

Climate change

What challenges for the South?

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A fresh look at local knowledge



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Most of the studies addressing the impacts of climate change consider that the people in the South—and especially farming communities and the native population of some 350 million people—are passive victims. It is true that these societies are still largely rural and particularly involved in climatic events as they are often dependent on food crops and local resources. However, human sciences have also shown that these societies create knowledge and know-how that are not only useful for their own development in changing climate systems but that are also valuable at the international scale (resources in tools, practices and, beyond this, system viability and relations between man and nature, etc.). The experience and knowledge of these societies as regards climate, nature, the environment and the changes that affect them are thus an essential part of understanding climate change.

However, the international community is slow in taking the measure of these local adaptive responses. Climate change undoubtedly induces new international socio-environmental measures that involve a host of stakeholders, each with frequently divergent legitimacy and interests (see p. 182). Decision makers opt to concentrate their priorities on the economic and environmental consequences of climate warming, thus justifying a top-down decision process that leaves very little room for the analysis and

In northern Cameroon, the Duupa grow sorghum, taking care to maintain great varietal diversity in particular through exchanging seed with family and neighbours.

support of local initiatives. The commitment chosen here is to favour a complementary, resolutely bottom-up approach based on understanding local adaptive strategies and taking them into account to a greater degree in the construction of international mechanisms for adapting to the various climatic scenarios.

Local perception and knowledge of climate

Perception of the climate is a key component of popular understanding of climate change. For example, farmers in the Sahel brought back practices that existed before the great droughts of 1970 to 1980, showing their observation, perception and response to the return of the rains since the end of the 1990s. Multidisciplinary scientific work seeks in particular to show all the dimensions involved in representations of changes and risks. For example, the perception of rainfall is related to water requirements and hence to farming systems, water management, etc. When the water requirements of a farming system increase, as is the case in particular of commercial soya and maize crops, the

Irrigated gardens in a valley bottom in the dry season in Niger.



amount of rainfall considered as sufficient increases and a year considered as being normal in climatology is then perceived as a drought year. Another example was recorded by IRD: farmers in Argentina consider that drought and floods are the most adverse climatological factors rather than frost or heat waves because crop yields are sensitive to the rainfall regime above all. Here, the perception of the climate by farmers is linked to greater or less vulnerability to climatological variables.

The inherent constraints of study of this knowledge

However, understanding local perceptions of climate and the resulting decisions taken is still very uneven and has gaps. Researchers can perform relatively good analyses of farming strategies during the seasons within an annual cycle. There is no lack of research work in the literature that takes intra-annual seasonal variations into account. In contrast, there are fewer studies based on the analysis of inter-annual climate fluctuations as they need to be repeated for several successive years. However, understanding the responses of rural societies to such fluctuations in the short term is hardly sufficient if it is wished to use these responses in long-term management models. Indeed, certain bioclimatic events—especially those following El Niño—may only occur very rarely during a person's lifetime. Responses to environmental changes that take place at a longer time scale remain a matter for speculation, especially when knowledge is only used sporadically and transmission is essentially oral, limiting historical depth. The major tendency to fund only short-term research (with a time step no longer than 3 years) makes it impossible for the scientific community to base its analysis on a long period although this is necessary for addressing these questions effectively.

The legitimisation of local knowledge

The interest of the scientific community in local knowledge (also called native, community or traditional knowledge) as an expression of a type of sustainable management of the environment goes together with the emergence of the biodiversity paradigm. Although anthropologists have always examined the local knowledge that is in essence a pathway for learning about the cosmogonies of these peoples, it was only in the early 1980s that scientists at IRD began to explore this knowledge from the angle of sustainable management.

This research contributed to the legitimisation of local knowledge that had long been ignored or even scorned by experts from the North who wanted to transfer their technological packages to intensify the agrarian systems of farmers in the South.

Family rice growing
on terraces
in Madagascar.
The know-how
of Malagasy farmers
contributes
to the sustainability
of the farming system.



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In the 1970s, just a few researchers criticised the arrogance of these expert solutions and demonstrated the relevance of farmers' local knowledge. The debates were extensively reported and empirical work by IRD researchers showed the use of local practices that are adapted to the opportunities and constraints of the environment.

There is now no longer any doubt that the knowledge and know-how of local populations in the South, generally backed by strong social cohesion, show the functional flexibility of their farming strategies as a gage of their capacity to adapt. These societies maintain as a base a range of activities that complement each other in a reasoned succession of crops during the seasons marking annual and inter-annual cycles, together with alternating mobile and sedentary phases to optimise the gathering of both wild and domesticated resources scattered through the territory.

