Edited by Paul Sillitoe

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Present and Future

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For the poorest of the poor in Bangladesh, may your voice be heard.

"We have for over a century been dragged by the preposterous West behind its chariot, choked by dust, deafened by noise, humbled by our own helplessness, and overwhelmed by the speed .... If we ever ventured to ask 'progress towards what, and progress for whom', it was considered oriental to entertain such doubts about the absoluteness of progress."

RABINDRA NATH TAGORE 1941 *Rabindra Nath Tagore on rural reconstruction.* Government of India, New Delhi.

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Foreword

THIS IMPRESSIVE VOLUME on *Indigenous Knowledge Development in Bangladesh* edited by Paul Sillitoe is an important contribution to the fields of both anthropology and development. It will be particularly useful for all those who are directly or indirectly concerned with the problems associated with development in Bangladesh including social scientists, planners, policy-makers, extension workers and both government and non-government workers. Divided into five sections relating to development issues, agroforestry, plant resources, fish resources and methodological issues, the book contains twenty-four valuable articles including an introduction and conclusion and brings together a range of disciplines from anthropology and sociology to natural resource sciences and development studies. Authors are both Bangladeshi and British, and as such the volume encompasses both emic and etic perspectives. Contributions are based on the authors own research experiences of indigenous knowledge with particular reference to Bangladesh. Taken as a whole, the volume provides us with a wealth of information on both the theoretical and practical aspects of indigenous knowledge research. However, the principle aim of this volume is to assess the current situation of indigenous knowledge research and development in Bangladesh. The authors have succeeded in achieving this objective through emphasising the importance and richness of local people's knowledge and by advocating its incorporation as an integral component in the planning and implementation of any development initiative in Bangladesh and elsewhere.

Bangladesh is predominantly a rural country with agriculture being the mainstay economy. The majority of the population is either directly or indirectly connected with agriculture. In such an agrarian society, farmers have relied upon indigenous knowledge for centuries, organising production on the basis of local knowledge handed down from previous generations where it is built upon, modified and refined to suit current circumstances. Today, farmers are exposed to modern knowledge of farming but they have not abandoned their indigenous knowledge, and this remains true for other traditional occupational groups such as carpenters, potters, weavers, blacksmiths, herbal practitioners and fishermen. These groups also continue to draw on their local knowledge heritage, intrinsic to daily life, when producing their goods and products.

I agree with the view that farmers' indigenous knowledge derives from past experiences, is transmitted from one generation to another, evaluated and fine-tuned, as people engage in a continuous process of experimentation and innovation. But today, local knowledge is eroding fast and much has been lost (or at least, dramatically changed) with the modernisation of agriculture and the rapid spread of 'foreign' technology introduced from outside. Thus, as many of the authors emphasise, we need to redouble our efforts to document this knowledge.

We can no longer afford to ignore the value of indigenous knowledge and, as the chapters in this volume demonstrate, by continuing to view the knowledge and practices of local people as 'primitive', unscientific and as a hindrance to development, the desired goal of achieving sustainable development in the country's many sectors (agriculture, forestry, fishery and so on) may continue to remain unrealised. It is essential that planners, policy-makers and development practitioners endeavour to understand the indigenous knowledge and practices of the community in which they

are working. At present many are either relatively unfamiliar with such a notion or otherwise suspicious of its worth. Through an understanding they will be better able to integrate local knowledge with modern scientific knowledge, and in doing so instigate development initiatives that are both environmentally and socially appropriate and hence more sustainable. This is the conclusion the reader inevitably reaches after digesting this volume.

Any development endeavour aiming to improve and enrich the lives of the poor and weak ('target group populations') in a country like Bangladesh should incorporate indigenous knowledge and involve local people's participation at all stages of intervention. Such a 'bottom-up' approach — working from the grassroots level — ensures both participation and empowerment of people. The present volume suggests such a development strategy for changing the fate of the millions of poor people in Bangladesh, a strategy with which I am in full agreement.

This volume represents an important contribution to the field of indigenous knowledge and development and should be considered an essential read for all those wishing to pursue further studies in this new and exciting field. I congratulate the editor and all the contributors to the book. We should also thank the Bangladesh Resource Centre for Indigenous Knowledge (BARCIK) for organising the 1998 workshop *The State of Indigenous Knowledge in Bangladesh* at which the majority of these papers were originally presented, and wish it well in the future in supporting this valuable work.

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INTRODUCTION

1 The State of Indigenous Knowledge in Bangladesh

Paul Sillitoe

"WHAT ARE YOU SAYING, that Bangladesh should go back to the stone age?" Although an exaggerated challenge, for it is no more conceivable that Bengal — part of the ancient South Asian civilisation where Harappan metallurgy arrived over 3000 years ago (Clarke 1962; Piggott 1950) — might regress to stone tool technology than the United States of America, this challenge, thrown out at the meeting to launch the indigenous knowledge network in Bangladesh, typifies a widespread attitude to the current promotion of indigenous knowledge research in development. It is a common misapprehension, particularly among scientists and technocrats that it somehow implies going backwards technologically. Another speaker, underlining the stone age challenge, pointed out that without the scientific breeding of high yielding varieties (HYV) of rice and associated technology of fertilisers, biocides and so on, Bangladesh would have been unable to feed its expanding population. The implication was that an interest in indigenous knowledge would somehow undo these advances. The unspoken question was what could indigenous knowledge research do to increase production similarly.

These two comments catch the provocative tone of some of the lively debate that characterised the meeting held in Dhaka in May 1998 to inaugurate the national network of indigenous knowledge researchers under the auspices of the newly founded NGO the Bangladesh Resource Centre for Indigenous Knowledge (BARCIK — see Sen *et al.* chapter 24 for details), which is affiliated to the rapidly expanding international network of indigenous knowledge resource centres (Liebenstein *et al.* 1995). The title of the conference, reproduced in the title of this introduction, was 'The State of Indigenous Knowledge in Bangladesh'. The comments cited above suggest that we need urgently to carry forward the debate initiated at the meeting, to clarify the possible contribution of indigenous knowledge research to development. This volume aims to facilitate this process. It is certainly not the intention of those of us promoting indigenous knowledge research to put communities backwards in any sense. Indeed the reverse. We believe that the relatively small resources that indigenous knowledge research requires will yield a large dividend in furthering poor peoples' advance forwards. There is no reason for scientists to feel threatened, it should not take resources away from their valuable research, nor undermine it. On the contrary it should enrich and improve it.

