3 Climate change and informal institutions in the Lake Victoria Basin

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ABSTRACT

The Intergovernmental Panel on Climate Change (IPCC) analyses of impacts of climate change suggests that in sub-Saharan Africa, where the majority of the population depend on rain-fed agriculture, economic activities are likely to be more vulnerable to climate change. This is so because the coping mechanisms of the indigenous communities in the rural areas are limited due to lack of appropriate technology. A survey of households and in-depth interviews with key informants in the Lake Victoria Basin (LVB), however, illustrate that local people in the LVB, through their informal institutions, have been developing different strategies to deal with the impacts of climate change. These findings also suggest that the strategies developed are in most instances adaptive to the changing ecological conditions and are effective and useful in responding to natural resource constraints as caused by climate change. The strategies employed include: creating and implementing specific rules on access to and utilisation of some specific natural resources, such as those in the water catchment areas; creating and implementing rules on the type of crops to be grown (mainly cassava and sweet potatoes); creating and implementing restrictions

on the type of harvests to be sold; and disseminating knowledge of weather forecasts informed by indigenous-based tools and indicators to understand the onset and end of rainfall. These findings form the basis for concrete recommendations to the governments in the region to formulate policies and enact laws to support informal institutions and indigenous-based technologies for sustainable development.

INTRODUCTION

Climate change is a global concern which typically threatens livelihoods and, more generally, the sustainability of the majority of any population.[1] The impacts of climate change are felt at different levels: global, regional, national and local. This chapter examines practices at the local level developed, by local people, to minimise and cope with the impacts of climate change. The focus of the present enquiry is specifically on rules and mechanisms created and implemented by informal institutions in managing natural resources. It also analyses cultural and social practices related to production systems and food management. The study on which this chapter is based was conducted in the Lake Victoria Basin (LVB) with particular focus on the Mara River Sub-Basin (MRSB), Tanzania.

For the purpose of natural resources management and control, Tanzania is divided into nine basins with sub-basins.[2] These are Pangani, with its major Pangani River; Wami/Ruvu, with their major Wami and Ruvu Rivers; Rufiji with its major Rufiji River; and Ruvuma, with its major Ruvuma River and the southern coast. All these drain into the Indian Ocean. Others are Lake Victoria, Lake Nyasa, Lake Tanganyika, Lake Rukwa, and the internal drainage basins of Lake Eyasi, Manyara and Bubu depression. The MRSB, with its major Mara River, is a sub-basin within the LVB basin. The MRSB and its major Mara River originate from southwest Kenya in the steep slopes of the Mau escarpments at an elevation of approximately 3 000 m above mean sea level.[3] The Mara River then flows to Lake Victoria, 1 100 m above mean sea level in Tanzania, for a distance of about 350 km.[4] The entire basin covers an area of 13 750 km^2, of which 4 812,5 km^2 (35 per cent) lies in Tanzania, and the remaining 8 937,5 km^2 (65 per cent), in Kenya. The MRSB is located in a semi-arid zone in the LVB. The rainfall is bimodal with brief periods of rain falling in November to January, and longer periods in March to May. The average annual rainfall in the MRSB ranges between 500 mm to 1 250 mm, with highlands receiving more rainfall than the lowlands.[5]

This chapter commences by contextualising certain socioeconomic conditions prevailing in Africa, with specific reference to the sub-Saharan region in the context of vulnerability and adaptation to the impacts of climate change. This is considered against the received, albeit flawed, wisdom that Africa is unable to manage its own natural resources.[6] Section three describes both formal and informal institutions that govern natural resources, including access, use and control thereof, with specific reference to water resources. Section four discusses in detail the role of informal institutions, namely the associations of traditional leaders in natural resources management. The section further examines rules on access to and utilisation of natural resources; rules on agricultural practices, and their roles in averting climate change risks and impacts. Section five examines the process of disseminating weather forecast information to local people, while section six explores the challenges facing informal institutions in setting rules to govern natural resource access and utilisation. The remainder of the chapter draws several conclusions and proposes some recommendations relating to the foregoing analysis.

