



Communicating Climate Change: Issues ahead and Action Needed in Himalayan Regions

Achyut P. Adhikari*

Abstract

Action on climate change consists of two complementary elements. Mitigation is concerned with the causes of global warming and calls for the reduction of greenhouse gas emissions. While adaptation is concerned with the impacts of a changing climate on society, the economy and the environment, and promotes activities to reduce vulnerability to extreme weather events and other longer term changes in our climate. This strategy looks to how to communicate both the mitigation and adaptation agendas. Effective communication on climate change policy is therefore necessary in order to gain public support and thus reduce GHG emissions.

The research is based on questionnaire, a critical literature review, policy analysis, interview, questionnaire survey, observations and reflections. Even though climate change is a matter of great scientific relevance and of broad general interest, there are some problems related to its communication. The purpose of this paper is to outline some of the problems inherent to the communication of climate change, list some of the challenges ahead and describe some of the action needed in order to allow it to be better and more widely communicated.

Keywords: Organizational Communication / Climate Information / Global Warming / Climate Change Governance/ Nepal

Introduction

Although concerns related to climate issues are not new, much has happened during the past two decades. Firstly, a world body which evaluates the risks of climate change brought about by humans and which issues periodical reports on the world's climate – the International Panel on Climate Change (IPCC) – was established in 1988. It was a joint effort of the World Meteorological Organization and the United Nations Environment Programme, which has found since its establishment worldwide acceptance and recognition.

Secondly, the UN Framework Convention on Climate Change (UNFCCC) was adopted on 9 May 1992 by the Intergovernmental Negotiating Committee established for its negotiation. In early June 1992, the UNFCCC was opened for signature and entered into force on the 21 March 1994. The UNFCCC has over 200 parties and observer states, which makes it one of the most universally supported and most influential multilateral environmental agreements.

The Himalaya region has been experiencing the multitude of undesired change that cut across both biophysical and social realms. Observed biophysical changes include unpredictability in the timing and magnitude of rainfall, frequent occurrence of

* Asst. Prof., Tribhuvan University Southwestern State College, Nepal



extreme heat during the summer season, glacial retreat and melting snow (Sharma et al. 2009; Gurung et al. 2010; MoE, 2010; Chaudhary et al. 2011). Temperature is rising over the past 100 years (Yao et al. 2006; Chapagain et al. 2009). These changes have already been posing serious threats on water, biodiversity, human health, agriculture, and consequently on food security throughout the region and downstream (Chaudhary and Bawa 2011). Vulnerable social and economic conditions pose further threat to the region. Recent social changes include rapid exodus of able-body manpower from the country, frequent economic crises, social and political unrest, and shrinking human capital. Since the region is the water tower of Asia and the lifeline for nearly one-fifth of world population, the current trend of climate change in the region will continue presenting an immense threat to humanity (Immerzeel et al. 2010). While any one of these factors will likely pose significant challenges on livelihoods of the people of the Himalaya region, the threat posed by changing climate and uncertainty associated with it cannot be ignored.

When objectively analyzed, climate change is seen as related to a set of natural causes (Leal Filho W. 2009) such as:

- Solar radiation;
- Volcanic activity;
- Continental drifts; and
- Earth's tilt.

These are complemented anthropogenic action such as emissions of greenhouse gases from industry. The combination of natural and human-induced causes in turn lead to a set of effects (e.g. global warming, ozone layer depletion, changes in socio-economic conditions) and consequences (e.g. disruptions in agriculture, sea level rise, increases in the frequency of draughts/floods). Stern (2007) has reiterated the fact that a sound understanding of the economics of climate change is needed in order to underpin an effective global response to this challenge. Adapting to climate change is important (Abramovitz et al., 2001; Adger, 2003), so as to reduce vulnerability (McCarthy et al. 2001) and so is a better understanding of what this means.

In trying to explain what the expression “climate change” means, it is important to define it. To the purposes of this paper, the UNFCCC definition of climate change is used. According to UNFCCC, climate change is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, Geneva). Owing to its scope, it is necessary to consider climate change as a process influenced by various variables, like socio economic, political, ecological, ethical, health, technological, bio-physical etc. as shown in Figure 1.