There is a profound misunderstanding of the indigenous knowledge agenda. There is clearly a need to establish what indigenous knowledge is and how incorporating it into the scientific research process might advance development. Scientists' attitudes reflect the current confusion. Some, far from joining their dismissive colleagues, are trying to incorporate an indigenous knowledge component into their work. Indeed it is these

scientists, together with the vigorous NGOs, who are largely furthering indigenous knowledge work in Bangladesh — where anthropologists are relatively new to the academy — as reflected in the contributions to this book by foresters, agronomists and fisheries specialists among others (see list of contributors). But even this enlightened minority is undecided what the indigenous knowledge component should amount to, how to access it and incorporate it effectively into their research.

It is important to capitalise on the opportunity that has opened up for this work with the recent dramatic change in approaches to development, with the shift that has occurred from a focus on the 'top down' imposition of interventions to a 'grassroots' participatory perspective. The emergence of local knowledge ideas and practice has depended crucially on this change. The dominant development paradigms until a decade or so ago were modernisation — the classic transfer-of-technology model associated with the political right — and dependency — the marxist informed model associated with the political left. They are both blind to local knowledge issues. The new bottom-up oriented development paradigms that have recently emerged to challenge these top-down perspectives give more credence to local perspectives (Potter *et al.* 1999:43-71; Preston 1996; Närman 1999). They are an attempt to access the very poor, now the explicit target group of aid agencies, which have been searching for some time for more effective approaches with mounting evidence of resources wasted in ill-conceived, frequently centrally imposed schemes that have not only failed to improve matters in lesser developed countries but have on occasion made them worse. The contribution of Haque (chapter 5) illustrates this point with a series of vignettes of what he calls 'development disasters' which failed to access local opinion and indigenous knowledge, from the displacement of people by hydroelectric and forestry projects to misconceived water management schemes. The contributions to this book seek to move us forwards, to promote 'development successes'.

Indigenous knowledge in Bangladesh

Typically the Bangladeshi production system comprises peasant farmers cultivating small intensively managed plots crowded together across the floodplain, a mix of landowners, sharecroppers and landless labourers. Muslim families dominate rural society. Farmers cultivate rice as a staple, together with other crops like mustard, onions and jute, for subsistence and sale at local markets. The number of crops which they are able to take in a year varies from one to three, depending on the extent and duration of the inundation of plots, large areas of the floodplain disappearing under water from a few weeks to several months during the monsoon. At this time many people turn to fishing to supply some of their food. A few persons, largely Hindu of low *jele* caste, are full-time or 'professional' fishermen, although their numbers have been decreasing of late with extensive disruptions to the hydrological cycle, notably with the construction of flood protection devices. They have joined the human flood of dispossessed persons who eke out an existence day labouring, pulling rickshaws, petty trading and so on in towns and rural areas.

Recent strategy documents for environmental management and agricultural extension indicate that the Government of Bangladesh is increasingly interested in seeing some attention given to indigenous knowledge, particularly as it relates to natural resources management. The National Environmental Management Action Plan (1995) includes in its recommended actions on land resources: "study on indigenous