AFRICA'S ECONOMIES AND THE IMPACT OF CLIMATE CHANGE

The climate change discourse started to gain increasing national and international attention in the 1980s. As a result, several governments came together in 1988 and formed the Intergovernmental Panel on Climate Change (IPCC). This led to the United Nations Framework Convention on Climate Change (UNFCCC), which was tabled in 1992 at the United Nations Conference on Environment and Development (UNCED).[7] UNCED, popularly known as the Rio de Janeiro Conference, focused on, among other issues, policy issues related to climate change adaptability. Africa, and more particularly the sub-Saharan region, are among the most vulnerable regions and are particularly exposed to the impacts of climate variability and change.[8] Africa's vulnerability arises from a combination of many factors, including extreme poverty, frequent natural disasters such as droughts and floods, and developing economies that are primarily dependent on natural resources and are thus extremely vulnerable to weather fluctuations. Vulnerability is the function of exposure, sensitivity and adaptive capacity of the people and their economic activities to climate change.[9] Therefore, the capacity to anticipate, cope with, resist and recover from

the impact of hydrological disasters, such as droughts, indicates the level of vulnerability.[10] Africa's high vulnerability to the impacts of climate variability and change is also attributed to its low adaptive capacity.[11] Despite low adaptive capacity, some communities have developed traditional adaptation strategies to cope with climate variability and extreme events. Examples include: creating informal institutions to regulate the use of natural resources; adjustments to planting dates to take advantage of early rainfall; planting drought resistant crops; and periodic long-distance movements by nomadic pastoralists to areas less affected by drought in response to changing climates.

Agriculture is the most important economic activity in the LVB, supporting over 80 per cent of the population of about 30 million people, but 60 per cent of these depend on rain-based rural economies, generating in the range of 30–40 per cent of the countries' gross domestic product (GDP).[12] Rain-fed agriculture in the LVB constitutes more than 95 per cent of the agricultural land use and it has undergone enormous environmental changes within the last 40 years.[13] Climate change and land degradation have been repeatedly recognised as being among the major contributors of rapidly evolving changes in the basin that seriously threaten its ecosystem functions, overall biodiversity and the livelihoods of it populations.[14]

INSTITUTIONAL ARRANGEMENTS IN NATURAL RESOURCES MANAGEMENT

Sustainable management of natural resources in river basins is an important but very complex issue. The conditions and requirements for its achievement could vary from place to place over time, since it depends on factors such as geographical location, ecological conditions, socioeconomic issues, institutional arrangements, and cultural background. Both formal and informal institutions have been established in Tanzania to manage and allocate natural resources among and between different users. Institutions, be they formal or informal, could potentially provide incentives to groups and individuals, and also structure human action and interaction, especially in economic activities, in collective action and in sustainable natural resource allocation and use. Institutions have dual facilities to constrain and liberate different actions in society, that is, either prohibit people from doing something or prescribe conditions for when something is done with respect to socioeconomic and environmental activities.[15]

Although different scholars[16] admit the difficulty, and acknowledge various contradictions, in defining the term 'institution', there is a common understanding that an institution is best described as a set of rules governing human beings and their activities. This can be seen from the definitions of two reputable scholars.[17] North[18] defines institutions, as 'the rules that govern a society or, more formally, are the humanly devised constraints that structure and shape human actions and interactions between members of the society and with the surrounding environment'. Ostrom[19] defines institutions as 'the set of rules actually used (the working rule or rule-in-use) by a set of individuals to organise repetitive activities that produced outcomes affecting those individuals and potentially affecting others'. North notes two forms of institutions, namely formal (constitutions, policies, laws and property rights) and informal (taboos, codes of conduct, norms and traditions). He further notes that institutions can be created, such as constitutions, or institutions can simply evolve over time, such as common law. Institutions, therefore, according to North, are creations of human beings and they hence evolve and are continuously altered by human beings.[20] Moreover, the ways institutions evolve and develop have an influence on the natural resource management and socioeconomic development of a society over time and space.

To manage natural resources in the specific basins, institutions, both formal and informal, (customary) are established to coordinate and set rules and regulations to govern the utilisation of the resources. In Tanzania, for example, most river basins have River Basin Water Boards (RBWB) and River Basin Water Offices (RBWO) established under the Water Utilization (Control and Regulation) Act.[21] These institutions have a basin-wide responsibility for resource allocation, in this instance, water.[22] In the LVB, formal institutions include the Lake Victoria Basin Water Office (LVBWO), based in Mwanza. Although the LVBWO was established by Act No. 10 of 1981,[23] which is the amendment act to the principal Water Utilization (Control and Regulation) Act No. 42 of 1974, which aims to control, regulate and allocate water resources for different uses in the LVB, there are limited water-use rights granted to users. The latter limits sustainable utilisation of water and other natural resources in the basin because users lack incentives to manage the resources. The only user rights have been granted to the Water User Associations (WUAs) for boreholes. Other formal institutions include the Lake Victoria Environmental Management Project (LVEMP) based in Mwanza, with subsidiary offices in

