Climate change and farmers response in rural China

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Abstract: Important external drivers in China such as the rapid economic growth, urbanisation, climate change and a growing awareness of environmental degradation have contributed to a shift in governance structures in general and in water governance structures in particular. These external drivers result in shifting governance, which is also shifting because of more decentralisation, involvement of NGOs and CBOs in China and new opportunities for initiatives for farmers at the local level. These developments have created an enabling environment for farmers to take more initiatives, because they are relatively left behind and need to defend their own interests. In this contribution the economic incentives which play a role in these developments are analysed. Using the multi level governance concept, we will indicate the importance of existing governance structures and analyse the emerging initiatives identified in our research in the Yunnan Province in Southern China. We conclude that farmer’s reactions can be classified as passive or active and the active reactions can be interpreted as showing agency, used to advance their own solutions, in a situation where they are not involved in current governance structures, which are not always considered to be effective and as such this is an example of adaptive eco water management.

Keywords: water management; adaptive management; paradigm shift; China.

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1 Introduction

China is faced with challenging issues with regard to sustainable development. One critical issue in this regard, is the problem of climate change. Given its complicated governance structures how does China deal with the consequences of climate change? Wherever communities of people emerge there is a need for the management of the community space and resources. Various approaches to governance have been adopted in different countries and cultures. In China farmland as well as water resources belong to the community and farmers obtain land use rights from the county or district authorities or through contracting with other community members. We will study to what extent farmers are participating in current government policies and initiatives and which initiatives they are taking themselves.

The Chinese Government has initiated policies to deal with climate risk/hazard, especially drought at national level. In this contribution we will assess to what extent initiatives initiated by the government to deal with climate change and in particular with drought are actually working through at the local level. We will analyse the initiatives of the farmers to deal with the more frequent occurrence of droughts due to climate change. In the next section, a theoretical framework for studying governance will be provided. After analysing the top-down approach by the government, the initiatives of the farmers will be classified and the role of the government in these initiatives will be assessed. Some theoretical and practical conclusions will be drawn at the end of the paper.

2 Research design and questions

This research contrasts national top-down policies with the grass root level initiatives of Chinese farmers in the Yunnan Province. Data were collected in Pu’er and Xishuang in the rural areas of Yunan. An analysis of the multi-level governance structures in place shows on the one hand that the implementation of policies and programmes frequently gets stranded at the provincial or the local level. On the other hand, farmers are not passive bystanders, and take initiatives to deal with the many challenges they are facing, which are partially climate change related and in particular concern the increasing incidence of droughts. This research took place in the Lancang River, where seasonal droughts have become more important recently. The Chinese governance structure for dealing with the effects of climate change can be described as a multi-level governance structure for drought management. At least seven levels can be distinguished (Figure 1).

Our major research question is: what kind of policies and governance structures are in place in South-Western China to deal with the consequences of climate change, and in particular with drought? More specifically we want to know:

1 How are climate change policies and programmes implemented at different levels of government?

2 Which organisational framework has been adopted by China to implement these policies and programmes?
3 What are the effects at the farmer’s level?
4 Which initiatives do the farmers take themselves to deal with the consequences of climate change, in particular with drought?

Figure 1  Administration levels in China

3  The theoretical framework for studying governance

Focussing on governance structures is a relative new approach in China, a country with a top-down structure of government and centralised decision-making mechanism. We will identify different drivers leading to the involvement of more actors and to different ways of decision making. This leads us to use the (emerging) governance structures concept for China. UNCHS Bulletin (1999) states that: “Good urban governance involves participatory decision making”. It refers to “the complex set of values, norms, processes and institutions by which cities are managed”. UNCHS and the World Bank, leading international organisations in the field of urban development, stress the importance of good governance, as does Van Dijk (2006). Good governance refers to the officials formally executing the policies which deliver the services required, but in collaboration with the major stakeholders. One definition of good governance is depicted in Figure 2. The emphasis in this figure is on norms and values, on participation of the population and on controlling what is going on. In a decentralised transparent system local managers are accountable for what they are doing and the results of their interventions can be monitored. We emphasise the importance of participation of the major stakeholders, of allowing initiatives from below and the concrete institutional form that this initiative may take.

Drought is an issue for water governance. Specific about water governance is that it covers all levels from local to global, it covers all actors from state to non-state, it covers all relevant activities determining the use of our resources and water governance implies norms, translated in policies and social practices. Due to certain drivers in China we observe a shift in governance structures, resulting in more opportunities for participation.
and local initiatives. Two major drivers of change in China are the rapid economic growth taking place in particular in the eastern part of the country and the process of urbanisation. Recently, climate change and a growing awareness of environmental degradation have helped to create an environment in which governance is shifting. Governance is shifting because of a different environment, economic incentives and urgent events such as climate change and a growing awareness that another approach is needed than the top-down and command and control approach. Liang and Van Dijk (2011) analyse a shift in water governance at the national level in China. In their case more initiatives in the urban areas are developing at the household and enterprise level to deal with drought. The shifts in governance are facilitated by more emphasis on decentralisation. According to the constitution, the national laws made by the National People’s Congress (or its Standing Committee) set the principles for one domain, for example climate change. The national and local ordinances, which are passed by the State Council or local councils, are used to work out the details. Subsequently, the ministry or local government concerned design their own rules (according to their responsibilities) to implement law and ordinance (see Figure 3).