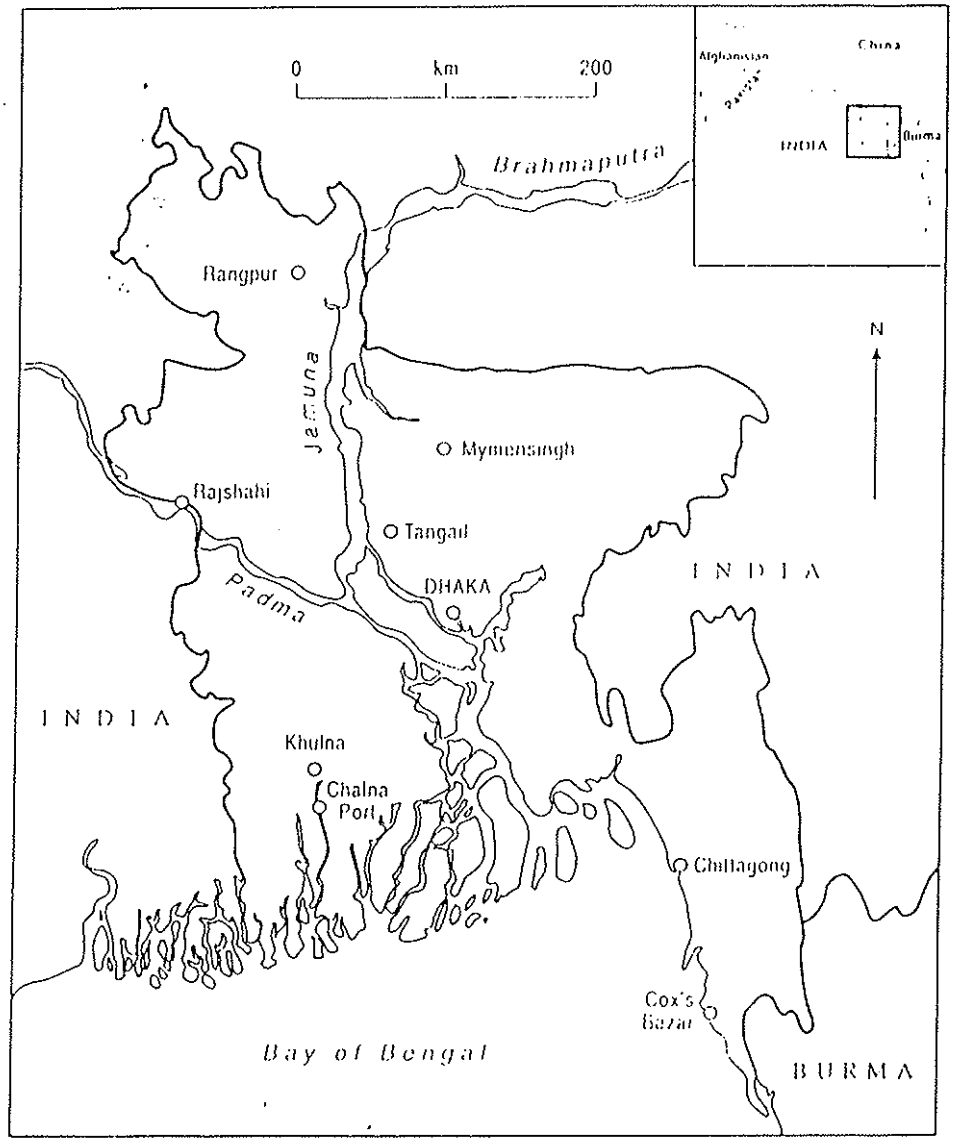

Figure 1.1 Map of Bangladesh

land use practices, to increase efficiency of the production system and its application". The New Agricultural Extension Policy (1996) states further that: "It is recognised that farmers' own Indigenous Technical Knowledge is often environmentally sustainable, and efforts should be made to support and learn from farmers, as well as the formal research system", going on that "The New Agricultural Extension Policy also recognises that farmers themselves are actively engaged in their own experimentation, as part of their daily agricultural lives. Efforts to learn from and strengthen such informal research should be made". These sentiments are expressed by many of the contributors to this book. It is clearly an opportune time for us to advance on indigenous knowledge work in the context of development initiatives in the country.

Indigenous technical knowledge

A widespread assumption among scientists and many others is that indigenous knowledge research comprises investigations into local technologies, and associated knowledge of natural resources and their management; for example boats and gears used in fishing and freshwater management, or ploughs and ladders used in farming and crop agronomy. Two recent books on indigenous practices in Bangladesh are excellent examples of this perspective (Bangladesh Academy of Agriculture 1997; Sharma 1998), which a colleague has dubbed the '100 useful indigenous how-to-do tips' approach. The Bangladesh Academy of Agriculture (1997) volume is a model compedium of technologies from around the country divided into sections according to crop production, livestock, fisheries and forestry, comprehensively described with illustrations. The Sharma (1998) volume describes fifty-two techniques and associated tools employed by tribal people in watershed management in the country's eastern hilltracts region. The contribution of Mallick (chapter 6), a review of the literature on Bangladeshi indigenous knowledge, is an good example of this approach, as a compendium of practices pertaining to crop cultivation, fisheries and livestock, and local environmental management. Other contributors give further examples, such as Quddus (chapter 7) who details several indigenous agroforestry practices, Shah and Nuri (chapter 12) on seed storage, and Begum, Haq and Naher (chapter 13) with their inventory of medicinal plant uses. This technologically framed approach has recently become called an 'indigenous technical knowledge' (ITK) perspective, to distinguish it from more culturally encompassing 'indigenous knowledge' (IK).

The definition of indigenous knowledge research in development is not easy. It is a new and fast moving field of enquiry which, in the process of establishing itself, is trying out different approaches to find its proper home. Several of the contributions to this volume address the issue of definition and attempt to clarify the field, and it would be presumptuous to attempt a brief definition in this introduction. It is still open to debate, as some of the coming chapters show. The contribution of Mustafa (chapter 3) is largely a discussion of definition and ensuing methodological issues, and my piece (chapter 19) attempts to move the debate forwards by situating it in the context of a continuum extending from local people to natural scientists. The many terms currently used for indigenous knowledge in development discourse reflect this fluidity (Purcell 1998; Antweiler 1998). The majority of these terms — such as folk, indigenous, peoples', local knowledge and so on — feature as synonyms, and do not clearly specify different fields of enquiry or approaches. They are used confusedly, largely in attempts to achieve political correctness, as writers seek a term that allows them to

distinguish between 'other' knowledge and science without implying inferiority. But the distinction between these and terms that specify technology, such as 'indigenous technical knowledge', does not rest on small semantic differences of the sort that fuel many academic debates. The contribution of Miah (chapter 2) offers a good definition of indigenous technical knowledge. When it started to find a place on the development agenda a decade or so ago, indigenous knowledge was interpreted in this narrow technical way, but now wider cultural contextualisation is increasingly recognised as necessary. There is a profound difference (Sillitoe 1998*d*). But this is not to decry interest in local technical issues, which is better than no interest and to be encouraged.

The attraction of technical matters to scientists, including Bangladeshi scientists working in local floodplain communities or hill tract villages, is understandable. They mirror their own disciplines' technically informed approaches to environmental problems. A forester will feel comfortable with agroforestry practices, an aquaculturalist with fisheries knowledge, a soil scientist with fertility management and so on. It reflects their own specialised reductive training and compartmentalisation of the world. Several of the papers in this volume illustrate this point well, for example Rahman (chapter 8) is clearly comfortable with tree diseases, Rahman, Khisa, Uddin and Wilcock (chapter 10) with botanical catalogues, and Islam, Reihlen and Thompson (chapter 15) focus on the concerns of fisheries scientists. They feel secure in identifying local practices that parallel their own subject areas of expertise and matching them up with their disciplinary understanding and expectations (Sinclair and Walker 1998). It is familiar and they do not feel deprived of their expert status. One of the problems with this approach is that it is what anthropologists call ethnocentric, that is the investigator uses a preconceived model of the world to access and structure others' ideas, even to assess them. And there is a particular danger that 'strong' heavily deductive scientific models will overwhelm 'weak' more inductive local ones, which may be ajudged inadequate when an inappropriate scientific yardstick is applied to them.