Musoma and Bukoba mainly dealing with the development of Lake Victoria's water resources and controlling water hyacinth (*Eichhornia crassipes*); and Mara River Initiative Project (MRIP) based in Musoma, dealing with the management of natural resources in the Mara River Sub-basin. MRIP works in collaboration with local communities to establish and implement strategies and mechanisms to manage natural resources. The RBWO, however, places significant emphasis on water supply for domestic and industrial uses, with little or no emphasis on environmental conservation.

Similarly, there are informal institutions that are established under customary rules to govern access, control, ownership and utilisation of natural resources.[24] These institutions play important roles in preventing the degradation of natural resources and/or restoring already degraded resources in order to minimise the effects of some extreme climactic events, such as droughts and floods.

Writing on the relationship between formal and informal institutions, Cousins[25] notes that formal institutions are rules enforced by the state, i.e. underscored by law, while informal institutions are rules enforced endogenously. Thus, as Boesen, Maganga and Odgaad[26] note, customs and codes of conduct developed under specific socioeconomic and cultural conditions are therefore meant to govern informal institutions and are dynamic. While institutions, such as the RBWO, that grant resource user rights have accordingly been developed by the state (formal institutions), informal institutions are based on customary laws.[27] Local communities have been developing informal institutions with rules, norms and regulations over time to govern access to natural resources and the use of natural resources in the specific sociocultural and ecological conditions. This is generally the case in most developing countries, where the majority of the population live in rural areas and depend on natural resources for their survival. In these conditions, access to, utilisation and control over natural resources seem to be governed by customary systems based on culture.[28] Thus, while informal institutions are mainly based on sociocultural practices of the local people, formal institutions are governed by policies and legislation.

POLICIES AND LEGISLATION IN NATURAL RESOURCES MANAGEMENT

Appropriate policies and legislation create an enabling environment for sustainable natural resource management and development. A policy is a government's

main governance mechanism to provide guidelines for implementing development plans and strategies. For natural resources, a policy sets broad criteria and procedures intended to provide guidance to planners and decision-makers and those charged with power to implement and execute natural resource-based development plans. To operate effectively and efficiently, laws are enacted to enforce the implementation of the policies. A law defines the legal entitlement to the specific natural resource and identifies the rights and obligations tied to its allocation and use and, consequently, provide the prescriptive parameters for the resource's development. Some of these laws facilitate natural resource management on a river basin basis. In Tanzania, for example, water resource development is governed by both law[29] and policy.[30] According to the 2002 Water Policy, water-based institutions, both formal and informal, are expected to play a greater role in water resource exploration, assessment, allocation, pollution control, catchment management, and basin planning and development. The policy, however, seems to afford more attention to formal institutions while informal institutions of water resource management are not afforded the same. Other sector-specific policies in Tanzania include the Agricultural Policy,[31] the National Land Policy[32] and the National Forestry Policy,[33] which are all equally important in governing natural resource use and management. Since these policies are sector-specific they sometimes create conflicts in their implementation. The National Environmental Policy,[34] for example, failed to harmonise sector-specific policies with a view to creating a common policy which cuts across different related sectors, such as forestry and water. The National Environmental Policy describes the role of sector-specific policies without necessarily indicating how different sector-specific policies merge. The conflicting natural resource policies could be one of the exacerbating factors that contribute to natural resource degradation in the country and accordingly, does not contribute to establishing a sound formal policy and legislative base to address issues such as the impacts of climate change.

Similarly, the uncoordinated informal and formal institutions have affected natural resource development, particularly as far as allocation, access and control are concerned. Chancellor, Hasnip and Oneill write: 'There is generally a gulf between institutions particularly the officials of government institutions and local people institutions resulting in poor communication and poor appreciation of others' needs and expectations.'[35] These existing weak institutional arrangements, particularly in the river basins, have in all