Figure 2  Governance under global environmental change

We focus on the experiences with adaptation to climate change in the rural areas of China. In the discussion about good governance, which was introduced by donors and donor organisations, there is often a cultural undertone as well. What is considered poor governance or corruption in one country according to certain norms and values may be considered as providing incentives in another country. However, the need for good governance and more transparency is often stressed to increase the chances of success of climate change related projects and, governance is embedded in a larger system of regional, provincial, municipal and district level government structures.
Policies for climate change can be seen as part of a triangle with the government formulating the policies, all kinds of institutions involved in implementing these policies and people who should eventually benefit from these policies. A broader approach to creating appropriate governance structures for climate change adaptation may be necessary, focusing also on the role of the drivers, such as economic development, the problems of the quality of life in the rural compared to urban areas and the need to reduce the uncertainty caused by climate change.

A theoretical framework for studying governance will be used to check its relevance in the Chinese situation. As shown in Figure 3, China has a policy framework where at least three levels are very important and where each level tends to use its own legal instruments.

**Figure 3** China’s multi-level policy structure

At national level, the Chinese Government has constituted some comprehensive coordinating committees in the State Council including not only representatives from relevant ministries, administrations, but also from banks, scientific bodies, social associations, NGOs and even the army. Although the mainstream of drought policies still lies in improving government’s authority on offering public goods directly, there is a shift to give non-governmental actors more space to self-govern, because the awareness of local actors, networks and knowledge playing an important role in coping with climate change and drought disaster. As mentioned above, the general climate change policy encourages local actors to play a role in adaptation.

There are at least seven levels of administrations in China, which are nation, province, municipality, county, township, administrative village and natural village. The first five levels have constructed a strictly hierarchical bureaucratic system to implement administration orders from upper government. The cadres of local government will be appointed by upper government, while they are authorised to choose their own developing pathway under the guidance of central government. These local governments can select options to implement the policies from central government according to their own benefit.

The county is a powerful unit of regional development, because issuing land rights is appropriated to this level of government. This institutional arrangement also affects other types of resources allocation. The administrative village level is the lowest Chinese level of officially paid officials. The cadres of administrative village are elected by
villagers and appointed by government. The natural village is loosely under control of administrative village and the elected leaders are not officials. The natural villages are more autonomous and are usually held together by informal institutions such as race and lineage.

Under this governance structure, the policy from central government is hardly implemented at the natural village level. The reform of agricultural taxing system has placed it in a more difficult situation. Before 2001, the public funds mainly came from taxes (tiliu), fees (fei), and apportionment (tanpai) in poor areas (Tsai, 2002). After 2001, the central government started to reduce farmers’ burden, and this reform is finished with a milestone of abrogating agricultural tax completely since 2006. Although this reform has improved farmers income, it also has blocked an important source of public funds, which is used to offer public goods and services to farmers as well as to promote bureaucratic agencies mediating between government and farmers at the natural village level. With the government retreating from the village affairs, the traditional approach of government will be substituted by polycentric governance structures. This leads to more self-organisation of farmers and companies, which now play a more prominent role in the autonomous villages (Rogers and Hall, 2003).

4 Evidence of the shift in governance concerning drought management

4.1 Governance at the national level

According to content analysis of almost 100 documents concerning drought policies from 1990s to now, we could find several shifts happened in governance of climate change. Based on framework and functions, these policies can be categorised into three groups, named general climate change policy, drought relief policy and capacity building policy.

<table>
<thead>
<tr>
<th>Year</th>
<th>Type</th>
<th>Document</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Policy</td>
<td>National CC Programme</td>
<td>National general CC coping strategy which includes adaptation strategies for drought</td>
</tr>
<tr>
<td>2007</td>
<td>Policy</td>
<td>Special Technical Activities for Coping with CC</td>
<td>Identifies research areas for technology and other adaptation measures including extreme events</td>
</tr>
<tr>
<td>2007</td>
<td>Report</td>
<td>National Assessment Report of Climate Change</td>
<td>Identifies impacts and vulnerability; and adaptation measures</td>
</tr>
<tr>
<td>2008 to 2010</td>
<td>Report</td>
<td>Policies and Activities Coping with CC</td>
<td>Policies and activities to improve the adaptation capacity</td>
</tr>
<tr>
<td>2009</td>
<td>Report</td>
<td>State Council’s Report on the Performance of Coping with CC</td>
<td>Integrates CC into development planning; promotes ‘green economics’; improves adaptive capacity and regulatory system, and international cooperation</td>
</tr>
<tr>
<td>2009</td>
<td>Policy</td>
<td>Resolution of Standing Committee of National People’s Congress on Coping with CC Actively</td>
<td>Formulates the framework for future science-based CC policy, improved institutions and public participation, cooperation with other countries</td>
</tr>
</tbody>
</table>
General climate change policies are now in primary stage, of which instruments are guidelines, collection of information and knowledge dissemination which are categorised into governing through creating an enabling environment (Alber and Kern, 2009). In 2006, a comprehensive assessment report on climate change has argued that placing more emphasis on regional case studies on adaptive measures can reduce the uncertainty caused by limited knowledge on climate change and has identified several pertinent adaptation measures for main sectors. These measures have been formally brought forward in 2007 National Climate Change Programme. Along with this in the 2007 approach reports on National Policies and Activities Coping with Climate Change were published each year, which aims to sum up the performance. In 2009, The Standing Committee of the National People’s Congress has passed a resolution for coping with climate change, which points out improving laws and regulatory systems as well as improving the realisation and ability to public participation should be the direction of policies in future.

