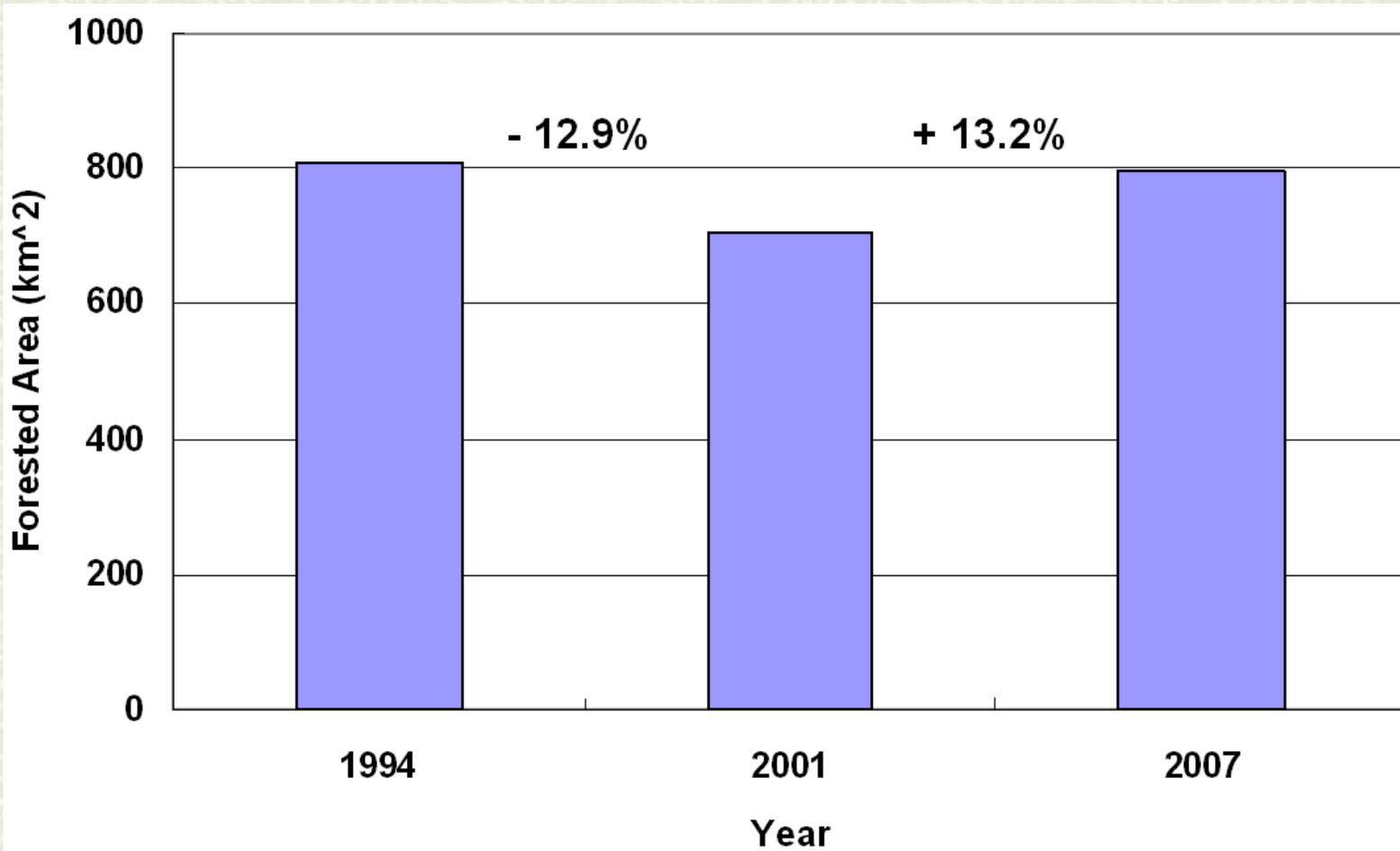


2001



2007

Change in Forested Area

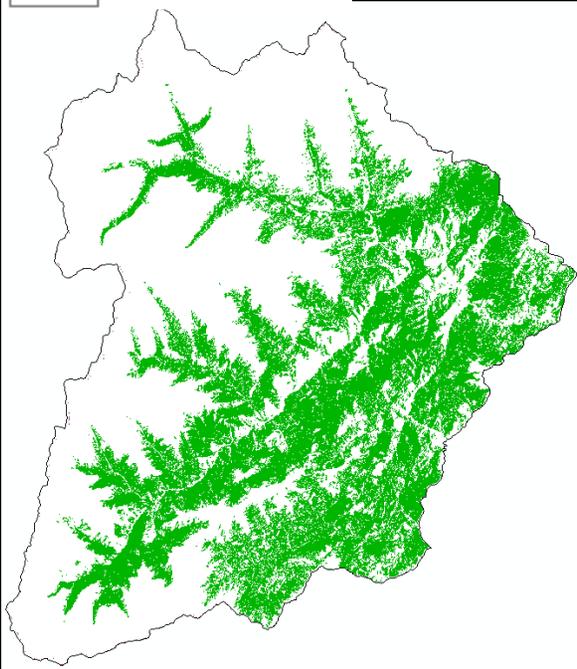


Panda Habitat

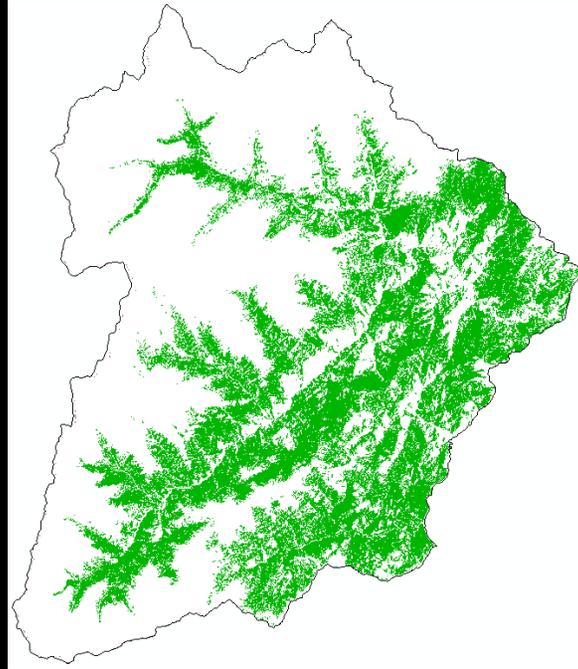
Legend

 Panda habitat

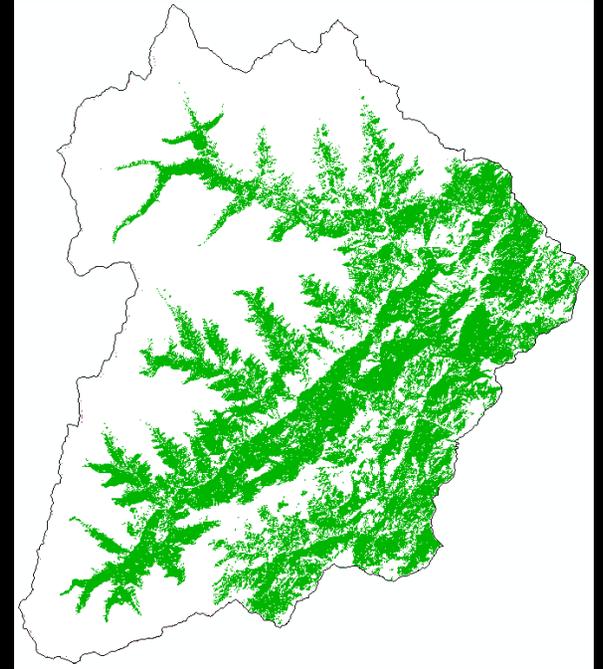
 Non-habitat



1994

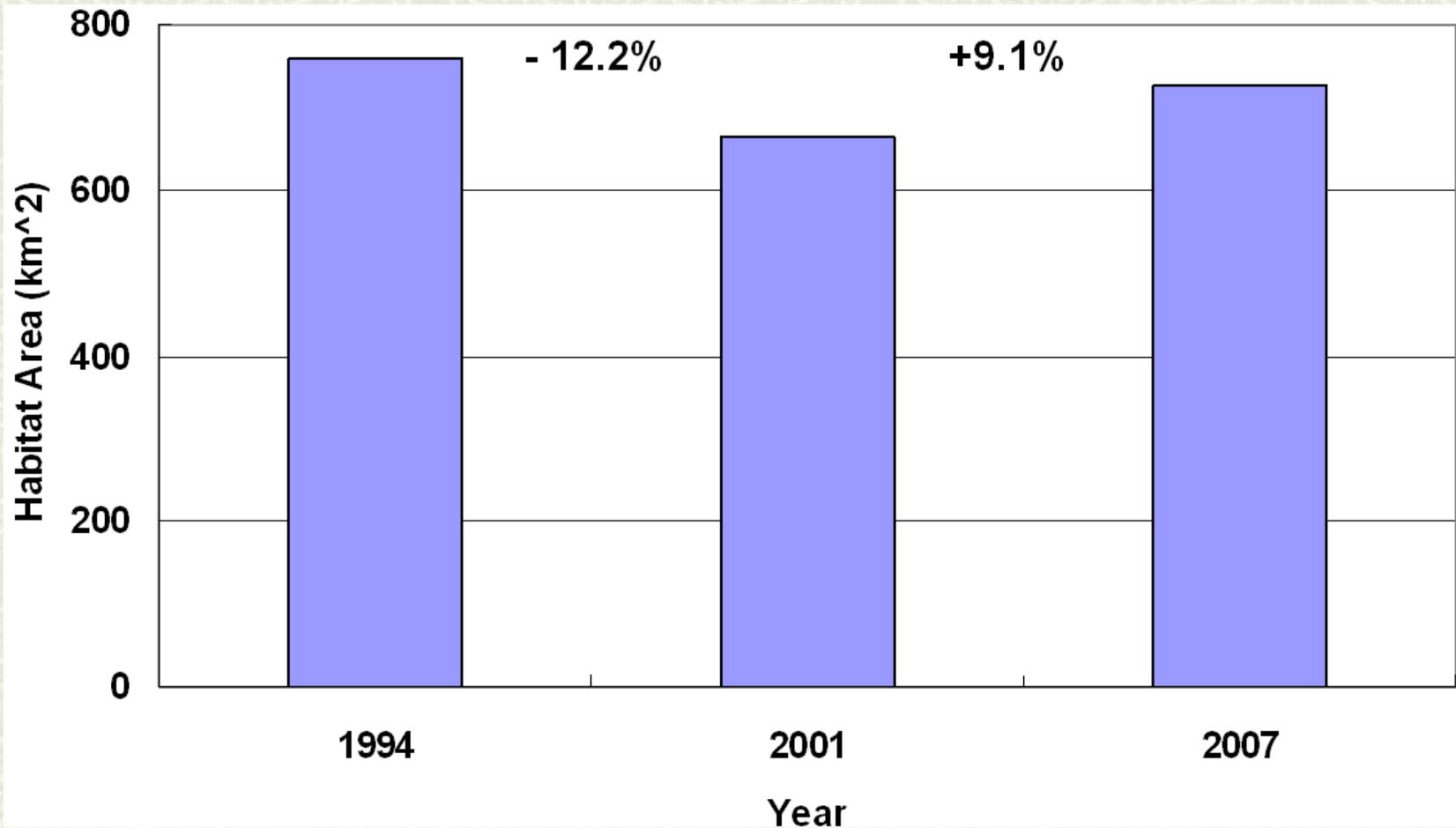


2001



2007

Change in Amount of Panda Habitat