The 1992 Convention on Biological Diversity (CBD) recognised in particular that local knowledge is essential for the conservation of biodiversity. Today, cultural diversity is recognised as an essential dimension of biodiversity and agrobiodiversity. Local knowledge and know-how, whether they concern climate, the environment, farming systems, biodiversity or ecosystem services, are used increasingly in development and conservation programmes for reasons of their importance for the conservation of certain ecosystems. This knowledge is recognised as providing economical and effective solutions that are hence sustainable, and also as bearing ethical and heritage values. It thus becomes the flag of procedures that are more just and fair. Here, reference to this knowledge is an inevitable component of statements that are ecologically correct.

‘Biotemporal markers’

One of the most astonishing facets of local naturalist knowledge concerning climate is formed by the ‘**biotemporal markers**’ used by populations in the South to plot the calendar of their work. Perception of these signals and hence the ability to anticipate a change of season is a determinant stage in the management of a farming system. This perception governs management of the risks inherent in the fluctuation of the availability of resources in time, affecting the success of sowing, of a hunting operation, of the gathering of a forest product with strong economic value or the livestock reproduction cycle. The signals form a corpus of visual, olfactory, sound and tactile stimuli emitted by surrounding nature, with each signal being just one component among others of a set of convergent indices that society has to use to finalise its choices. The convergent indices may take the form of a flight of migrant birds, the reproduction period of a fish species swimming upstream to its spawning ground, massive leaf drop from a deciduous tree species, the cry of a nocturnal batrachian, the massive simultaneous flowering of certain plants, etc.

Burning *Aframomum* leaves to prevent rain before a Baka people (Cameroon) hunting expedition.

© IRD/E. Dounias



The expression of certain stimuli is so tenuous that perception is almost a question of the unconscious. These societies often popularise the occurrence of these signals through animist beliefs featuring supernatural forces that can rapidly disconcert a western manager. The latter will see only superstition and will consider wrongly that he will have nothing to do with these considerations in the good running of his operations. The ethnoscience approach typically tries to establish a link between the system of representations and its specific modes of expression (founder myths, stories and other forms of oral tradition, rituals) on the one hand and the observed bio-ecological fact recorded by the sharp senses of the local observer and that reveals the operation of bio-ecological cycles on the other.

Insects are particularly remarkable biotemporal indicators as they can react to infinitely small changes in climatic conditions, to thresholds—atmospheric moisture, wind direction, temperature, the lunar cycle and so on—that humans are incapable of sensing directly. The entomological knowledge used in the observation of social insects such as ants, termites and bees is a remarkable illustration of their biotemporal indicator function. Using attentive observation of these biotemporal markers, local populations gain access to information that researchers miss. Their expertise is particularly valuable in ecosystems for which the predictive models covering climate change lack accuracy. Thus although analysis of climate change is easier at polar latitudes and high altitudes (Himalayan peaks) where change is extreme, it is marking time at low elevations in more equatorial latitudes. The effects of climate change in humid tropical forests are subtle and tenuous and usually hidden by more tangible and immediate threats (deforestation). Adding local expertise is even more important in such a context. The cultural diversity of this expertise is all the more valuable as it concerns ecosystems with the greatest biological diversity.

The hybridisation of knowledge

If we talk about local knowledge rather than traditional knowledge, it is because the second term gives a static image and assumes a historical depth that is often difficult to establish when knowledge evolves and becomes hybrid. Study of the speeches of nativist leaders in Latin America shows for example how these community spokesmen are now adjusting their positions according to nativist ideologies that have been developing for some 30 years in the region and are centred on the naturalist or ecologist Indian. The approach draws on the knowledge of the Yanomani in Brazil or the Aymara in Bolivia that is based on the idea of a social totality governed by a system of exchange between human and non-human subjects. This concept contrasts

Box 57

The 'Sentimiel' initiative: bees, humans and local naturalistic knowledge

The 'Sentimiel' initiative run since 2011 by IRD researchers is emblematic of research questioning the effects of climate change using local naturalist knowledge of bees.

Collection of honey
by the Baka (Cameroon).



Sentinels of an environment currently under threat, bees warn us of the damage to terrestrial ecosystems caused by humans.

Subsistence economies in the South where wild honey is collected are thus in the front line for the observation and documentation of behavioural changes in bees.