Drought relief policies, which aim to resolve the actual drought disaster or very possible drought risk faced by human beings, include the instruments of early warning, weather modification, drought relief emergency response plan, soil moisture monitoring, and drought relief planning. These policies are top down and are usually implemented by government directly with the purpose of helping victim out of disaster. The National Meteorology Law in 1999 and revised National Water Law (2002) have provided principles and frameworks of measures in coping with drought. Under these two frameworks, different functional departments in central government have crafted their own policies separately. After several years implementation, it became clear that overlaps and gaps existed simultaneously in these policies. As a result, the more powerful national ordinance was used to integrate separated policies. These national ordinances include National Drought Relief Ordinance in 2009, National Natural Disaster Salivation Ordinance and National Meteorological Disaster Defence Ordinance in 2010 (see Figure 4).

**Figure 4** Drought policy shifts

![Drought policy shifts](image)

Capacity building policies, which aim to enhance the adaptive capacity of farmers, include improving water availability and use efficiency, disseminating drought relief
knowledge and technology, enhancing farmers’ income, initiating drought hazard loans and insurance, and strengthening social network of local communities.

The amendment of National Water Law (2002) is a milestone of changing from ‘supply management’ to ‘demand management’ in the integrated water resources management paradigm. This changing places more emphasis on utilisation of property rights, market mechanisms, and water saving technology to improve water use efficiency to resolve water scarcity. Since 2006, the water levies for direct withdrawals has ended free water use. One of main ideas of policy is to offer direct help to farmers which could improve their capacity. The fund for special projects to promote advanced technology as well as the subsidies to improved seeds and drought relief machines are all under this paradigm. Other relevant policies at the national level include:

a dissemination of drought relief knowledge and technology by promoting the diffusion of agricultural technology, drought resistant seeds, new seed planting techniques, water conservation technologies and technology promotion projects

b improving farmers’ income through temporary jobs in urban areas, allowing land use rights transferring, conversion of farm land to forests, subsidies for improved seeds and obtaining the necessary equipment

c drought hazard loans and insurance such as subsidised loans from the council for farmers to reduce poverty, post drought emergency low-interest loans to farmers; and drought disaster insurance financed from a central budget.

The social capital of local communities is enhanced through the establishment of local drought relief teams, Water Users Associations (WUA), and rules for communities to raise money and labour. From 2002, the central government started to realise it’s a big problem that investment in and maintaining of water infrastructure depend mainly on the government, because the limited budget of government cannot meet the increasing needs for water infrastructure, along with which is widespread water scarcity and high frequency of water disaster. Therefore, the central government is promoting several reforms which encourage local government, companies, or private investment in middle or small size water infrastructure through approving transfers of property rights of water infrastructure from government to non-governmental actors. Although the big water infrastructures are traditionally regarded as be controlled by central government, the forms of management are more diversified as well as the decision making structures are more polycentric. This reform shows the effects of decentralisation on water governance, which will involve more participation in water affairs, encourage multi-actors to take responsibility, improve the public awareness on water conservation, and so on.

Since the policy process is so large, diffuse and competitive, the government constituted some comprehensive coordinating committees in the State Council including representatives from relevant ministries, administrations, banks, scientific bodies, social associations, NGOs and even the army. Four such committees relevant to drought management are the State Council Leading Committee on Poverty Alleviation and Development (STLCPAD), the National Headquarters of Flooding Control and Drought Relief (NHFCDR), the National Leading Committee of Disaster Alleviation (NLCDCA) and the State Council Leading Committee of Coping with Climate Change (SCLLCCCC) (Figure 5).
4.2 Governance at lower levels of government

Most policies are paternalistic, designed to help farmers but not involving them in decision making. Relations between the province and local level are not as hierarchical as between the national and provincial level, the decision-making authority is at the local level, especially the county government. Central government’s funds and subsidies are the two main incentives for local government to implement related policies.