It is not only scientists who are beguiled by the narrow indigenous technical knowledge approach to local natural resource management issues, but also many other Bangladeshis involved in development work, policymakers, aid agency staff, extensionists, NGO personel, and so on. The interest that many of these people evince in indigenous knowledge may in part be interpreted as motivated by concerns that are the polar opposite of scientists' interest in it. We have a contradiction of the kind so familiar to Asian philosophy with its interest in the mediation of opposites. Coming to terms with paradoxes is a recurring theme in indigenous knowledge documentation, which should recommend it to Bengali thinkers. Scientists would argue that while their disciplinary specialisms may be narrow, they have contributed to the devising of technological advances that have furthered food production, people's health and so on. The application of these advances is the rationale behind many development programmes. But these development interventions, driven by a largely materialistic Western view of human advancement, albeit in the context of South Asia's complex modernity (Bose and Jalal 1998), are a threat to the integrity of Bengali culture. Threats of this kind have been evident since at least the start of Western colonialism, and were varyingly contained throughout South Asia (Chaudhuri 1998), but they have become progressively more overwhelming, until now, with the identification of the process as globalisation (Waters 1998), many people perceive of them as accelerating juggernaut-like out of control, indiscriminantly crushing cultural differences.

Protecting culture

The perception that Bengali culture is under threat promotes the idea that it needs protection. It is the material possessions of people that change rapidly and most obviously when what they perceive of as more efficient imported technology becomes available. It is what development is all about after all, facilitating such changes and increasing the material standard of peoples' lifestyles. They swop draught ploughs and ladders for mechanical cultivators, earthernware pots for alluminium vessels, large nylon drift nets for locally made fishing devices, and so on. These adopted technologies in turn result in changes in working practices, the manner in which villagers organise themselves to work and the nature of their co-operative arrangements, which in their turn again have wider social implications, perhaps changing the content of relations within extended families, between landlords and sharecroppers, and so on. The social changes take longer to have effect, although they are arguably the more significant in the long term, heralding some changes in peoples' values about life. The technological changes are frequently dramatic, one can see that the use of traditional muscle powered irrigation technology for example has declined markedly in the space of a decade or so with the introduction of diesel pump shallow and deep tube wells.

One way to protect the perceived loss of cultural heritage is to document it. This is a significant incentive in Bangladesh currently for the interest evinced in indigenous techncial knowledge. Several of this book's papers voice this sentiment; Mallick (chapter 6) laments the loss of valuable folkways and the need to save them, arguing that indigenous knowledge research has a role to play here, likewise Quddus (chapter 7), Rahman *et al.* (chapter 10), Zuberi (chapter 14) and Naseem (chapter 18) all talk about indigenous knowledge being lost and the urgent obligation on us to document it. The promotional literature for the Bangladesh Resource Centre for Indigenous Knowledge (BARCIK 1998) catches these sentiments well. It notes that "Today, because of its oral tradition as well as the introduction of new technologies, the preservation of indigenous knowledge is at risk. It has also been eroded by different cultural perversions ... because much indigenous knowledge has never been documented, it is being forgotten as it is replaced by modern education and technology. It is not only important but a much felt need to preserve the indigenous knowledge before they are lost forever". The solution is obvious, these outside induced corrosions must be combatted, and one way is to record knowledge and practices before people forget them. As the Bangladesh Resource Centre for Indigenous Knowledge flyer goes on to explain, the Centre has been established "with a view to preserve, document and for dissemination of indigenous knowledge in the fields of agriculture, environment conservation, food preparation and other development arenas". It is not only Banglas who think this way, but also some Bideshi foreigners working in their country; for example a piece that I was asked to write for a UK Department for International Development publication was retitled by the editor, without any reference to me, "Preserving Indigenous Knowledge" (Sillitoe 1997)!

There are marked parallels here with nineteenth century assumptions and the emergence of anthropology. The rate of change observed among some recently colonised peoples suggested to the Victorians that their cultures were disappearing at an alarming rate. For example one hundred years ago Hunt observed in the *Journal of the Anthropological Institute* "My own experience, gained by ten year's residence in Polynesia and New Guinea, it that the advent of the white man is invariably followed by the gradual extinction of the native race. Unintentionally, perhaps, but none the less

certainly, the white man carries with him wherever he goes, causes which ultimately destroy the native population" (1899:18). It became a priority to some scientists, missionaries, and travellers among others, to document this disappearing human heritage before it was too late, and they embarked on what has subsequently become called salvage ethnography. For example, in the same volume of the *Journal of the Anthropological Institute* Cooke reported on the Central Hill Tribes of India "They had lived for countless ages in a state of comparative isolation; it was clear that their origin and distribution suggested a most interesting series of ethnological problems ... . It was obvious, too, that if their social polity and creeds deserved enquiry, no time should be wasted. As the newspaper and Board School are playing havoc with our native folk-lore, so the Hindu missionary, the ascetic, like the Jogi and Sannyâsi, were gradually bringing them within the Brâhmanic fold, and it was certain that before long much that was interesting and characteristic would be utterly lost" (1899:220). Some of the most thorough ethnographic records that we have date from this time. In some places technology and material culture were among the more accessible topics to study, where disruption to the pre-contact lifestyle was so extensive that many aspects of it, such as rituals, ceremonies, warfare and so on, were discontinued. Reduced to relying on what people could recall, sometimes from a previous generation, fieldworkers could find examples of handicrafts (in museums, private collections etc.) and discuss their manufacture, use and symbolism.

We have come to realise that the outcome of the overwhelming change induced during colonial contact was not cultural annhilation. Human reactions have proved far more complex, their cultural responses more flexible, extending an unexpected resilience in the climate of change. A Hopi artist in a recent Survival International[1] brochure (1998:8, 13) observes "Watching a dance ... . I thought 'so we're dying are we?' I first heard that when I was two, now I'm 44. People think of the dances as ancient, but in fact they are as contemporary as the jets flying overhead ... . We are on a continuum". A Makah filmmaker further catches these sentiments when she observes "I hope we can get to the point where we don't have to be the frozen images of the past". The cultures of the Navaho, Eskimo, Aborigine, Zulu and so on have not 'died out'. They have changed. But there is nothing new in this, societies have been changing for all time. If this was not so, we should never have ventured from our palaeolithic caves to today's skyscrappers. The salvage image encourages stone age misconceptions.