Unfortunately, analysis of the information provided by bees is focused only on the domestic bee reared in professional or semi-professional beekeeping; the expertise based on subsistence honey gathering and that concerns an incredible diversity of honeybees, estimated at around 1,500 species, is still totally underrated and therefore ignored.

Precious signs of environmental changes

However, wild honey gatherers have singular know-how as finding nests is a complicated or even dangerous endeavour as honeybees protect the result of their work from many predators in search of sugar.

The basic aim of the 'Sentimiel' initiative is thus find and federate groups of holders of naturalist knowledge about honey-making insects and their production.

Through regular observation of the activities of these insects, honey gatherers are valuable witnesses of the effect of global changes on their environment.

Their involvement results in a tropical watch of the effects of these changes on bees and honey production. Hunter-gathering peoples in Borneo, India, the Himalayan regions, the Congo basin, North Africa and Amazonia are thus mobilised in a joint action to provide researchers with information about the changes observed during the gathering of honey and other substances.

By increasing the visibility of this naturalist knowledge through the forming of an international network inspired by **citizen science**, the 'Sentimiel' initiative is aimed at improving our understanding of the consequences of global changes and especially climate changes on world biodiversity through the pooling of very precise, very local information.

Furthermore, the network works on bringing into the light small local artisanal honey gathering initiatives by enabling them to join a federative international structure whose credibility can provide them with access to sources of funding and support.



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Trampling rice fields in Madagascar.

This impressive practice carried out by the men precedes the irrigation of the rice field and serves an agricultural purpose by improving soil imperviousness and also plays a social role.

with the western anthropocentric approach in which the question of the exploitation or conservation of nature makes reference to a 'nature-object' that is reified and cut off from humanity. These native cultures are thus neither ancestral nor simply subjected to others. They create symbols, practices and knowledge in a process of hybridisation with scientific knowledge and with ideologies and standards from the west.

Box 58

**The rain trees of El Hierro,
a model for the island system?**

Ancient rainwater collection practices still provide the water supply on arid El Hierro Island.

Work by IRD has contributed to the use of local knowledge, especially by combining it with modern technology.

The first inhabitants of El Hierro used the rain tree to obtain their freshwater requirements.

Water is a valuable resource on this arid island in the Canary Island archipelago, with an area of about 270 km².

This legendary tree in the Lauraceae family collects the fine drops of water in mist on its leaves.

The drops are then channelled and collected in wells.

The virtues of the rain tree were rehabilitated by the forest guards on the island after the great drought of 1945.

Mist water was collected again in old wells dug before Spanish colonisation. New tank and pipe systems have been constructed under several dozen trees since the 1960s.

After discussion with professionals on the island and analysis of their knowledge, IRD developed 'mist catchers' consisting of nets attached to stainless steel tree-like structures.

The structures are for collecting mist water in places where there are no trees, such as crests exposed to the wind. In all, these installations only collect a few cubic metres of water per day.

The impact is symbolic so far but it could become stronger.

Since then, several ecological projects have been developed on the island with the help of the local authorities and the European Union.

El Hierro has even become a symbol of energy transition as the island is preparing to become 100 % autonomous in renewable energy.

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A 'rain tree'
on El Hierro.

Pruning argan trees
in Morocco.
The argan woodlands
are the result
of several centuries
of domestication.



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Between local knowledge and science: joint production of knowledge

Scientists sometimes draw on traditional knowledge. Research actions thus combine a research phase with concrete development projects. The study of the 'rain tree' on the Spanish island of El Hierro is emblematic of the use of local knowledge combined with scientific knowledge (Box 58). This example shows how countries and regions that succeed in using relevant knowledge—whether scientific or native—have a comparative advantage for both their own development and the use of their skills at the international scale.

New research practices

Climate change is also inducing new research practices that change the nature of relations between researchers and possessors of local knowledge. After being subjects for study, the latter have now become full partners in research. Local populations and their knowledge must be associated far upstream in the designing of research subjects;

they must be involved in the implementation of protocols, data collection, the exploitation and ownership of the results and, finally, international diffusion. This involvement also has the merit of making the long duration of the research conducted with them more acceptable and of defining the terms of the continuous back and forth movements between fundamental and applied research.

The involvement of local populations in research can usefully draw inspiration from citizen science programmes and participatory action research. This category includes research projects conducted in countries in the North in which individual volunteers or networks of amateur naturalists who have had no particular training in research perform research tasks: observation, counts, surveys or data entry. It is perfectly possible to transpose the citizen science approach to people with local knowledge of nature and who in a way replace a network of amateurs or ordinary citizens. Initiatives like 'Sentimiel' (Box 57) that is based on a network of honey collecting peoples, are still too few and far between but have opened a promising breach in favour of more formal contribution from local naturalist knowledge to the understanding of the dynamics of complex ecosystems that the scientific community still does not know well.