At the provincial level, there is a general programme and assessment report on Climate Change, and in 2010, Yunnan was selected as one of the five Green GDP priority provinces for experimenting with the climate change programme. The selection as priority, on the one hand, will bring Yunnan province more political and financial support from central government. On the other hand, it will also bring the cadre of the Yunnan province more opportunities for professional promotion. Therefore, local governments have great incentives to compete.

Regarding drought relief policies, the Yunnan Government had a drought relief ordinance that predates that of the central government, and a meteorology ordinance that corresponds to the national law. Under the legal obligation of these two ordinances, all levels of local government have been asked to craft annual plans for weather modification, drought relief planning and emergency plans. A policy initiated by Pu’er Government has involved mobile phone companies in offering short message service (SMS) for farmers to spread drought information. These services are not always freely available for the farmers, but very important for them.

To improve adaptive capacity, five groups of policies have been emphasised by all levels of governments, which include reform of the agricultural technology promotion...
system, management reform of Small Rural Water Infrastructure (SRWI), transferring free labour from rural to urban areas, subsidies for improved seeds and conversion of farmland to forest in mountain areas. There are two reasons why these policies have been implemented at all levels. One reason is local government having received subsidies or project funds from central government. Special policies are necessary to appropriate, monitor the use of this money. Secondly, these policies give more freedom which stimulates local government to implement them.

Many national level initiated policies are not translated beyond the provincial level, namely planning for water saving, improving agricultural and water resources technologies promotion, raising money and labour on a case-by-case basis, management reform of subsidised loans to reduce poverty, regulations on subsidies for agricultural machinery, and regulation of water-withdrawal permits and levies.

Table 2   Leading committees at different levels of governance

<table>
<thead>
<tr>
<th>No</th>
<th>Leading committee</th>
<th>National level</th>
<th>Provincial level</th>
<th>Municipal level</th>
<th>County level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leading Committee on Poverty Alleviation and Development</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2</td>
<td>Headquarters of Flooding Control and Drought Relief</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>3</td>
<td>Leading Committee on Disaster Alleviation</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>4</td>
<td>Leading Committee on Coping with Climate Change</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Leading Committee on Reforming of Small Rural Water Infrastructure</td>
<td>X</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>6</td>
<td>Leading Committee on Subsidies for Improved Seeds</td>
<td>X</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>7</td>
<td>Leading Committee on Labour Transfers from Rural to Urban Areas</td>
<td>X</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>8</td>
<td>Leading Committee on Grain for Green Programme</td>
<td>X</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

Some policies, which have not been translated at provincial and local level (Table 2) include central government policies on funding of The Water Saving Society (WSS), the policy on low premium insurance which asks for a 50% contribution from provinces, the policy on promoting rural microfinance, the policy on subsidies to SRWI construction, and policies on construction of drought relief teams (DRT) and WUA.

In addition to the four local leading committees corresponding to the national leading committees, there are four other leading committees at local level who are in charge of reforming the SRWI, providing subsidies for improved seeds, ensuring labour transfers from rural to urban areas, and converting farmland into forests in mountain areas. These committees coordinate the drought management of different departments, and use joint meetings for making decisions. Figure 5 illustrates how the coordinating committee of flood control and drought relief is organised at different levels. Table 2 shows a mismatch if certain committees are not present at the local level, or when the national level is not involved, as in the numbers 5 to 8.

There are still many challenges faced by climate change governance in China. The national policies can be characterised as emphasising drought relief polices more than
capacity building. The underlying idea still seems to be ‘disaster management’ (Wilhite, 2005). In other words, the government now prefers an emergent response system in dealing with drought. But this system could not manage drought completely, because the drought’s impact is cumulative without clear boundary. So it needs a long term adaptive system besides a short term response system. Secondly, the government mostly promotes subsidies and fund-based approaches and has only just started introducing some market measures. The funds and subsidies can help local government to realise their goals rapidly and directly. However, these instruments are not flexible and apt to government’s budget constraints. Meanwhile, the effects can be reduced by corruption. Figure 6 shows how China’s multi-level policy structure works in the case of flood relief.

Figure 6 China’s multi-level policy structure in case of flood relief

4.3 Initiatives of the farmers and governance at community level

We will now analyse what these changes mean at the community level, or for people living in natural villages and whether the existing governance structures facilitate or hinder the implementation of these initiatives. This level is interesting in China because the people living there have the freedom to elect their own village leaders, who are not paid by the government but tend to be able to negotiate with the authorities at the administrative village level for favours. According to the household survey, several activities have been taken by farmers to deal with droughts (Table 3).
Table 3  Adaptive activities taken by farmers to cope with drought