probability been exacerbating natural resource mismanagement in most river basins in Tanzania. The challenges associated with conflicting formal and informal systems of natural resource management are further exacerbated by the fact that local people have limited knowledge about the policies and legislation governing water resources. Successful and sustained natural resource management requires the commitment of relevant institutions, policies and legislation. Certain studies[36] indicate that over 80 per cent of local people have limited knowledge regarding natural resource-related policies and legislation. Government and other responsible institutions seem not to have plans to disseminate the guidelines and laws governing natural resources as stipulated in the relevant national policies and legislation. Moreover, in Tanzania, some policies and laws lack clear strategies and mechanisms to protect the environment from degradation. For instance, water laws[37] seem to be inadequate to facilitate proper catchment management and to protect water sources from degradation. The primary objectives of the Water Utilization (control and regulation) Act No. 42 of 1974 and its subsequent amendments, No. 10 0f 1981 and No. 17 of 1989,[38] seem to be focused on water allocation, that is, administrative issues of granting water rights, and water pollution control, including setting water quality standards and permissible effluents standards. Few provisions are put in place to minimise or combat the degradation of natural resources.

Governments would therefore be well-advised to integrate formal and informal systems for sustainable natural resources management. Gillingham[39] notes that the existing environmental problems in river basins are accelerated by the tendencies of formal river basin-based institution officials to ignore the basic principles of customary systems of natural resources utilisation. To show the need to integrate customary and formal legal systems in natural resources management Gillingham writes: 'If water managers attempt to impose change on water users by altering statutory law, such initiatives can be rendered ineffective if the water users do not integrate them into the customary rules which govern their daily water use'[40]. It is further important to note in this respect that formal and informal systems can contradict or complement one another in natural resources management. North[41] notes here that formal rules can compliment and increase the effectiveness of the informal constraints through lowering information, monitoring, and enforcement costs and hence rendering informal constraints possibly more efficient.

THE ASSOCIATIONS OF TRADITIONAL LEADERS AND NATURAL RESOURCES MANAGEMENT

Background

Informal institutional arrangements play a significant role in natural resource management in the LVB and, particularly, the MRSB. The most common and effective informal institutions in governing access, use and control in the MRSB, are the associations of tribal traditional leaders, which are governed by taboos, codes of conduct, norms and traditions. These institutions are important in governing local people's involvement in different sociocultural, economic, political and environmental activities, including the utilisation of natural resources. Members of these informal institutions are mostly elder men who are elected based on particular social, political and cultural characteristics of the family, including extensive knowledge of the spatiotemporal changes of surrounding natural resources and local medicines. The number of members of the associations of tribal traditional leaders per village range between 15 and 20, usually consisting of a chairman, secretary and treasurer. These associations have powers, based on customary laws, to set rules and enforce these in their areas of jurisdictions. They therefore play an important role in settling cultural, social, economic and political matters and conflicts as reported to them and/or observed by one or more members of the association.

In the LVB and specifically the MRSB, tribal traditional leaders are the local experts in several aspects, including, *inter alia*, the society and surrounding environment, local medicines, knowledge of environmental changes in their area, and location of different resources. Traditional leaders are superior individuals in society and are highly respected by members of their community. Tribal traditional leaders are only older men, mainly 60 and above years of age. This gender and age, specifically, seem to reflect gender division of labour in the community, both in the production system and knowledge about the surrounding environment. Through their role of taking livestock to pasture and water, men seem to gain extensive knowledge of the dynamic nature of the surrounding natural resources as compared to their women counterparts.[42] Although each village has the association of tribal traditional leaders, there are, however, information flows from one village to another, provided that the same ethnic group(s) inhabit the villages concerned. Tribal traditional leaders play

the key role in setting rules to govern and control all cultural practices, such as ritual activities, and utilisation of some specific resources, particularly forests and water resources. Spiritual leaders further design mechanisms to implement the rules they set, also with the view to ensuring that local people adhere to those rules and regulations. The main rules that relate to coping mechanisms as regards the impacts of climate change include rules on access to and utilisation of some specific natural resources, rules on the type of crops to be grown, and restrictions on the type of harvests to be sold. Traditional leaders are also responsible for disseminating knowledge and information on weather forecasts, and are informed by indigenous tools and indicators to understand the onset and end of rainfall in this respect.

Rules on access to and utilisation of natural resources

Traditional leaders typically impose limits on access to those natural resources, which are believed to be important for the livelihoods of local people. The most important natural resources that would require some restrictions in this respect include water resources; natural forests believed to control rainfall; and certain trees, such as fig trees, which are believed to be a source of water. There are also restrictions and prohibitions on felling trees for making charcoal intended for commercial purposes. Furthermore, bushfires are prohibited and non-compliance is heavily punished. The main objective of limiting access to these resources, is conservation, with the view to reducing or curbing degradation. Forms of restrictions of access to and utilisation of specific natural resources include the uses for which the resources are intended; the time of a day to which one is allowed to access the resources; the ability of social groups to access the resources; and the quantity of the resources to be harvested or utilised.