Another example of innovative research practices consists of the analytical inventories that can be made of all the types of knowledge produced in a given area. For example, IRD and its partners are conducting a climate change study focused on cities in the Mediterranean region by examining the innovative technical know-how in architecture and town planning (in terms of response to climate warming), legislative practices (in control and adaptation to changes) and methods of analysis (climate measurement systems). This technical knowledge of social regulation or analysis of the phenomenon may come from professional and academic spheres but also from indigenous knowledge.

Educational policies concerning climate change

This gradual recognition of the importance of knowledge in the addressing of warming has also led international organisations to wonder about the circulation of this knowledge. Education and training in questions of climate have become strategic sectors for attempting to control at the international scale the emergence of new citizen positions that better match the new economic and ecological situation. World scholastic programmes devoted to climate change have thus been developed during the last 10 years. They suggest to states the new skills that the new generations should acquire, such as how to make decisions in a context of uncertainty, understand world climatic interdependence, master 'good practices', etc.

These international education policies are not neutral and refer today to a specific development model: sustainable development and green capitalism. However, some countries reject this model and prefer another vision of modernity: for example, this is the case of the Bolivarian Alliance for the Peoples of Our America (ALBA) (Box 59). It is hence not certain that models of rationality and development that dominate international education policies will succeed in achieving a concerted approach to teaching concerning the environment and climate change in countries in the South.

This variety of approaches is visible for example in the way in which native knowledge concerning climate is handled. Overall, international organisations are for the transmission in schools of local knowledge that is considered to be effective in addressing climate change and its consequences, but countries have very varied positions in this. Work conducted in Senegal thus shows that in environmental and climate themes, education officials use local knowledge partly remodelled *ad hoc*, together with a religious approach. This research also highlights the fact that environmental and climatic questions are identified as being imported from elsewhere and are little embraced by families and local officials. Studies conducted in other countries such as Bolivia show that teachers use a combination of scientific, native and political knowledge to address these questions. The government is currently for a native view of the environment and the climate in which native knowledge is reconfigured in the light of the criterion of reshaping the country politically to approach a different societal model (Box 59).

Box 59

Other development models, different education in climate?

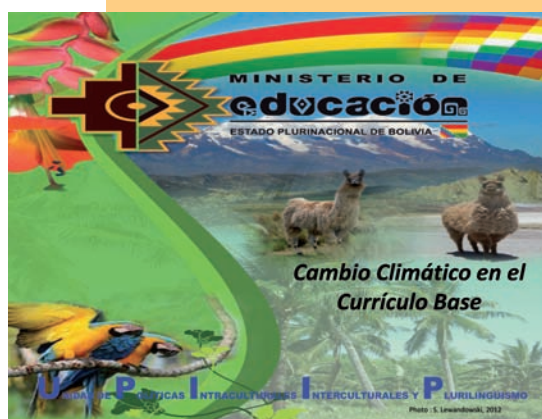
School programmes
on climate change,
Bolivia, 2012.

Bolivia has launched a full reform of its education system so that young people receive teaching based on an alternative societal model: 'vivir bien' (living well). The model features bio-centred ontology in which human beings are just one component of nature. Inspired by different socialist, green and nativist movements, the model is considered to be based on economic, political and cultural pluralism.

As regards climate change, 'vivir bien' proposes knowledge that does not seek to concentrate only on its cognitive or behavioural aspects but to address the individual as a whole using four keys: knowing, doing, deciding and being. 'Deciding' concerns the political sphere: for example, a young person should be aware of the history of climate change and the inequality of responsibility for its intensification.

'Being' concerns behaviour and, beyond this, the personal position of a young person in a life 'in harmony' with nature.

In the project called SAVE (*Savoirs relatifs à l'environnement dans les Andes*), researchers at the LPED, IRD-CIDES and UMSA units are studying among other things the construction of this reform and the problems that it comes up against. In addition to the complexity of constructing a new model of society and political ecology, its transposition in scholastic programmes and in the training of teachers is a challenge for educational policies. The reception given to the model is very varied among teachers, urban and rural families, etc. This is particularly so as the model sometimes seems to be theoretical, with the country not really managing to move out of a resolutely extractivist economy.



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