<table>
<thead>
<tr>
<th>Activities</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage in non-agricultural work</td>
<td>Engage in non-agriculture work at local or urban areas. Some of them work for themselves by operating restaurant or a small store</td>
<td>Improve income, reduce dependency on agriculture</td>
</tr>
<tr>
<td>Livestock, or fish culture</td>
<td>Spend more energy or money on breeding pork, chicken, and fish</td>
<td>Improve income, reduce the dependency on irrigation</td>
</tr>
<tr>
<td>Rotations</td>
<td>Rotations of rice-maize in two years are becoming more wide spread</td>
<td>It reduces the dependency on irrigation water</td>
</tr>
<tr>
<td>Change crop structure</td>
<td>Shift to drought resistant crop, such as from rice to maize or coffee, from maize to coffee, tea, orange, from orange to coffee, tea</td>
<td>Improve income, reduce dependency on irrigation; change risk types from drought to low temperature risk</td>
</tr>
<tr>
<td>Change land use type</td>
<td>Change cultivation land to pond for fish culture</td>
<td>Reduce dependence on irrigation</td>
</tr>
<tr>
<td>Change planting schedule</td>
<td>Adjust seeding time according to short term weather forecasting information, especially for maize seeds</td>
<td>Partly to avoid drought and to reduce the losses caused by drought</td>
</tr>
<tr>
<td>Adopt improved seed</td>
<td>Farmers prefer to adopt drought resistance and high productive seeds of maize, and pest resistance and high quality seeds</td>
<td>Improve the crop’s resistance to drought</td>
</tr>
<tr>
<td>Change drinking water supply</td>
<td>Change from separated to centralised drinking water supply mode</td>
<td>Improve water storage and supply ability when facing drought; Improve stability of water supply</td>
</tr>
<tr>
<td>Construct water storage infrastructure</td>
<td>Construct small tank for drinking and irrigation by farmers individually or by one or several communities together</td>
<td>Improve the water storage ability</td>
</tr>
<tr>
<td>Change irrigation method</td>
<td>Change from gravity irrigation to drawing water from canal by pump</td>
<td>Improve ability to access to water</td>
</tr>
<tr>
<td>Water transfer</td>
<td>Fetch water from river, well for irrigation and drinking by vehicle or manpower; import water from other place by pipeline</td>
<td>Improve ability to access to water</td>
</tr>
<tr>
<td>Dig well</td>
<td>Dig well for livestock by farmer themselves</td>
<td>Improve ability to access to water</td>
</tr>
<tr>
<td>Apply water saving technology</td>
<td>Use cement to construct irrigation channel; use plastic mulch to store water more efficiently; use spray irrigation for banana adopted by a big land contractor</td>
<td>Reduce the water consumption</td>
</tr>
<tr>
<td>Food storage</td>
<td>Store rice and maize for their own consumption</td>
<td>Reduce the risk of food shortage caused by drought</td>
</tr>
<tr>
<td>Use agricultural machine</td>
<td>Adopt new agricultural machine for water pumping, transporting, etc.</td>
<td>Improve ability to access to water</td>
</tr>
</tbody>
</table>
Ad 1 Engage in non-agricultural work

Although local governments have implemented a special policy to offer training courses or job information for farmers, nobody among the interviewees has ever been involved in this project. The main job information comes from lineage, relatives or community members. It was also found that several farmers came back during the last five years, for marriage, old age, low income in the urban areas or to engage in more intensive agriculture.

Ad 2 Livestock or fish culture

Increasingly households become involved in livestock or fish culture diversifying their sources of income. There was a tradition of growing animals for the spring festival. The farmers increasingly also do these activities for the market because since a number of years the government subsidises female pigs and increases the fertility of the pigs by providing growth hormones.

Ad 3 Change the rotation

To reduce the dependency on irrigation water farmers are changing their rotation to crops requiring less water.

Ad 4 Change crop structure

The subsidy to planting grains from central government aims to secure China’s food supply. In Yunnan province, this subsidy tries to stimulate farmers to plant rice or maize which are vulnerable to drought. The main trends at local level, nevertheless, are still changing from grain to economic crops which are resistant to drought. The other policy related to this activity is ‘grain for green’ programme which aims to conserve soil and water in mountain areas. Interestingly, the farmers who change planting from maize into tea in mountain area will receive 40USD per mu per year. It means if you change from maize into tea, you will receive subsidies from the government. Changing the crop structure is a risk avoiding strategy chosen by farmers. For example, since coffee is more vulnerable to frost and gales than to drought, farmers prefer to plant coffee instead of rice or maize because the frost and gales seldom occur locally. In order to improve farmers’ ability to plant economic crops, some special planting associations supported by local government have been established to disseminate related technology. These associations are usually organised by technology promoting agency on behalf of local government. The organisation usually takes the administrative village as unit and farmers can chose to join it freely. The associations often organise some training courses for farmers.

Ad 5 Land use changes

In particular do farmers change to fish culture to reduce their dependency on irrigation.

Ad 6 Change planting schedule

As TV and mobile phones are very popular in the rural areas of Yunnan Province, the government can provide weather information and drought early warning messages
Climate change and farmers response in rural China

through them. A TV station and mobile phone company help the local meteorological department to issue weather information and warning messages. But the SMS services are not free. According to our survey, some farmers have adjusted their planting schedule according to this information.