Identity and indigenous knowledge

The tendency to see indigenous knowledge research as saving cultural property from being lost may be related to deep-rooted identity issues in a world perceived to be changing rapidly and in undesireable ways in some respects. While ethnic identities and cultural traditions persist, they do so under constantly and increasingly fast changing circumstances. This was recently conveyed to me during a visit to a friend's house in Dhaka, sitting watching the TV with his daughters who, indoors, were *purdah* free and relaxed, when to their amusement an American musical show came on featuring near naked dancers. The hilarity was not the reaction I expected, feeling somewhat embarrassed, and then it struck me that with global communications the same programme might be watched with quite different reactions, as it meets with different local circumstances in the American mid-West, the Australian outback and African savanna, viewed by US wheat farmers, Aborigines and Masai pastoralists. But

when they reflect on these trends some people feel a sense of threat to their own cultural identity: public displays of nudity do not sit well with the tradition of the veil.

We have another intriguing paradox of the kind beloved by Eastern philosophy. People are embracing aspects of Western driven globalisation, particularly evident in the adoption of material things such as TVs, vehicles, PCs, and clothing, iconised in the ubiquitous baseball cap and coke can, which imply exposure, particularly via mass media, to alien lifeways and values. Yet simultaneously they wish to protect what they perceive of as their distinctive cultural heritage, expressed in dances, language ceremonies, ethnic dress and so on.[2] Identity is a concern of human-beings the world over, and there is a fast growing literature on identity and boundaries (Cohen 1994; Woodward 1997). In the Pacific region, for instance, it is common to hear people talk about *kastom*, which derives from the English word 'custom'. While *kastom* appears to exemplify persistence, it is in fact a reponse to social change, it relates the old to the new and as such is a paradoxical blend of convention and invention (Keesing 1992; Foster 1995). It marks a concern to cling to certain traditional ways, for example ceremonial exchanges of wealth, dances, songs and rituals, even sometimes to rediscover or reinvent them, to counter outside influences. When people talk about *kastom* they have in mind something which we can gloss as traditional lore, that is following practices that originate from their own cultural tradition and rooted in their value system as opposed to deriving from elsewhere. People want the best of both worlds, access to cash and material prosperity without the loss of culture and customary rights, aspirations which riddle *kastom* with contradictions. It is an ambiguous notion, demanding sympathetic, and frequently multi-layered and even contradictory, contextual interpretation. Sometimes it is used locally, others regionally and occasionally nationally to differentiate kin, neighbours and strangers, to demarcate boundaries, to lay claim to rights, and assert cultural autonomy.

In the quest for *kastom* we can identify parallels with Bengali interest in indigenous technical knowledge, both relate to people's search for, and defence of identity in the contemporary world. Several of the papers in this volume evidence sympathy with this quest. The review of the indigenous knowledge literature relevant to Bangladesh by Mallick (chapter 6) reflects the theme, as do Zaman (chapter 4) and Begum *et al.* (chapter 13). These apprehensions relate to present concerns, not historical ones to turn the clock back to the stone age or whatever epoch. These customary declarations often feature cultural revivalism and reclamation. They sometimes involve idealisation of the pre-colonial past. They may promote a view that is too romantic. This is evident in another part of the world known well to myself, and many emigrant Bangladeshis too. In England we have people promoting a particularly rosy view of rural life in the past, with morris dancers, craft fairs and folk museums, of communities featuring the local public house, village cricket and church services. It is an industry no less, supported by institutions such as the National Trust and English Heritage, and while partially pandering to tourist expectations, it features a strong element of cultural identity, defining and protecting Englishness against outside threat, one of which is perceived to be a large immigrant population, including the Londonis from Bangladesh (Gardner 1995; Stolke 1995; Grillo 1998).

These overly positive views are a distortion. In many respects life was hard. The indigenous technology and practices — of Bangladesh, England or wherever — associated with hand-scythe harvesting, cattle-drawn tillage, transportation of straw bales on the head and so on, involves heavy and tiring labour. Life is not only hard but

also insecure. Before inorganic fertilisers, biocide sprays, mechanical irrigation and so on yields were considerably less and more erratic, and the spectre of famine more common. We have another Eastern brain-teaser of an opposition which we have to try and resolve to come to some operable definition and understanding of indigenous knowledge research. This knowledge harps back to difficult conditions, echoed in queries about returning to the stone age. It is unclear, particularly to many scientists, how such knowledge might feature in development to improve peoples' lives. And yet others are urging its consideration, as in this book.

One counter argument is that indigenous knowledge may include some valuable wisdom that could prove useful in unforseen ways. Shah and Townsley (chapter 17) offer a good example from local aquaculture. A spur to this work is the fear that the introduced technologies, such as the high yielding varieties of rice and associated husbandry practices, may not prove sustainable, even that they are currently damaging the environment, and will need to be reversed. The theme of sustainability informs several of the contributions to this book. Some commentators, such as Zaman (chapter 4), Miah (chapter 2) and Naseem (chapter 18), foresee serious problems in Bangladesh with its expanding population and evidence that the yields of high yielding rice varieties may prove unsustainable. Other problems mentioned by these and other writers include loss of plant genetic material and biodiversity, which can impact particularly hard on the poor, as Stokoe (chapter 11) points out for women and Zuberi (chapter 14) for herbal healers, and declining soil fertility and increasing dependence on inorganic inputs to keep yields up, as I mention (chapter 19). Some fear that a disaster could occur, Zaman for example urging us to learn from history and the collapse of South Asian civilisations in antiquity. The indigenous techncial knowledge needs to be there for people to fall back on, if the the environmental disaster some people fear comes to pass.

