Impacts of Climate Change and Adaptation in Yunnan and Guangxi Provinces of PRC

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Shortcomings of the present report
• Lack of the specific assessments of the CC impacts on rural livelihood
• More adaptation measures taken, less adaptation measures to be taken
• The adaptation priorities not thoroughly analyzed

How to improve
• The impacts of extreme climate events discussed a lot, it is closely related to rural livelihoods, more to do......
• To clarify the adaptation priorities in these 2 provinces
Priorities

- Capacity building
- Northing of tropical zone
- Enhanced damage of disease and pest
- Rock desertification
- Extreme climate events
- Loss of biodiversity

Priorities

- Cropping systems—new crop varieties breeding
- Corridor design
- Water resources managements
- Ethnical behavior
- Cost-effectiveness analysis
- Reasonable investments plan
- ..................

Yunnan—
Population: 45.43 million
Area: 394 thousand km²

Guangxi—
Population 50.49 millions
Area: 237 thousand km²

Geographical locations of Yunnan and Guangxi Provinces

Karst Topography
Overview of Climate Change

- Yunnan—
  - Temperature: 0.64°C
  - Warming rate: 0.14 °C/10a
  - Precip: slight decrease
- Guangxi—
  - Temperature: 0.66°C
  - Warming rate: 0.14 °C/10a
  - Precip: slight increase

More climate extremes……
More damages……

Extreme Weather/Climate events

Drought

- The aridity is aggravated. Arid average disaster area present the ascendant trend
  in the past 50 years.
- The severe drought, affected an area of more than 1 million ha, 90% occurred in
  the late 80s.
Extreme Weather/Climate Events

Heavy Precipitation, Flood, Tropical Cyclone

- The heavy precipitation events increased, the flood is more frequent.
- There were 7 times in the late 1980s among 10 times of the most serious flood events of Guangxi in the past 50 years.
- The landing tropical cyclone number slightly reduced but the impacts is more serious.
Extreme Weather/Climate Events

The Hot-temperature Events

The hot-temperature events obviously increases. Especially since later 1980s, the number of hot-temperature events has increased, account for 70%.

• Impacts and adaptation
  • in Yunnan

• Impacts and Adaptation of Climate Change On Biodiversity
• Impacts of Climate change on wildlife are mainly embodied in suitable habitat change, fragmentation of natural habitats, reduction of food resources, habitat drought and the reduction of availability of resources.

(1) Direct Impacts of climate warming on biodiversity

• Due to habitat destruction, fragmentation caused by climate change and other factors, reduction and extinction have happened to animals.

(2) Impact of change of land use and cover on biodiversity

• Experts pointed out 188 kinds of vertebrates in Yunnan are endangered. After the 1980s, the government has taken various measures to protect the forest, but most of them are to replace the natural forest to plantations, the habitat of many animals is still in a very bad state.

(3) Impact of biological invasion on biodiversity

• Crofton weed (Eupatorium) and Fragrant Eupatorium (odoratum) invasion due to climate warming, they moved northward and to higher altitudes every year.
Crofton weed (Eupatorium) and Fragrant Eupatorium (odoratum)

Adaptation measures and priority issues to address climate change in the future

• (1) Select Yunnan snub-nosed monkey (Rhinopithecus bieti) and Hylobates hoolock as health indicators of forest ecosystem, to assess the impacts of climate change, and the proposed species protection technology.

Yunnan snub-nosed monkey (Rhinopithecus bieti) and Hylobates hoolock

• (2) Identify the priority areas for biodiversity conservation in Yunnan Province and climate change sensitive areas
• Rhinopithecus bieti only grows in the Yunnan. Rhinopithecus bieti is endemic rare and endangered animals in China, and is considered as a state I-class protected animals.

• Hylobates hoolock is listed as the first-class national protected wild animals and endangered animal species in China.

• (3) To set up monitoring system in the natural reservation areas and develop the monitoring relationship between species/ecosystem and climate change.

• 4 Impacts and Adaptation of Climate Change on Food Security

Observed impacts of climate change on agriculture
The rate of change of climate zone area

(2) Climate change impact on agricultural production

- Warm winter
- More spring crops
- More tropical crop varieties
- Shorter the growing season.

• Since the 21st century, the trend of high temperature and drought events have increased in Yunnan Province, from once in 2-3 year to once in 1-2 year. According to official statistics, 1996-2000 the accumulative losses of meteorological disasters in Yunnan is 38.571 billion Yuan, accounting for 4% of the provincial GDP, and in 1988 it reaches 6.8%.