Ad 7 Adopt improved seed

Stimulated by subsidies to use improved seed, this is very popular in the surveyed area. But this policy does little to improve the farmers’ adaptive ability to drought. According to our survey, farmers prefer high quality and anti-pest seeds instead of productive or drought resistant seeds of rice and maize, because in this area most grain is consumed by the farmers themselves. The information on improved seeds usually comes from the seed company and community members.

Ad 8 Change drinking water supply mode

This is one kind of public service offered directly by the government, which is the only investor. The farmers sometimes need to provide some labour for this purpose.

Ad 9 Construct water storage infrastructure

Small tanks or ponds for drinking water and irrigation are usually constructed by farmers themselves. Some big reservoirs or dams which offer one or several communities irrigation need to be financed through public funds. As the agricultural tax (tongcou and tiliu) has been cancelled, public funds for communities have shrunk. According to our survey, the policy to “raise money and labours case by case in rural areas (yishi yiyi)” has been found to play an important role to compensate the shortage of public funds on the condition that the farmers come to an agreement on investing labour and money in public goods firstly. Local governments have offered money for reservoir construction and cement for dam construction in the area of our survey. The policy on legalising farmland contracts trading has offered chances to merge small farmlands into big ones. In the area of the survey, several agricultural companies have also rented farmlands from farmers, and invested in constructing small reservoirs and in spray irrigation systems for bananas.

Ad 10 Change irrigation method

Increasing droughts and deforestation mean farmers cannot obtain enough water for irrigation. Therefore, farmers have to resort to new sources of irrigation, such as using canals. Some policies have been implemented to alleviate the costs. Villagers can borrow pumps from local government (township) which is responsible for putting aside special funds to offer drought relief material to farmers. One village has received diesel oil for pumping. Community leaders play an important role in requesting these materials from local government.

Ad 11 Water transfer

Community members fetch water from other places solely or in cooperation when facing drought. But sometimes water in that place are not free, farmers need to pay local people.
This could be considered a primitive type of water market. In other cases, villages offer farmers pipelines coming from local government to import water.

Ad 12 Dig well

In addition to investment of a single farmer or government, tube wells for irrigation can also be financed by several farmers jointly, which can be regarded as one prototype of stakeholder management of water resources in this area.

Ad 13 Apply water saving technology

Several farmers have taken water saving measures or use different technologies including using cement to construct irrigation canal to prevent infiltration, use plastic mulch to store water more efficiently, adopting a spray irrigation system for bananas. There is no evidence that these activities are related directly to water saving policies implemented in China. The initiatives have been initiated by farmer themselves with the main purpose of improving their revenue.

Ad 14 Food storage

This is quite common, but has become even more important.

Ad 15 Use agricultural equipment

With the expanding subsidy for agricultural machines, an increasing number of farmers are using vehicles and pumps in agricultural production. These activities have improved the farmers’ ability to access water resources. The agricultural machine company which mediates between government and farmers has effectively facilitated popularisation of such equipment in the rural areas. Activities such as livestock, rotation, changing land use and food storage, are usually adopted by a single farmer spontaneously without direct supports of policy.

These activities can be categorised into seven groups in terms of their function:

1. to reduce the dependency on agriculture, especially traditional agriculture, non-agricultural work and livestock culture have been applied
2. to reduce dependency on irrigation, farmers have adopted rice-maize rotation, adjusted crop structure, and changed land use type
3. to improve the drought resistant ability of crops, farmer have changed planting schedule and adopted improved drought resistance seeds
4. to improve reliability of water supply, farmers have adopted centralised drinking water supply system and facilitated construction of water storage infrastructure
5. to improve ability to access to water resource, farmers have dug wells, transferred water by pipeline or vehicle, pumped water from canal, etc.
6. to reduce irrigation water consumption, water saving technologies have been adopted
7. to avoid food shortage caused by drought, farmers rarely sell all their own grains.
Table 4 shows the link between these 15 activities and the policies of the government and the relevant organisations