Insiders' versus outsiders' knowledge

It is understandable that Bangladeshi researchers should see indigenous knowledge in terms of material culture, technology and associated practices that symbolise something of their Bengaliness, reflecting their own, commonly unspoken concerns, with identity in an increasingly global community. There is a further dimension regarding this subjective tendency that relates to the attraction of the narrow indigenous technical knowledge focus. The inclination to see indigenous issues in these terms may relate in part to these comprising the Bengali commentators own culture. It is an anthropological tenet that it takes outsiders to see things from a holistic perspective, to put them in their broad anthropological context. According to some, anthropological research can only be undertaken by outsiders. It is one of the few defining features of the discipline. An Englishman working in Cornwall or an American in Kentucky are sociologists, unlike a Chinaman in Cornwall or a Pakistani in Kentucky, who are anthropologists. It is a moot point how wide the cultural difference should be between investigator and investigated, but some would argue that an American in Cornwall or Chinaman in Japan would not be anthropologists either because their cultural backgrounds would be too similar to the people among whom they work.

Whatever the status of this unresolved distinction between anthropology and sociology, it is thought that persons view their own culture in different ways to other cultures, that in some senses, as members of it, they are unable to see the 'cultural wood for the personal trees', to distinguish aspects of the collective from their

individual experience. In other words, a great deal of what is relevant to understanding a society is too obvious to insiders, who take it for granted as part of their daily lives. It is tacit knowledge. Mustafa (chapter 3) makes some interesting observations about the methodological implications of this and related issues, and the contribution of Dixon, Barr and Sillitoe (chapter 20) likewise has some relevant methodological points. Furthermore, some issues may be beyond questioning for members of a culture; for example, many Bangladeshis would be unwilling to critique their Islamic beliefs and practices in their investigations, holding them sacred and beyond enquiry, even thinking that the idea is blasphemous. Ahmed's contribution (chapter 23) illustrates this point, relating his conflict with a local *imam*, who perceived in indigenous knowledge research a challenge to his religious authority. Islamic beliefs undeniably comprise a central part of Bangladeshi society and from an anthropological perspective cannot be overlooked without distorting overall understanding. It is consequently difficult to situate indigenous technical knowledge in cultural context, members see it from the point of view of their own concerns as members of the society, namely as something to symbolise their threatened Bengali identity.

The narrow notion of 'indigenous technical knowledge', presenting it as culturally disembodied technical knowledge, is dubious. And if the separation of knowledge from the human milieu where created, reproduced and manipulated is questionable, it is doubly dubious to isolate technical information from its cultural context and attempt to match it with Western scientific concepts. In this regard, narrow interpretations of indigenous knowledge, as in the study of the modifications that local people make to introduced technologies, need to be treated with care. Some of the papers in this volume take this restricted view, such as Mazumder, Samina and Islam (chapter 16) who consider how people accomodate to interventions in openwater fisheries and modify of introduced aquaculture technology to fit their management regimes, and Rahman (chapter 8) in his account of tree diseases. National scientists involved in development work, Bengalis or whoever, need beware because the distorted understanding that results may not only promote inappropriate interventions, but also falls into the trap of accepting Western society's and science's definition of development. We find people caught in another paradox. On the one hand they are unable in some senses culturally to contextualise local knowledge because it is a part of their heritage, and yet in failing to do so they are acceding a dominant role to western science. They are falling in with their western scientific education at the expense of allowing expression to their own cultural reality. Ultimately they are furthering development not as a partnership, but as an imposed process continuing Western hegemony.

When decoupled from its socio-cultural context, local knowledge can fall prey to ambiguous science-like representation, which encourages focussing on those aspects thought to mirror science and technology and likely to prove amenable to further manipulation. The conceptual framework of western science and development discourse come to define it. This is seen in the selection of knowledge to reflect our disciplinary distinctions and interests, as in its ordering according to ethnosciences that reflect scientific subjects, such as ethnopedology, ethnobotany or ethnozoology. We see this in some of the papers here, for instance those of Rahman *et al.* (chapter 10), Begum *et al.* (chapter 13) and Islam *et al.* (chapter 15), all are good examples of ethnoscientific accounts, with accompanying catalogues of plants and fish. In this approach the information implicitly becomes a construction of western-trained

professionals, claiming to act in the interests of local populations, whereas the status of this knowledge may be different from a local viewpoint. Like any other scientists, Bangladeshi ones need beware of misinterpreting indigenous knowledge. It is mistaken to recodify and interpret it scientifically. If science sets the parameters, it will isolate for analysis specific resource use practices from the broader circumstances that critically inform them, whether agroforestry, crop manipulation, water management, erosion control or whatever. Outsiders decide what is relevant, not those who possess the knowledge.

The imposition of our scientific categories and technological priorities not only threatens to misrepresent knowledge, but also to limit analysis by predisposing us to think certain issues important and to overlook others that may be significant to local understanding and experience (Hobart 1993). Taking knowledge out of cultural context threatens both to misrepresent and devalue it. The 'indigenous technical knowledge' formulation, implying universality, overlooks unique features of particular local knowledge traditions. It defines as irrelevant some issues that might crucially inform others' environmental understandings, notably the non-empirical such as ritual, social and symbolic formulations. It is necessary to accommodate to the notion of the 'cultural construction of the environment', that culture informs understanding of the natural world (Croll and Parkin 1992). People may codify and store the intelligence amassed by their cultures over many generations of trial-and-error in ways alien to science. Indigenous knowledge can be a complex of contexts, and may incorporate supernatural, cosmological, everyday technical, socio-political, and kin factors. The farmers' approach is more holistic, and may reflect wider socio-cultural and economic issues, distinguishing resources according to various uses and associations. The contribution of Islam *et al.* (chapter 15) illustrates this well for fish classification, and Stokoe (chapter 11) illustrates it for wild vegetable resources, prominent in the diet of many poor families. Some of these issues and practices, being local, culturally relative and context specific, may limit the wider use of indigenous knowledge in the development of generic technologies. The implication is not that it is irrelevant and has no value.