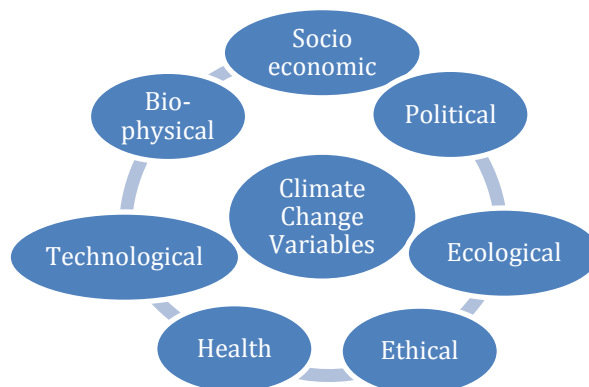


Figure 1. Some Climate Change Variables (Leal Filho W., 2000, p. 6)

Therefore, the search for solutions to the problems caused by climate change cannot be uni-dimensional: it needs to be pursued in an integrated way.

Research Questions

Even though climate change is a matter of great scientific relevance and of broad general interest, there are some problems related to its communication. The purpose of this study is

- To outline some problems inherent to the communication of climate change,
- List out some of the communication challenges ahead, and
- Describe some of the action needed in order to allow it to be better and more widely communicated.

In the next section, I will provide background of Nepal, a Himalayan country that is sandwiched between two giants, India and China. Following that section, I present evidence of climate change, both observed and perceived, which is followed by situation of education and awareness regarding to climate change. Then I introduce ways and methods to communicate climate change issues. Finally, the author discusses some of the issues in communication and provide some necessary actions to mitigate the issues.

Research Method

This study is based on questionnaire, a critical literature review, observation, informal discussions and authors' reflections. The policy and institutional preparedness related to adaptation through information discrimination are investigated through a content analysis of government policy documents, published and unpublished reports of the developmental and research organizations and government agencies. The study is focused on identifying the major communication issues, suitable methods to communicate and suggests the best actionable alternatives for climate change information discrimination.



Case Background

Nepal is a small landlocked mountainous country located between the world's two most populous countries: China to the north and India to the east, west and south, with a total land area of 147,181 square kilometers. The elevation of the country increases from about 60 meters in the south to 8848 meters in the north at the peak of Mt. Everest. Nepal receives major portion of rainfall during summer monsoon from June to September.

Agriculture is the mainstay of the economy, providing a livelihood for over 80 % of the population. About 80 % of the total population depends on the forests for daily fuel wood supply. Forests and shrubs cover 52,283 sq km, which amount to 39.6 % of the total area of Nepal. Although Nepal occupies only 0.03 % of the total land surface of the earth, it has nearly 4.3 % and 8.5 % of mammalian and bird species of the world's total respectively. The immense bio-climatic diversity in Nepal supports more than 35 forest types. Nepal is one of the richest countries in terms of water resources where the monsoon contributes plenty of rainfall. About 6000 rivers and streams including three major basins namely SaptaKosi, Karnali and Narayani basin drain the country. The annual run off from total drained areas is estimated to be 202 billion m³.

General Overview on Climate in Nepal

Peer-reviewed studies analyzing regional changes due to global CC in South Asia - and even more so in Nepal are limited, especially in relation to water resources, because of the difficulty in scaling down the general circulation models (GCMs), a lack of long-term climate records, and the natural high variability of water supply (Cruz et al., 2007; HMG, 2005; Eriksson et al., 2009). Also, GCM outputs do not have sufficient spatial resolution to provide information on changes across the different elevation zones. A variety of different non-climate factors that have varying effects on water resources and agricultural systems in the region, including pervasive resource mismanagement and rapid population growth, also cloud the effects of CC. There are, however, general trends that have been corroborated by ground level observations of various communities in Nepal that do at least give a basic framework of the identified and projected changes, including glacial melt, changes in precipitation patterns, and increasing water stress into the twentieth century, with most of South Asia projected to be under water stress by 2050 (IPCC, 2007; UNEP, 2008; Bates et al., 2008). The following section summarizes information that is available in existing literature on the primary climate variables, i.e., temperature, precipitation and runoff for Nepal (IPCC, 2007; World Bank 2009b; NCVST 2009; Mc Sweeney et al., 2008; Bates et al., 2008; Kundzewicz et al., 2007). Table 1 below provides a brief outline of the likely changes to these variables.