<table>
<thead>
<tr>
<th>Activities</th>
<th>Related to policies</th>
<th>Related to social and biophysical factors</th>
<th>Organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage in non-agricultural work</td>
<td>No relationship to policies on offering training course or job information</td>
<td>Constrained by education, race, ages, intensive needs of labours</td>
<td>Private and informal: lineage, relatives</td>
</tr>
<tr>
<td>Livestock, or fish culture</td>
<td>No directly related policy</td>
<td>Technology to improve productivity of rice and maize, market access</td>
<td>Private; market</td>
</tr>
<tr>
<td>Rotations</td>
<td>No directly related policy</td>
<td>Constrained by crop productivity</td>
<td>Private</td>
</tr>
<tr>
<td>Change crop structure</td>
<td>Negative related to subsidy to planting grain; positive related to ‘grain for green’ programme</td>
<td>Constrained by education level, knowledge on planting and wealth of farmers</td>
<td>Private, planting association</td>
</tr>
<tr>
<td>Change land use type</td>
<td>No directly related policy</td>
<td>Constraint: geographical conditions, knowledge</td>
<td>Private</td>
</tr>
<tr>
<td>Change planting schedule</td>
<td>Positive related to weather or drought early warning policies</td>
<td>Constrained by planting knowledge</td>
<td>Private; mobile phone company; TV station</td>
</tr>
<tr>
<td>Adopt improved seed</td>
<td>Subsidies to improved seed</td>
<td>Constrained by degree of market development</td>
<td>Government, seed company, members of community</td>
</tr>
<tr>
<td>Change drinking water supply mode</td>
<td>Subsidies to rural development</td>
<td>Constrained by fiscal ability of local government</td>
<td>Government, private</td>
</tr>
<tr>
<td>Construct water storage infrastructure</td>
<td>Positive: policy raising money and labour case by case in rural areas and farmland tenure reform (tudi chengbao hetong liuzhuang); negative related to policy on agricultural tax reform</td>
<td>Constrained by public funds of community, social relationship, potential revenue of farmland; constrained by ability of community cadres</td>
<td>Private, community; agricultural company</td>
</tr>
<tr>
<td>Change irrigation method</td>
<td>Drought relief emergency plan; subsidies on big drought</td>
<td>Constrained by local government and the ability of community cadres</td>
<td>Government, community, neighbours and private</td>
</tr>
<tr>
<td>Water transfer</td>
<td>Drought relief emergency plan; subsidies on big drought</td>
<td>Constrained by geographical condition, labours availability</td>
<td>Private, lineages, community, government</td>
</tr>
</tbody>
</table>
### Table 4
Links between activities, policies and relevant organisations (continued)

<table>
<thead>
<tr>
<th>Activities</th>
<th>Related to policies</th>
<th>Related to social and biophysical factors</th>
<th>Organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dig well</td>
<td>No directly related policy</td>
<td>Constrained by wealth, degree of water scarcity, social relationship</td>
<td>Private, neighbours</td>
</tr>
<tr>
<td>Apply water saving technology</td>
<td>No directly related policy</td>
<td>Constrained by education, cost of water saving technology</td>
<td>Private</td>
</tr>
<tr>
<td>Food storage</td>
<td>No directly related policy</td>
<td>Market development; crop productivity</td>
<td>Private; market</td>
</tr>
<tr>
<td>Use agricultural machine</td>
<td>Subsidies for agricultural machine</td>
<td>Constrained by farmer’s wealth, biophysical condition of farmland and transport infrastructure</td>
<td>Private; government, company</td>
</tr>
</tbody>
</table>

#### 4.4 Local level organisations

Besides local government, some informal and formal organisations have been promoted to organise adaptive activities under pressure of climate risks. The formal organisations include the community and companies, special associations and markets while the informal organisations include lineages, neighbours, and relatives, etc. Under pressure of impending climate change and concomitant water scarcity, communities have been required to be responsible for undertaking collective actions. The policy of offering public goods gives a positive incentive to strengthen their ability to organise farmers to sit around together to formulate an agreement on raising money and labour on public service domestically. The companies start to participate in drought relief activities when they can benefit from offering public service. Special planting associations which are self-organised by administration or natural village members and financially supported by local government engage in offering training course, investing in machines, seed purchasing, production promotion, and so on. As for the weak formal organisations, the informal organisations are also very important in the study area. The information on jobs and improved seed is mainly disseminated through neighbours, lineages and relatives. Farmers also will help each other when facing drought disasters. It should be noticed that some informal organisations start to become to formal organisations. Water trading happened in a serious dry season and will contribute to development of water markets. Several farmers cooperated in digging wells and this may develop into creating a new WUA.

The shift of water governance at local level shows that:

a the policy on offering direct help farmers seldom improves governance of the local community

b the policy can play an important role in strengthening local organisations

c grass root informal organisations take a certain form under the pressure of climate change
grass root organisations help policy implementation monitoring

e and that collective actions have become more important in coping with drought.

Most national policies have been translated into local policies, but local governments have developed policies based on their own goals. We first looked at policies trying to improve the adaptive capacity of the farmers. For example, guidelines were developed for local government what to do in the future. However, no detailed action plans have been prepared to implement the climate change policies. This process was not easy. It started with laws or departmental rules and was followed by a series of ordinances. The problems are that the departmental rules are binding for different departments and there were policies that overlap and even conflict with each other. Sometimes there were conflicting interests between institutions. For short there is a need for coordination and at the national level it was decided to create four coordinating committees in the State Council including representatives from relevant ministries, administrations, banks, scientific bodies, social associations, NGOs and even the army. Four such committees relevant to drought management are the STLCPAD, the NHFCDR, the NLCDA and the SCLCCC. Three are organised in a top-down way, while one is meant to be more bottom up.

5 Initiatives initiated by the government and reactions of the farmers

What are the initiatives initiated by the government and are they actually working through at the local level? We have studied how Chinese institutions are developing policies to help local communities in the Lancang River basin to cope with problems of climate variability and change, by mapping of the relevant policies and interviewing stakeholders to assess how to improve drought preparedness. It could be concluded that Chinese policy instruments are wider than those mentioned in the literature, but not always these policies get translated into action at local level.