The assumption that there exist definable bodies of knowledge independent of socio-cultural context is unacceptable from an anthropological perspective. Understanding is flawed, abstracting knowledge from the milieu that generates and sustains it, giving it meaning in use. This approach is open to the same criticisms as topdown development theory for over-simplifying and generalising complex local problems (Hobart 1993; Fardon 1995), instead of promoting an in-depth appreciation of other people's ideas about their environments and natural resource management, thought necessary for appropriate development interventions. Any indigenous technical knowledge emerges from a particular culturally informed world view, it is a local cultural construction. This is evident with fishing on the Bangladeshi floodplain. It is all very well to give an account of Bengali fishing nets and techniques, but if you overlook to situate the use of this technology within the socio-political and historical context of rights of access to waterbodies like *beel* and *hoar*, and the marginalised position of minority Hindu fisher groups, any understanding of fishing practices will be totally compromised. You will fail to comprehend why certain persons use certain techniques and not others, when they employ them and why, as Shah and Townsley (chapter 17) show. Consideration of these wider issues leads us onto political matters, among others, which critically condition understanding of indigenous technical knowledge, and lie at the root of

many of development's problems in attempting to assist the poorest of the poor. Wealthy large landowners frequently monopolise access to the waterbodies that remain stocked with fish after the monsoon floods recede, commonly employing illegal methods to intimidate local fishermen. Fishing is certainly not a case simply of the correct tackle and boats, and knowledge of how to deploy them to best effect.

Politics and indigenous knowledge

The employment of indigenous practices, even their reinvention, to assert cultural identity is common around the world, and may easily shade off into a politically motivated acts; as evidenced for example in recent newspaper reports of Makah Indians of the U.S. Pacific coast reviving their traditional seasonal whale hunt after seventy years in abeyance, both to assert their spiritual heritage but also to challenge the global whaling ban with all its commercial implications (Langton 1998). The political dimensions of indigenous knowledge predictably pose further contradictions and anomalies. The implications of politically contextualising knowledge brings up another possible point regarding the attractiveness of the narrow concept of indigenous technical knowledge to Bangladeshi researchers.

Many of those currently interested in indigenous knowledge research, including some academics, still have farming connections through their families and own land in Bangladesh, some of them owning considerable areas by local standards. They may not wish to contextualise indigenous technical knowledge with regards to the wider society as wealthy absentee large landowners. If they can restrict interest to technical knowledge, which is relatively neutral and harmless, and frequently perceived not to have much development potential, even be regressive in some minds with its 'stone age' implications, this can serve to protect their vested interests. If they venture into the wider socio-political domain they will have to deal with the unequal political relations that characterise Bengali rural society, which the national researchers, as relatively privileged and 'wealthy' members of their society relative to peasant farmers, would rather avoid and keep off the agenda. They may not do this consciously, for many of these persons are well-meaning and would like to do something to improve the lot of their fellow poor countrymen. But few would contemplate doing so at the expense of their own families' comfort and security. Zaman (chapter 4) has some sharp observations to make on these political issues, talking about the need for a revolution to overthrow the pernicious hierarchical aspects of Bangla society which cast rural peasants as only one up from beggars and the destitute (Sen and Dréze 1999).

These comments also bear on the self-evident, but often overlooked point that local communities are variable in their composition and not homogenous (Scoones and Thompson 1994). This raises some interesting methodological challenges, namely how we should access and document this individually variable knowledge, as Mustafa (chapter 3) comments in his contribution. The chapters by Stokoe (chapter 11), Shah and Nuri (chapter 12) and Begum *et al.* (chapter 13) illustrate the gender dimensions to this variability in their discussions of wild vegetables, seed storage and medicinal plants respectively, which are largely female domains. The paper by Islam *et al.* (chapter 15) intimates the variability in fisheries and aquatic ecology knowledge both within and between communities. And the contribution of Barr and Sillitoe (chapter 21) suggests a way forwards methodologically to handle this variability using the rapidly developing qualitative database sofware now available.

These political realities illustrate the point made above about members of a society having difficulty undertaking an anthropological investigation of it. They have too many vested interests. It also vindicates the argument that we need to situate technical knowledge in the wider social context to understand it. Ahmed (chapter 23) explores some of the issues, casting his argument in terms of current postmodern critiques of representation and subjectivity. The dimension of power relations raises a further methodological point regarding national researchers engaging in indigenous knowledge work. This relates to the danger of creating national gatekeepers, controlling access to, and interpretation of, indigenous knowledge. These persons will have entrenched interests as members of the society studied and will naturally further these, albeit perhaps unconsciously, if well-meaning persons. They will be tempted to direct development assistance to their own ends. Our experience in Bangladesh suggests that this may be quite blatant. The consultancy culture for example is entrenched among relatively wealthy Bangla university and research institute staff, who expect to receive a generous daily allowance on top of their salaries for any contribution to aid-funded projects. And sometimes their contributions are minimal. Such as the institute staff who, on a trip searching for a field research location, did nothing other than enjoy a chaffeured day out looking at the countryside. Or the corner-cutting scientist who conducted a survey from the verandah of a field house, taking it easy and ordering villagers to bring him material from their fields. They made a mockery of the research while pocketing the money.

These episodes suggest that considerable communication problems may occur between collaborators, as is common in interdisciplinary work, presenting indigenous knowledge research with a further range of methodological problems, as Dixon *et al.* (chapter 20) discuss. These problems may be exacerbated by different cultural expectations, one's graft maybe another's fair recompense. They also suggest attitudes towards poor farmer-fishers, which South Asian hierarchical cultural values may again promote, that could seriously hinder indigenous knowledge research. The contribution of Mahbub Alam (chapter 22) graphically illustrates from an anthropological viewpoint how these can interfere with ethnographic fieldwork. And Naseem (chapter 18) has some observations from the other side, as a natural scientist. The high status that they report some scientists assume, and their dismissive attitudes towards indigenous knowledge, suggest the need for urgent re-education. This is one of the aims of this book. In the light of these comments, we have to ask ourselves some difficult questions. What percentage of internationally donated aid money can we justify going to relatively wealthy national scientists, legitimately to fund their research work (travel costs, laboratory expenses etc.), and what returns should we expect on the investment? These monies would support, to put them in perspective, a considerable number of desperately poor families, the target beneficiaries of aid agencies, and raise their standard of living above starvation. These comments illustrate the difficult issues that come up when we follow the dictate of indigenous knowledge research, as advocated here, and put our enquiries into wider socio-cultural context. But they are issues, however uncomfortable, that we should debate to advance the development research agenda. And the foreigner Bideshi researchers and administrators are caught up in the power plays too. They are also comfortably off, coming from wealthy nations. And they need in-country partners, who will only collaborate if the personal renumeration is right, and so collude in meeting their demands.