Temperature

Some observed studies on climate trends suggest that from 1960-2003 there have been no increases in annual temperature over Nepal (World Bank 2009b; Mc Sweeney et al. 2008). Other studies cite an increase in temperature in recent years (Cruz et al., 2007; Agrawala et al., 2003), with more pronounced warming at higher altitudes (Liu and Chen, 2000; Bhutiyani et al., 2010). There has been a small but significant increase in the frequency of hot nights and a significant decline in the annual frequency of cold days and nights. Hot nights have increased by 2.5% (Mc Sweeney et al., 2008). GCMs (General Circulation Model) predict that the country is expected to become warmer with more frequent heat waves and less frost. Average temperature is predicted to rise significantly by 0.5 to 2.0 °C by 2030 (NCVST2009), 1.3 to 3.8 °C by 2060, and by 1.8 to 5.8 °C by 2090 (Mc Sweeney et al., 2008). The number of days and nights considered hot by current climate standards is projected to increase, occurring on 11 to 18% of days and on 18 to 28% of nights by the 2060s. The greatest increase is projected to occur during the months of June to August (Mc Sweeney et al., 2008).

Precipitation

Projected mean annual precipitation for Nepal does not show a clear trend with reference to both increases and decreases: -34 to +22% by the 2030s; -36 to +67% by the 2060s; and -43 to +80% by the 2090s (NCVST 2009). This is, in part, because the exact effects of CC on precipitation levels in the region are based on complex factors governing the Asian monsoon and their interaction with increased carbon dioxide (CO₂) levels, which is not well understood. Nevertheless, there is general agreement in recent models and studies that the monsoon will at the very least become more variable in the coming decades. Various studies, including those from the Intergovernmental Panel on Climate Change (IPCC), indicate that on a general level the summer monsoon (June to August) will become more 'intense', but also more variable, meaning more frequent heavy rainfall events, even as the number of rainy days decreases (IPCC 2007). Although monsoon rainfall projections for Nepal do vary, more models suggest an increase rather than a decrease towards the end of the century: -14 to 40% by the 2030s; -40 to +143% by the 2060s; and -52 to +135% by the 2090s (NCVST 2009).

Table 1, Anticipated climate change impacts in Nepal (Bartlett et al. 2010: p. 6)

Temperature	<ul style="list-style-type: none">• Significant rise in temperature:<ul style="list-style-type: none">➢ 0.5 to 2.0 °C by 2030➢ 1.3 to 3.8 °C by 2060➢ 1.8 to 5.8 °C by 2090• Increase in the number of days and nights considered hot by current climate standards• Highest temperature increases during the months of June to August and at higher elevations
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Precipitation	<ul style="list-style-type: none">• Wide range of mean annual precipitation changes:<ul style="list-style-type: none">➢ -34 to +22% by the 2030s➢ -36 to +67% by the 2060s➢ -43 to 80% by the 2090s• Increase in monsoon rainfall towards the end of the century:<ul style="list-style-type: none">➢ -14 to 40% by the 2030s➢ -40 to +143% by the 2060s➢ -52 to +135% by the 2090s
Runoff	<ul style="list-style-type: none">• Higher downstream flows in the short term, but lower downstream flows in the long term due to retreating glaciers and snowmelt and ice-melt• Shift from snow to rain in winter months• Increased extreme events, including floods, droughts and GLOFs

Further conflating any understanding of predicted changes to precipitation levels are these effects of aerosols like black carbon or soot. Such effects are primarily felt through atmospheric brown clouds (ABCs), “regional scale plumes of air pollution that consist of copious amounts of tiny particles of soot, sulphates, nitrates, fly ash and many other pollutants” that hover over parts of the globe (including South and East Asia) with concentrated industrial emissions, limiting summer on soon rainfall, contributing to glacial retreat in mountainous regions, and ultimately affecting crop yields (Ramanathan et al., 2008). According to United Nations Environment Programme (UNEP), “ABC-induced dimming” of surface solar radiation is the primary cause for reduced rainfall in India over the last 20 years (Ramanathan et al., 2008). Previous studies had indicated that the effects of ABCs actually offset some of the negative impacts of increased CO₂ levels, but more recent work indicates that the overall combined effect of ABCs and increases in greenhouse gas emissions negatively impact crop yields (Auffhammer et al. 2006).