(3) Crop pests and diseases significantly increased

- The northern boundary of pests and diseases—the rice planthopper popularity reached alarming proportions
- Since the 1990s, the occurrence of pests and diseases has been significantly enhanced
4.3 Projected impact of climate change on agriculture

- Decline in yield and quality
- Increase the risk of agro-meteorological disasters
- Cost and investment in agriculture will also increase dramatically

4.4 Adaptation measures that have been taken

- (1) Selection of new "cooperation" crop species to adapt to climate warming.
- (2) Strengthen the agricultural infrastructure.
- (3) Explore the opportunities from tropical hot expansion.

4.5 Future countermeasures in adaptation to climate change

- Adjust the agricultural structure and cropping systems.
- Breed new varieties
- Policy and legislation-mainstreaming
- Pest and disease-rice plant hopper
- Climate extreme events impacts-disaster reduction
- ........
5.1 Survey of water resources

- In Yunnan Province, mean precipitation is 482.08 billion cubic meters, equivalent to about 1.258 meters deep. Self-produced water is about 222.2 billion cubic meters perennial, accounting for 1/7 of total water resources, taking the third in China.

5.2 Impacts of climate change on water resources

- During 1961-2006, it is shown a slight decreasing of precipitation.
The impact of climate warming on glaciers

- There are totally 21 glaciers along Lancang River Basin (upstream of Mekong river)
- Ice tongue is currently at an annual rate of about 50m back.

5.3 Drought and flooding damages

5.4 Adaptation measures

- (1) Promotion of the "five small and one change" pattern of dry-land agriculture. That is, small pool, small ditch, small pond, small cellar and small water pumping station together with dry slope reclamation.
- (2) Promotion of water-saving agriculture and novel technologies, new products and new materials.
- (3) Promotion of six water-saving farming methods. Gradient to terraced, efficient mode of rainwater harvesting projects focus on water-saving irrigation techniques, U-shaped seepage-proof groove made of concrete, gravity irrigation system with high water storage and PE cannula equidistant layout, FRP cellar in mountain-PE cannula water-saving irrigation technology and some other methods such as gush, drop and spray, etc.

5.5 Adaptation measures in the future

- (1) It’s necessary to establish and improve laws and regulations about water resources management, cross-border international river management legislation.
- (2) Build up a water-conserving society.
- (3) Strengthen water conservancy construction and enhance adaptability.
- (4) Pay attention to ecological protection.
- (5) Improve scientific and technological research related to water resources.
Priority issues to climate change in the future

• ① Study about the impacts of climate change on extreme hydrological events, water quality and water environment;
• ② Study on the vulnerability and adaptability of water.

• 6 Impacts and adaptation measures of climate change on livelihood

• Among the 2.484 million poverty populations in Yunnan, 2.164 millions live in mountainous areas, accounting for 87.1%, 25.1 million in the mid-levels area, accounting for 10.1%. The poor live in the mountains and mid-levels mountain accounts for 97.2% in this province. Cold, drought, floods, landslides, mudslides, soil erosion and other natural disasters occur frequently because of climate change. For example, there was a large mud-rock flows in Nujiang Lisu Minority Autonomous Prefecture in 1989, which caused 30% of the crop inundated, more than 480 buildings destroyed, over 100 persons dead, soil was eroded, rock was exposed, farmers lost their production base and became flotsam.

Impacts on livelihood

• First of all, drought, floods, hurricane, geological disasters and any other natural disasters happen more frequent in some areas.

• Second, infectious diseases, such as malaria, which are sensitive to climate change, may be increased in the speed and scope.
Adaptation measures

- Strengthen the infrastructure construction in poor areas.

Adaptation measures in the future

- More additional measures should be taken for public participation, strengthen early-warning technology and disaster prevention, adjust the industrial structure, enhance the ability of export workers to adopt, and so on;

6.5 Priority adaptation issue

- Enhance studies about impact of climate change vulnerability on livelihood in greater Mekong regions.
- Strengthen studies about the relationship between infectious diseases in greater Mekong regions and climate change.

Impacts and adaptation in Guangxi
Past CC Impacts on Agriculture and Food Security

Guangxi is an important agricultural province in China, climate change makes the instability of agricultural production increase, the production fluctuates largely, agricultural production distribution and structure present change, the agricultural working condition changes, agricultural cost and investment increase greatly.

* The severe freezing and cold injury caused large impacts for many kinds of crops in early 2008. Take sugarcane as example, Guangxi is mainly planting area of sugarcane of China, the sugarcane yield account for about 60% of China.
* This disaster caused great losses, drop by about 20% of sugarcane yield.

Impacts on Rice

The date of sowing become earlier and the date of harvesting later, which results in expansion of growing season and growing area of rice. The vulnerability of rice to climate change mainly manifests weak resilience to drought and flood, which cause the lower yield.

Impacts on Litchi and Longyan

For Litchi and Longyan have a strict temperature condition, which need a relative low value of daily average temperature and minimum temperature in winter. At present, the planting border spreads northward.
Impacts on Water Resources

Disaster losses

During 1993–2007 years, the annual average direct economic losses reached 15 billion CNY due to meteorological disasters; especially more than 35 billion CNY in 1994 and 1996, about 20 billion CNY in 2001, accounting for about 30%, 19% and 9% of Guangxi annual GDP, respectively.