Traditional leaders use different strategies and mechanisms to enforce the rules they set on access to and utilisation of natural resources. These strategies and mechanisms include practising ritual activities within and around the natural resources, and setting penalties for violators of the rules. The penalties are socio-culturally constructed, including separating violators from participating in and sharing sociocultural and economic activities with other members of the society. Others include paying fines of livestock, local brews and money. This would accordingly coerce each member of the community to adhere to the rules to avoid penalties. Ritual activities, on the other hand, place limitations

(by informal rules) on access to and utilisation of certain areas and resources by restricting the access of some social groups believed to degrade natural resources to areas where ritual activities are practised. Traditional leaders claim to have local medicines that, when applied to a specific area, harm any unauthorised person visiting the area. For example, one man is claimed to have injured himself in the process of cutting down trees. For this reason, therefore, only traditional leaders have access to and authority over utilisation of forests and forest products located in and around areas where ritual activities are practised. These areas are mainly near or around water sources, within natural forests, and under certain large trees. The result is that local communities respect highly sensitive natural resources within and around these areas because they are aware of the rules, and in most instances agree with these rules. This, in turn, is expected to reduce degradation of natural resources and consequently would reduce levels of vulnerability to the impacts of climate change.

Rules on agricultural practices

One of the key impacts of climate change and variability relating to human security in the LVB is food insecurity. This is so because over 80 per cent of the population in the basin depends on rain-fed agriculture as their main source of livelihood. To minimise the impacts of climate change on agricultural production, traditional leaders set rules, informed by knowledge of rainfall variability and change, on what, where and when to plant certain crops. For instance, growing drought-tolerant crops such as cassava and sweet potatoes may be made compulsory for each household when less rainfall is expected in a specific year. This has made cassava and sweet potatoes, which were not the main food crops in the MRSB prior to the 1970s drought,[43] the main food crops in the area. It has, for instance, been made compulsory for each household to grow cassava and sweet potatoes as a strategy to minimise the impacts of droughts and thus improve food security.

Furthermore, decreased rainfall seems to have compelled traditional leaders to introduce the second cultivation season, that is, the 'short' season, to supplement food deficits in the 'long' season due to unreliable rainfall. When rainfall was sufficient and reliable, harvests from long seasons were sufficient. The decrease and unreliability of rainfall may have led to the reduction of harvests during the long season, compelling local people to introduce the short

cultivation season. Other factors such as population increases at the household level and commercialisation of agriculture may, however, have caused the shift from one cultivation season to two cultivation seasons in the year, due to increased food requirements. Similarly, commercialisation of agriculture may have increased demand for land leading to a reduction of land for food crop production.

Other agriculture-related rules, practices and coping strategies which are commonly used in the LVB in response to climate change and variability, include selecting the type of landscape (land surface units) where crops are grown, when crops should be grown (cultivation seasons), and techniques employed during cultivation. What, where, when and how to cultivate crops in the MRSB depends on, among other factors, the knowledge of the amount of rainfall in a specific time period (season) and the capacity of different landscapes to hold water. For instance, when there is insufficient rainfall over protracted periods of time, local people cultivate in the lowlands with relatively high moisture content. They also construct and grow crops on ridges in order to tap surface run-off water, thereby increasing moisture sufficiency for plant growth. Similarly, during heavy rainfall, ridges reduce surface run-off and therefore minimise impacts on the land, such as soil erosion. This strategy ensures sustainability of food sufficiency at household levels throughout the year.

Furthermore, traditional leaders set rules to limit households from selling food crops following harvests. When weather forecasts, based on indigenous indicators, indicate either insufficient or late onset of rainfall, each household is prohibited from selling their harvested food as a strategy to increase food storage and security for future use. In some cases, members of households are also prohibited from having celebrations or cultural practices that require extra food. For instance, when low rainfall and, as a consequence, a smaller harvest is expected, traditional leaders prohibit circumcision ceremonies that normally take place every two years.