Runoff

The effects of the changes in precipitation and temperature are expected to change the balance between ‘green water’ and ‘blue water’. ‘Green’ water is the water that is used or lost in catchments before it reaches the rivers, while ‘blue’ water is the runoff that reaches the rivers. Glacial melting and retreat, rapidly thawing permafrost and continually melting frozen soils in higher elevations is already being observed (Eriksson et al., 2009). In the sub-basins dominated by glaciers, this will mean increased downstream flows in the short term, but in the long term, runoff is expected to decrease with the retreating glaciers, causing major reductions in flow and significantly affecting downstream livelihoods and ecosystems (Bates et al. 2008). In the winter months, more precipitation is falling as rain, which also accelerates deglaciation, and in turn means a shorter winter and earlier snowmelt, ultimately affecting river basins and agricultural systems dependent on surface water diversions for the summer growing season.



Another particularly significant threat in the Himalayas and directly correlated to rising temperatures are glacial lake outburst floods (GLOFs) that result from rapidly accumulating water into glacial lakes that then burst, sending flash floods of debris and water from high elevations, wreaking havoc on downstream communities and damaging valuable infrastructure like hydropower facilities and roads. There are approximately 9,000 such lakes in the Himalayas, of which 200 are said to be in danger of bursting (Bajracharya et al., 2007). High rates of glacial melt due to increases in temperature are adding to this threat, as the rate of such incidents increased between the 1950s and 1990s from 0.38 to 0.54 events per year (Bates et al., 2008).

Public Education and Awareness

Nepal has promoted education and public awareness on Climate Change issues through various means. At the very basic level, a primer to increase understanding of Climate Change issues is being translated into Nepali and disseminated to public schools, libraries and government agencies. In the mean time, information materials related to Climate Change problem have been distributed on special occasions or events. Workshops and seminars, to present and discuss key issues, have been organized. Public education and awareness as well as public participation in environmental protection activities have also been promoted regularly (MoPE., 2004). To promote public awareness of the deteriorating environment, various government agencies stage campaigns through different media. A bottom up approach to resources management has stimulated more local participation and awareness of environmental programs. Public awareness is strongly linked to public participation in activities that address environmental issues. Promoting the role of local community, NGOs and the private sectors in pursuit of sustainable development, Nepal has contributed greatly to raise public awareness of environmental problems and issues such as Climate Change. Nepal is resolved to continue its active support and efforts to promote education and public awareness on Climate Change issues (MoPE., 2004).

Communicating climate change

In order to better understand climate change, it is important that one has an understanding of what it means to different people in different parts of the world. A recent study undertaken in the UK by the Department for Education and Skills and disseminated by the British Broadcasting Corporation (BBC) has shown that climate change “worries children”. A sample of young people was asked about the world’s problems and climate change was often referred to as young people’s biggest concern for the world’s future.

Some 24 per cent of the sample believed it is the greatest threat faced, while 19 per cent think it is crime and violence, the study found out. Of the 1,000, 10 to 18-year-olds questioned, 18 per cent nominated terrorism and 12 per cent said it was lack of housing around the globe which concerned them most. In this context, it is important to acknowledge that there are some factors that influence attitudes towards climate change (Table 2) and that, at the same time, there are some barriers seen when one tries to communicate climate change. One of such barriers is related to some



misconceptions of what climate change in fact is. If not addressed, they may lead to a negative view of climate change or to a wrong assumption of what it means.