Impacts on Ecosystem and Biodiversity

Due to frequent natural disaster:
- Drop of forest quality
- Bio-diversity loss
- Soil erosion
- Rock desertification
Impacts on Rural Livelihood

The most area of the Northwest Guangxi is struggling with poverty. Shortage of soil and water is very remarkable in the rock desertification, only some drought-resistant crops such as maize can be planted in rock desertification area, the yield of maize is low for suffering from drought and flood which occur more frequent and severe than other non-Karst areas, and the peasants where live in are poverty and have no sufficient food to survive by themselves.

Impacts on the Occurrence of Insect Pest and Diseases

With the climate warming, diseases, insect pests and weeds are intensified and expand, and the wintering border spreads northward for insect pests.

Especially since 1990s, the area of vegetable disease and insect pest in Guangxi become much more serious than before.

Future Impacts— on Agriculture and Food Security

• Longer crop growing season
• Northing of the north boundary
• Diseases, insect pests and weeds are intensified, drought and waterlog as well as agro-meteorological disaster would be increased, and the disadvantage would become more severe.
Future Impacts—on Water Resources

- Prolonged drought is likely to exacerbate the local rock desertification further
- The drinking water would be short for people and flocks and herds in the drought area

Future Impacts—on Biodiversities

- The tropical species would occupy the ecological location of the subtropical species by competing.
- The characterized species in Guangxi would become extinct.
- CC would cause the changes of phenology, influencing the reproductive ability, competitive ability and interaction among the species.
- Extreme weather and disaster would lead to a large number of species extinct directly.

Future Impacts—on Rural Livelihood

In the following 30 years, the sea level of Guangxi will rise by 70 ~ 110 mm relative to 2008.
It causes the coastline of Guangxi to go backward and the land loss.

Taken Adaptation Options—on Agriculture

- Building the agricultural system of scientific and technical innovation
- Strengthening the great agricultural research of technique
- Accelerating popularizing the agricultural scientific and technical results
- Developing water-saving irrigation and circulating agriculture
Taken Adaptation Options—
on Water Resources

- Building of Water Pond Near Farmland
- No-Tillage with Mulch Technology
- The Demonstration Project of Prevention and Recovery of Rock Desertification
- The Project of Turning Farmland to Forest

Pingguo county achieved satisfying effects in the demonstration project of prevention and recovery of rock desertification. The following figure shows distinctly the dynamics developing process of rock desertification in Pingguo county, Guangxi province.
**Taken Adaptation Options — on Livelihood**

Due to the impacts of frost and cold extreme weather in early of 2008 in Guangxi, the disaster area of turning farmland to forest was 76,000 hectares, accounting for 9.9% of total area of turning farmland to forest, which largely influenced encashing of compensation and caused the difficulty to livelihood of some peasants who inhabit the rock desertification area and poor productive condition region.

**Taken Adaptation Options — on Ecosystem and Biodiversities**

- Issued and implemented ‘zoning of ecological function in Guangxi’, and establish the ecological conservation zone and other relevant planning.
- Continue implementing the ecological construction project.
- Prevention and control of rock desertification in 12 counties.

**The Future Adaptation Options — on Agriculture and Food Security**

- ★ Build and Perfect the System of Agricultural Disaster Prevention and Reduction
- ★ Breed High Disaster-resistant Varieties and Adjust Planting Season

**The Future Adaptation Options — on Water Resources**

- ★ The scientific researches of soil erosion in the Karst areas should be enhanced
- ★ Strengthen the system construction of preventing and controlling drought and flood
- ★ Popularize the application of the equipment of agriculture water-saving irrigation and water-saving agriculture technology
The Future Adaptation Options — on Ecosystem and Biodiversities

★ Popularizing Various Eco-agriculture and Eco-migration
★ Improve the Management Ability to Risk and Reduce the Extreme Climate Events Impacts
★ Developing Eco-tour

The Future Adaptation Options — on Rural Livelihood

• Some preferential policies such as a special rule of the soil and water conservation, ecological compensation and ecological emigrant should be made further more
• Building eco-tour region and eco-resorts around ethical culture and native scenery for improving the rural livelihood and conserving ecosystem.
• Strengthen relative technology training such as eco-agriculture and water-saving agriculture to enhance the peasant’s cultivating skill

Priorities

• Climate risks to the biodiversity
• Rock desertification
• Opportunities from northing of tropical zone
• Adaptation planning
• Capacity building
• Financial resources
• Cost-effectiveness analysis
• Poverty alleviation
• Legislation-mainstreaming
• Infrastructure
• ..................