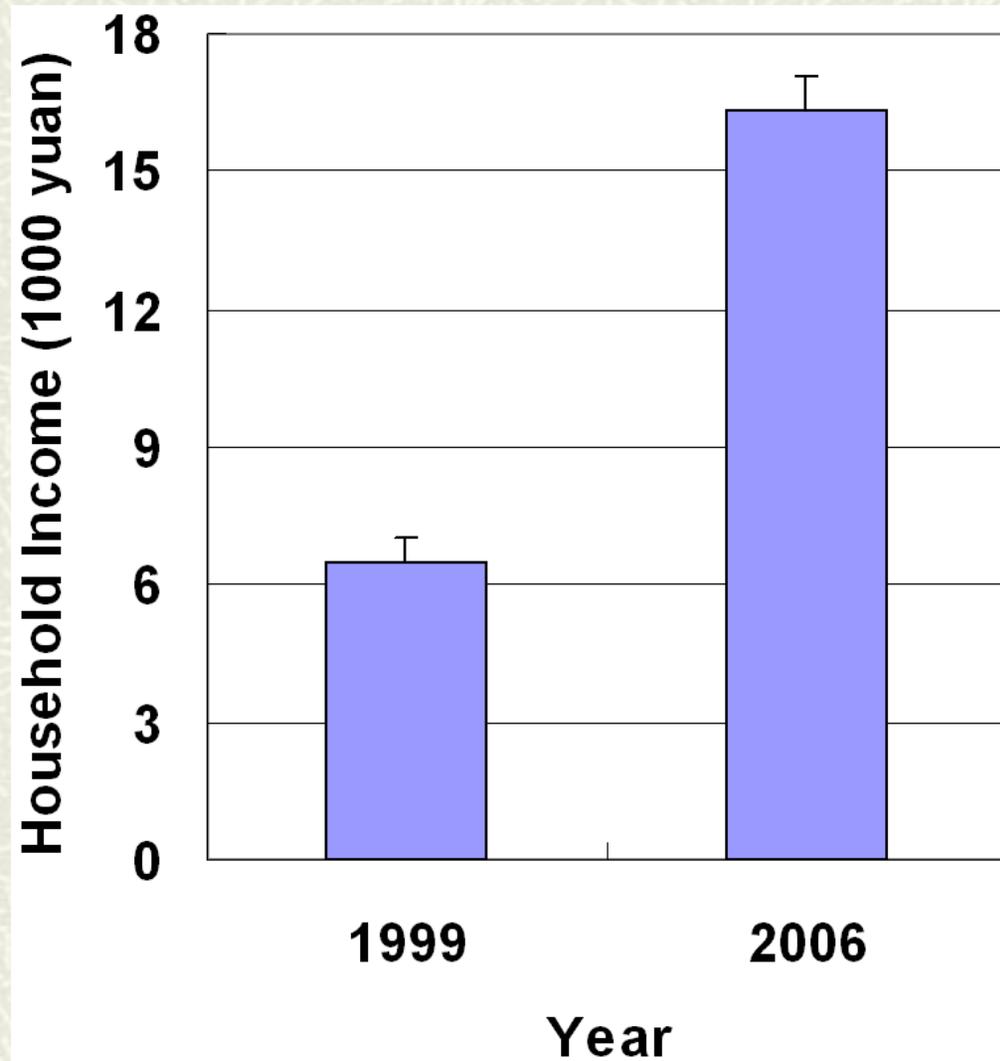
People's Responses to the Policy

- # No households detected timber harvest in the forest parcels that they monitor.
 - # About 50% of households' fuelwood consumption has been replaced with electricity.
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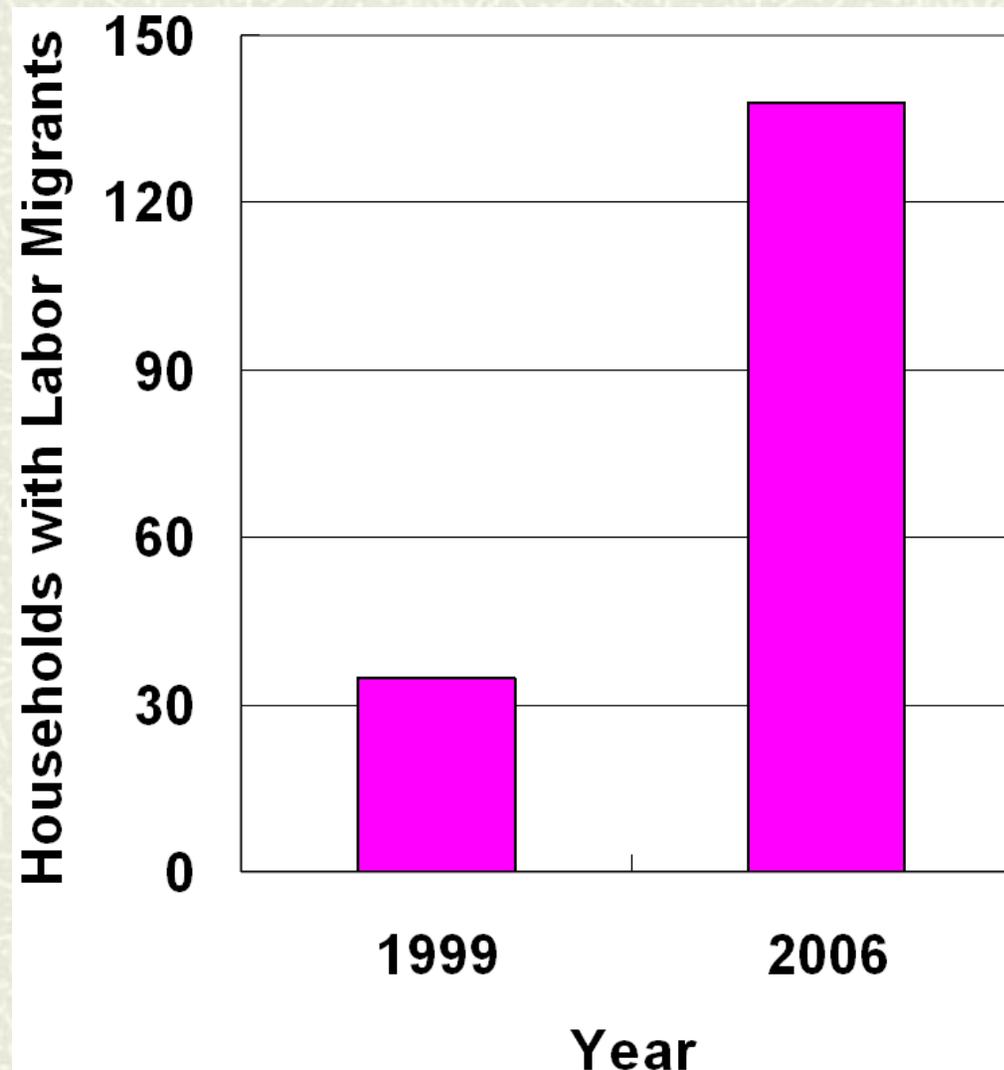
Ordinary Least Squares of Fuelwood Consumption on Household Characteristics

Household Characteristics	Coefficient
Household size (number of people)	621 ^{***}
Senior household member (dummy)	861
Rural-urban labor migration (dummy)	-1373 ^{**}
Household income (1000 yuan)	-1011 ^{***}
Farmland (ha)	33 ^{***}
Gengda township (dummy)	-2619 ^{***}
Adjusted R ²	0.24
Dependent variable: fuelwood consumption (kg)	
^{**} p < 0.01; ^{***} p < 0.001	

Change in Household Income



Change in Households with Labor Migrants



Summary and Discussion

- # Both forest and panda habitat were degraded during 1994-2001, and have been recovering since 2001.
 - # People in Wolong responded to the Natural Forest Conservation program with halted timber harvest and reduced fuelwood collection.
 - # Involvement of local communities in conservation efforts, such as payments for ecosystem services, may improve the effectiveness of conservation.
 - # Increased income and rural-urban labor migration may also have contributed to replacing fuelwood with electricity
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Questions?