Table 2, Factors influencing attitudes towards climate change (Filho 2009: p. 10)

Knowledge	Information on the meaning of climate change and its implications
Background	The nature of one's education or training often influences an individual's degree of understanding in relation to the topic of climate change
Experience	Previous experiences with other environmental and social issues facilitate understanding on climate change and the role of sustainability
Perception	An integrated view of environmental, political and economic elements enable a broader perception of climate change and ways to address it
Values	Differing from the previous factors due to its high degree of complexity, an individual's values often determine whether his/her attitudes are favourable to climate change or negative to it
Context	Climate change is not only related to climate or ecological components per se, but also entails items such as economics, politics and social matters. However, such contextual links are often ignored

Leal Filho (2000) undertook a study, where an analysis of some misconceptions of what the process of sustainable development is and what sustainability represents to an institution was performed. The study has allowed the identification of some of the misinterpretations associated with them, which in their turn are usually translated into a negative view of sustainable development. Owing to the complexity of matters related to climate change and the closeness of such a complexity with the subject matter of sustainable development, some analogies are possible. Some of the most common misconceptions related to climate change are:

- Climate change is too abstract an issue;
- Climate change is too broad a topic;
- Climate change is mostly a technical matter where calculations and forecasts are made;
- There are no trained people to handle the approach of climate change topics in an understandable way;
- The amount of resources needed to communicate climate change do not justify it; and
- Climate change has too wide a scientific basis.

If one carefully examines them, the above outlined misconceptions have quite deep roots. It is thus important to understand them so as to allow misconceptions to be overcome. The existing misconceptions have led to various problems, which have been preventing the wider communication of issues related to climate change.



Some Communication Issues

Abstraction

A substantial number of people see climate change as an abstract issue, not connected to the day-to-day reality. Most people do not think they can, as individuals, do anything against climate change and hence are reluctant to engage in related initiatives.

Lack of qualified personnel

Institutions of higher education (i.e. universities and colleges) have largely failed to give due emphasis to climate change out of the traditional areas of physics or meteorology.

As a result, great opportunities to inform and educate students from other fields such as biology, sociology or economics, are being lost. In addition to upgrading their teaching plans so as to cater for the handling of matters related to climate change in general university teaching, there is much universities can do (Eagan et al., 2008; National Wildlife Federation, 1998; Rappaport and Creighton, 2007). For example, it is important that staff (e.g. professors, teaching assistants) discover themselves the connections between their respective areas and climate change as a whole.

Unlike the widely spread belief, climate change is not the sole domain of climate modelers or physicists. It is much more than that. The scope of climate change means that it is a matter of interest and relevance to teachers, sociologists, economists and biologists, to name all but a few. If long-terms changes in attitudes and behaviours are expected and if new technologies are to be developed, it is crucial that climate change is embedded into the curriculum of universities.

Lack of documentation

Most of the good and well-working initiatives on communicating climate change which are happening on the ground are not sufficiently documented. Moreover, many interesting projects are not widely disseminated. This is a problem stated many times before. The lack of dissemination of such initiatives – which may be referred to as good practice – means that also here great opportunities to document and promote such good practice are being missed. Although some individual, one-off measures outlined by Brown (2006) on the volume *Global Warning: The Last Chance for Change* such as less water in the kettle, switching off the lights, going for a jumper before putting the heating on, etc. are important, they do not per se suffice. Dessler and Parson (2006) acknowledged the need to help scientists, policy makers, and the public sort through the conflicting claims in the climate-change debate and explain in the volume *The Science and Politics of Global Climate Change: A Guide to the Debate* how scientific and policy debates work, summarize present scientific knowledge and uncertainty about climate change, and discuss the available policy options.



Based on the relevance of the subject issue of climate change, it is important to address these problems in a holistic way so that they can be solved and the identified solutions can be widely disseminated.

Issues ahead and action needed

Houghton (2004) explored the scientific basis of global warming and the likely impacts of climate change on human society, before addressing the action that could be taken by governments, by industry and by individuals to mitigate the effects. Leal Filho (2006) explored the links between education and communication on sustainable development and climate issues, whilst the volume *Information, Communication and Education on Climate Change – European Perspectives* (Leal Filho et al., 2007) specifically looked at examples of projects and initiatives on the ground across Europe.

Dependence on Subsistence Agriculture

Though there are some indications that incomes are diversifying as people migrate and take advantage of new options that were not available to previous generations of farmers, there are wide swaths of the country where dependence on subsistence agriculture still dominates and options for improving resilience in the face of imminent impacts from a changing climate are slim. Major percentages of the population are entirely vulnerable to even the slightest fluctuation in climate. To discriminate information of climate change to the peoples is a crucial task as they may not take climate change as a serious issue as their subsistence agriculture.