Table 5  Classification of farmer’s reactions to drought

<table>
<thead>
<tr>
<th>Type of farmer’s reaction</th>
<th>Reaction</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive</td>
<td>Wait for government</td>
<td>Instructions to plant drought resistant crops</td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Traditional</td>
<td>Using existing governance structure</td>
<td>Village leaders mobilise support at the administrative village level</td>
</tr>
<tr>
<td>2 New</td>
<td>Developing new or emerging governance structures</td>
<td>Farmers work together to build water supply work</td>
</tr>
<tr>
<td>3 Individual</td>
<td>Individual reactions</td>
<td>Farmers choose alternative options: trees, cattle, etc.</td>
</tr>
</tbody>
</table>

We note an increasing self-consciousness at different levels in China, including the farmers and entrepreneurs in the rural areas faced with a major challenge for which the government has no adequate reaction. The drivers of change lead to new governance structures and emerging structures from below which respond to the priorities of these groups. The drivers mentioned have created the enabling environment for this kind of
actors to build their own governance structures and take initiative; however, this may eventually lead to a very different situation in the rural areas.

We concluded the farmers’ reactions can be classified as passive or active and the active reactions can be classified in the following way (Table 5). They use their social capital in water user associations and local drought relief teams to advance their solutions.

6 Conclusions

After analysing the top-down approach by the government, the initiatives of the farmers have been classified and the role of the government in these initiatives has been assessed. The farmers have learned how to benefit from government programmes, but also that they should not wait for government support. It is important to utilise the indigenous knowledge of the farmers and their capacity to deal with the issues.

This changing governance structure has brought some problems in coping with drought.

1. communities are too weak to adopt public service although the water resources belong to them
2. the traditional agencies such as technology promotion agency and drought relief team have become less and hardly implement policies
3. household are the major water resource managing unit, the competition for its utilisation leads to waste and scarcity simultaneously
4. except to offering direct help to farmers, it’s hard for the government to organise effective collective adaptation among farmers without using bureaucratic agencies
5. private and informal organisations have played an important role in adaptation.

The following governance problems were identified:

1. Although a coordinating body for climate change issues exists, its contribution is limited to four pilot ‘green’ provinces and the necessary co-management with the ministry of finance to obtain the necessary funds for implementing the programmes is not always successful.
2. Implementing the different national policies for climate change at the provincial and local level is not easy. Many national climate change policies have not yet been translated to lower levels of government
3. There is a lack of involvement of the farmers in the decision making process. Formal governance structures are missing, except for the role of the local leaders to submit projects and obtain government subsidies. If the farmers are involved, for example in rural employment and obtaining subsidies, these activities are generally more successful.

Shifts in water governance to adaptive and eco governance improved the local ability to deal with drought, but just as Ostrom (1990) pointed out, decentralised water resource governance system also have several flaws, which should be considered, which include:
a the water resource is easily controlled by leaders or an elite without democratic
decision procedure at the community level

b the local people stick to successful experiences from the past and find it hard to
adjust to a changing environment

c water scarcity leads to conflicts.

Finding financing for climate change activities is important. Given the increase of costs,
alternative financing mechanisms, such as the Clean Development Mechanism and
Tradable Carbon Emission Rights could be used. The objective is to increase the
resilience of the different ecosystems in the Lancang River basin. This requires better
management, strong formal (public) and informal institutions, public private partnerships
(PPPs), sharing of knowledge, and leadership. In China there is a strong emphasis on
technocratic solutions and geo-engineering solutions, but the use of market mechanisms
is still at a nascent stage. However, the effectiveness of China’s policies to cope with
drought is limited by financial challenges, organisational challenges, participation
challenges and market mechanism challenges. China need to put more emphasis
on enhancing adaptive capacity of institutions; drought management; enhancing
coordination between different departments and levels of government; decentralisation in
policymaking; and involving farmers or other stakeholders in decision making.

We reviewed the various reactions to climate change in the case of the Lancang
(Mekong) river basin in South China. In the Lancang River basin different types of
reactions were observed. They are only partially initiated by higher levels of governance.
A number of factors seem to influence the number of initiatives coming from below. We
concluded the farmer’s reactions can be classified as passive or active and the active
reactions can be interpreted as showing agency, used to advance their own solutions, in a
situation where the government is not considered to be effective.

We can now suggest possible solutions to the current issues. Local government can
adopt a more comprehensive approach to drought management than the national
government. Many policies are not implemented at local level because of the weak local
government and the lack of suitable organisations. Local governments are good at dealing
with emergency disasters, but do not help farmers when they face drought. Some policies
encourage community and other gross-root organisations to become stronger, and to start
to play a more important role in dealing with daily climate risk. In response to the
multiple hierarchical organisations operating independently in the field, leading to policy
gaps and overlaps, the central and local governments are increasingly using leading
committees and integrated policies, but it appears that farmers try to organise themselves
to cope with drought.

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