Informal institutions and dissemination of weather forecast information

To set specific rules or adopt a specific strategy, traditional leaders employ knowledge of the past, current and future weather conditions related to rainfall. The knowledge of rainfall variability is based on a number of elements observed

over a number of years. The need to understand rainfall variability has required traditional leaders in the MRSB to develop tools for forecasting rainfall onset and end in order to prepare for the expected adverse hydrological conditions, or to prepare to take advantage of the expected favourable hydrological conditions in their socioeconomic activities. The tools for rainfall forecasts that have been developed have been based on practices and experiences gained while interacting with the environment, particularly when practising socioeconomic and political activities.

The main tools that have been developed and employed for forecasting rainfall in the MRSB, are divided into seven major categories, namely: elements of weather, wild animal behaviour, insect behaviour, astronomy, water body characteristics, bird behaviour, and fishing. These tools are used to predict the beginning and end of rainfall. A single tool and its indicator(s), however, are not sufficient to forecast the onset and/or end of rainfall. Instead, spiritual leaders use a combination of tools and their indicators to reach a decision concerning the expected hydrological condition in their area.

Thus, traditional leaders, as an institution, disseminate knowledge on expected weather conditions to the local communities, which is a critical process necessary for enhancing the adaptive capacities of the smallholder communities in rural areas to climate change. Traditional leaders, through their associations, are therefore sources of information on weather or new and potential strategies for averting climate change risks. Smallholder communities could therefore benefit greatly from weather forecasts in a number of ways. For example, knowing in advance if the rainfall will be normal, below or above average, could help them chose the most suitable crop/varieties, adjust to their cropping practices, or take other measures necessary to maximise benefits or minimise losses.[44]

Challenges facing informal institutions

Informal and formal institutions seem not to complement one another. For instance, the granting of water rights to private companies or individuals, and the allocation of land to individuals or private companies which is done by formal institutions, deprive traditional leaders of the right to impose any rule over the land and resources. Since local people seem to have limited knowledge of policies and legislation, these people do not give due support to rules and regulations imposed by formal institutions and, instead, they rely on informal rules. Ruttan[45]

establishes the hypothesis that institutions governing natural resources should follow the principle 'restraint for gain', that is, if users are able to agree on the rules in operation, it becomes possible to follow the rules. Similarly, Gillingham[46] observes that, in Tanzania, formal rules have been ineffective because formal institutions tend to ignore the customary systems of the local people.

Furthermore, rapid population growth due to in-migration, for example, migration of livestock keepers together with their livestock, has put informal institutions at risk. Migrants to specific ecological systems alter the natural states due to increased pressure on natural resources. Migrants with different sociocultural and political backgrounds also disrupt the management systems of natural resources of the local communities. Moreover, migrants lack alternatives to earning their livelihoods, which leads to overexploitation of natural resources, including water, fuel wood, wild meat and land for cultivation. These and other needs have led to deforestation, degradation of catchments and general encroachment on marginal lands, making the land vulnerable to the impacts of climate change.

Transboundary resources are also difficult to manage through informal rules as they cut across different socioeconomic and political boundaries. For instance, the main water catchment in the MRSB is the Mau escarpments, which lie in the MRSB, Kenya. This renders rules set by traditional leaders in the MRSB in Tanzania inapplicable to the Kenyan side.

Urbanisation is another challenge facing informal institutions in the management of natural resources in the LVB. Urbanisation in the LVB and Africa in general is increasing at an alarming rate. With urbanisation, informal systems lose their strength because urban areas are mostly inhabited by people from different socioeconomic and cultural backgrounds. The major problem seems to be a lack of adequate policies and legislation to support these informal systems of natural resources management.

CONCLUSION

This chapter has illustrated the roles that institutions and, in particular, informal institutions play in governing day-to-day natural resource use and management thereof at the local level. Institutions, be they formal or informal, can provide incentives to groups and individuals, and also structure human action and interaction, especially in economic activities, individually or collectively,

in sustainable natural resource allocation and use. Institutions can either constrain or liberate different actions in society, and also establish rules to be followed before or when performing different socioeconomic and cultural activities. With respect to natural resources, rules and regulations can prohibit people from doing something, impose conditions on actions and also permit certain socioeconomic, political and cultural activities at specific locations over certain resources during a specified period of time. These rules, as this chapter demonstrated, are important in natural resource management and would enhance the resilience of resources to the impacts of climate change at the local level. It is, however, essential that, since informal institutions are important to sustainable natural resource management, they are supported by more formal policies and legislation.

NOTES

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