Challenging Geophysical Conditions

The extreme and beautiful geography of Nepal, though a boon to the tourism industry and the source for such ample natural resources, is also an inherent reason why development levels are so low. Topography is a particularly worrisome concern for the potential adaptation process because it will be one of the most difficult to overcome, requiring massive and consistent investments in concentrated road development, which is an arduous process even for developed nations. Investing more in water resources infrastructure, a crucial aspect of adaptation for the developing world, is also severely limited by the extreme topography of the middle hills and upper mountains of the Himalayas that make for inherently unfeasible large storage and irrigation facilities that would otherwise help with a changing and increasingly variable water supply. Developing communication network for climate change is being a far crying in this context. The options available for improvement in these areas are thus extremely limited both because of high costs and geophysical constraints.



Population Growth in Urban Centers

At the opposite end of such isolation, urban areas are facing constant population growth and migration from rural communities at a rate far beyond what the government is able to keep up with in service provision. Though the most recent trends of urban migration in Nepal are the result of security fears during the insurgency, there is likely to be an increasingly positive correlation between urban migration and the impacts of CC, with more and more “climate refugees” moving to urban areas. Most of the urban areas in Nepal are still dominating by the traditional societies and are seems to be unaware about climatic matters though much more climate related awareness campaigns and other information discrimination programs are concentrated in urban areas. On the other hand constantly increasing population due to migration is becoming another threat to develop and set up information discrimination mechanism. More research needs to be carried out in Nepal as to the exact causes of migration and to what extent CC will lead to future increases in urban population growth as farming becomes increasingly risky and untenable due to the effects of CC.

Institutional Failures and Weaknesses

Alongside the numerous socioeconomic, environmental and geophysical constraints to CC information discrimination facing Nepal, there is a long history of institutional failures that currently complicate the development process and will severely hinder any effective communication, either strategic or autonomous. From constantly changing governments, including vacillation between pure royal control to constitutional monarchy and the republic in 2006, and frequent turnover of administrations, Nepal has a long history of political upheaval and impermanent stability. The following are the most relevant failures that will be the most difficult, but essential, to overcome if the most severe effects of the imminent impacts of CC are to be avoided.

1. Constantly Changing Organizational Structures

The Ministry of Environment, Science and Technology was recently split into the Ministry of Environment and Ministry of Science and Technology. This is a perfect example of how institutions are constantly changing and restructuring in Nepal. This is not the first time such restructuring has occurred. The current Ministry of Agriculture and Cooperatives has been majorly restructured nine times since 1967 (FAO-UNDP, 2003). Such constant rearranging has an obviously detrimental effect on government effectiveness and continuity of policy, which in turn serves to perpetuate an already stagnating development process.

2. High Turnover of Government Personnel

Due to the interim nature of the government at present, the transfers of administrators (including all the heads of ministries) that follows a change in the government is frequent. The Ministry of In some of the most isolated areas, as observed during my study, it is also difficult to find qualified and interested persons for government positions. It is also difficult to find officials that want to work in the



most remote regions. Out-migration is also depleting the country of qualified and skilled manpower.

3. Failures of Public Institutions

Constantly changing structures and personnel have a consequent effect of perpetuating the failures of Nepal's public institutions. There is little oversight, a lack of transparency and extremely low salaries, resulting in little incentive to follow the letter of the law. Many conversations with current and past government officials indicated that bribery is pervasive for reasons no more complex than an inability to pay for a child's secondary education. At the national level, such problems are pervasive, but at the local district and village levels (where there is even less oversight), especially due to the lack of elections for the VDCs and DDCs, the problem can be much worse. Currently run by appointees of the Ministry of Local Development, these bodies are less accountable to local populations that had no say in their appointment. Also a few percentages of project budgets are actually spent on their respective projects.

4. Ineffective to Nonexistent Coordination

Such problems of high employee turnover and constantly fluctuating institutional structures are also responsible for poor coordination and communication between ministries and departments on a variety of issues. Communication and effective coordination between local and national level institutions is also minimal. In one particularly egregious example, the DDCs have to wait as long as six months for their budgets to be released from the Ministry of Finance, which then only gives them the same amount of time to implement and develop entire projects before the end of the fiscal year, significantly reducing their long-term sustainability due to hurried, shoddy construction.

There is also a severe lack of coordination and communication between NGOs and the government at local levels, with limited official knowledge on the amount of money being spent, the number of projects, and what issues are being focused on. This leads to overlapping projects between the two entities, leading to inefficient resource allocation and confusion for local populations. The reasons for such solitary action by NGOs are apparent and may be justified in some cases, but it also has an unintended consequence of worsening relations with government, which is particularly detrimental for future coordination around adaptation planning. Given the comprehensive nature of the likely impacts of CC facing Nepal, the need for such coordination will be a critical aspect of the adaptation process.

5. Deficient Capacity

Capacity deficiencies are rampant throughout the Nepali bureaucracy, not only related to the general development process, but even more so in terms of CC and thus adaptation. It was not apparent that they understood how truly detrimental those effects will potentially be on a Nepali economy so heavily dependent on agriculture, and thus climate. At the local level, some officials were at least aware of CC, but with little idea as to what to do about it or how it might affect livelihoods in their communities.



From a perspective of education and communication related to climate change, there are many challenges ahead and various sets of action that need to be taken, in order to improve current trends and addresses the various deficiencies. Four crucial elements need to be taken into account in order to promote education and raise awareness on climate change and hence allow it to be communicated more efficiently. These elements are:

1. **The need to mobilize local level groups and organizations.** The local level groups and organizations are the witness for climate change in their society. They also may have a good understanding of climate change. Local youth clubs, Mother Group, Community forest consumer group, Local FM radios etc. are some of the references. If climate change training and other orientation program could provide to those group and organizations, virtually they could become the torch bearer in climate change information discrimination.
2. **The need to engage the relevant stakeholders.** Owing to its scope, climate change is not a matter of concern exclusive to scientists. Politicians, economists, teachers, health officials and many other stakeholders need to be involved in the climate change debate due to the fact that it does have implications to them. Current experience shows that topics which involve a variety of stakeholders and – in particular – the general public – tend to be much better understood if their specific information needs are taken into account. Technical information on temperature increases (or decreases) are unlikely to generate much interest unless it becomes clear the effects such variations may have on the fauna, flora, health or agriculture.



Figure 3, Elements to catalyze public engagement on climate change (Filho, 2009, 12)

3. **The need to combine technical expertise with communication approaches.** It has to be acknowledged that there are limits to the contribution that technical expertise can provide to handling climate change. Nonetheless, if the problems linked to climate change are to be holistically understood, they need to be complemented by information on its social and economic dimensions.
4. **The need to identify and promote solutions.** There is a perceived need to integrate information on climate change with practical measures people –, i.e. each individual – can take, so as to provide their own contribution to the problem-solving process. Most people feel frustrated when they realize that climate change as a whole and phenomena such as global warming in particular, are matters distant from their day-to-day lives. Yet, they feel more motivated to become involved if it is shown what they can do in order to help to address the problem, be it in respect of sustainable transport use, in the purchase of products or simply by having energy savings at home.



Conclusions

It is widely known that the Kyoto Protocol was only a first step and that its targets expire in 2012. International negotiations are now taking place under the UNFCCC with the goal of reaching a global agreement governing action to address climate change after 2012. Information and education on climate change as a whole and initiatives will play a key role in this process in support of the various policies and measures which have already been agreed and will no doubt be agreed in the future. They will also be important in ensuring the success of emissions reductions and trading systems, which are some examples of the future global efforts to mitigate climate change.

As outlined on this paper, although some significant developments have been made, much needs to be done in order to foster communication on climate change and catalyze the participation and public engagement needed. The aim of this research was to analyze the problems which are connected with the communication of matters related to climate change and find ways to address them. In addition, it also aimed at bringing about a broader understanding about climate change. The rationale behind the study is the fact that, although the subject matter of climate change is regarded as a critical issue and sound scientific knowledge is needed in order to address the problem in a holistic way, there is a scarcity of events focusing on the different aspects of climate change information dissemination.

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