Starting from the apparently unexceptionable premise that indigenous knowledge and practices should inform development, we are led to question the very foundations of development. Who should be making decisions about the proper distribution of limited assistance and resources? International agencies contribute them and expect to maintain some control over their use; it would anger English tax payers and politicians to hear that funds are going to the wealthy, not poor people. But Bangladeshis understandably wish to have control over what happens in their own country. Again we have another contradiction, of the kind that politicians regularly wrangle over. Indigenous knowledge research cannot act as awkward commentator alone, it is caught up too. The outsider definition of anthropology given above raises important methodological issues regarding interference. Outsiders prying into others' lives relates to issues of power relations of the kind that have recently lead to a growing Asian critique of the Western driven notion of development. By what right do outsiders come and enquire into others' lives? Ahmed's reflections (chapter 23) bear on this question. It is one that indigenous knowledge research has to address, not only in Bangladesh but worldwide, because associated with development it implies, more so than academic anthropology, facilitating some interference in peoples' lives. Should this research be undertaken by invitation only, and if so, whose invitation (national or regional government, local community or headman)?

Asian philosophy and development

In response to these anomalies and conflicts an Asian reappraisal of development is evident, informed both by Eastern philosophy and world views (Dallmayr 1996*a*) and contemporary orientalist and postmodern debates (Said 1993). The Bengali interest in indigenous technical knowledge might further be interpreted as unwitting support of this critique. It focuses on quintessentially Bengali things, such as fishing nets and traps, the use of plough and ladder in rice cultivation, and so on, which may symbolise Asian lifestyle and values. These may serve as a rallying point to fend off undesireable aspects of development imposed interventions. It gives a political aspect to the assertion of identity. The association of Bangladeshi material culture with political identity is direct, parties regularly using ploughs (Jatio Party), boats (Awame League), ladders (minority parties), sickles (Communist Parties) rice (Bangladesh Nationalist Party), vendor's scales (Jamet Party) and so on, as readily recognisable symbols to illiterate peasants during campaigning and at elections.

We have a questioning of the Western notion of development. There are parallels with the ideas of cultural revival that featured in Asian and African nationalist struggles, and likewise they invite interpretation as symbolic discourse expressing anti-colonial, and more recently anti-development sentiments. While the recent power discourse in the West may inform this critique (which has attracted left wingers as the shortcomings of marxism have become evident — Escobar 1995; Fergusson 1994; Nabudere 1997; Nederveen Pieterse 1998), it is taking on a decidely Asian perspective. It is not advocating a return metaphorically or otherwise to the stone age, but creating space for the expression of Asian views, with their roots in an ancient philosophical tradition. The emergence of this critique further vindicates the indigenous knowledge movement's insistence on setting problems in cultural context, which includes historical context. In going beyond indigenous technical knowledge we have also to consider the social and intellectual history of Bengal. This includes centuries of written

history and reflection, which indigenous knowledge research needs to access, with all its methodological implications (research to-date occurring exclusively through interviews and oral history, as illustrated by the many contributions to this volume).

The commitment for which this Asian critique is calling has a moral and spiritual quality, a concern for social relationships and experiential reality, not only academic enquiry and debate. We should be participating in the world of which we are a part, not merely commenting on it. Advocates talk in terms of political commitment, as a manifestation of love and wish to transform reality, not as a quest for power. They view development as a monolithic imposition by the West on the Rest, the Western idea of knowledge being used to steamroller a uniform world (Kothari 1988; Sachs 1992; Hobart 1993; Mehmet 1995). It is about power. The occidental tradition of science and technology puts humans at the centre of creation and encourages us to use our knowledge to advance our power and domination over everything: nature, other humans, the universe. The Western modernist framework dominates the quest for knowledge, setting a narrowly utilitarian corrosive agenda motivated largely by materialistic objectives, assumptions and values, driven by capricious market forces. It crushes 'alternative traditions of thinking about knowledge, for instance, knowledge being concerned with understanding, love and selfless devotion to humanity. The modernist framework of knowledge alienates the man of knowledge from the wider social and cosmic reality' (Giri 1997:6).

But there is an alternative view. Asian authors talk of knowledge traditions, such as their own, which search for enlightenment and liberation, not control and domination. They are holistic and allow for pluralities of knowledge as opposed to 'annihilating universalism' (see Uphoff 1996*a* who contrasts Western 'and/or' thinking with Asian 'both and'concepts). The brief contribution by Lalon (chapter 9), an NGO worker involved with the health of the poor, gives an inkling of this tradition. These writers are mindful of philosophies that accept contradictions, indeed welcome them as part of the human condition, and look to pluralistic traditions that embrace these such as the Hindu pantheon with its many *avatar* manifestations of the single god. The cultural heritage of these writers makes them deeply unhappy with the Cartesian duality of subject and object that has until recently informed science. They argue for its dissolution, for us to realise that human beings and the world comprise part of a single universe. The goal is moral and ethical, to transcend the self for humanity, while not denying that knowledge contributes to empowerment (Das 1995). They cite the *bhakti* spiritual tradition of India where knowledge is sought to serve the world in a spirit of devotion.

A central characteristic of the Asian world view is the oneness of everything, its experience as a unity of mutually interrelated phenomena and events. In everyday life we are blind to this unity, necessarily dividing our experiences up, as in reductionist science, according to things and events in order that we can manage our daily lives and the world around us. The flaw is to mistake these intellectual and operational abstractions as fundamental aspects of reality. We need to conceive of these discriminations as relative within all-encompassing unity. According to this view, the distinctions that comprise opposites are relative, intellectual constructs that originate in thought. We cannot accomodate this relativity in our normal state of consciousness. The experience of reality beyond opposites requires freeing of the mind from the rigid divisions of conventional logic, allowing it to flow constantly and seamlessly. The *sadhu* transcend these abstractions in meditation to comprehend the unity of opposites, as Krishna says

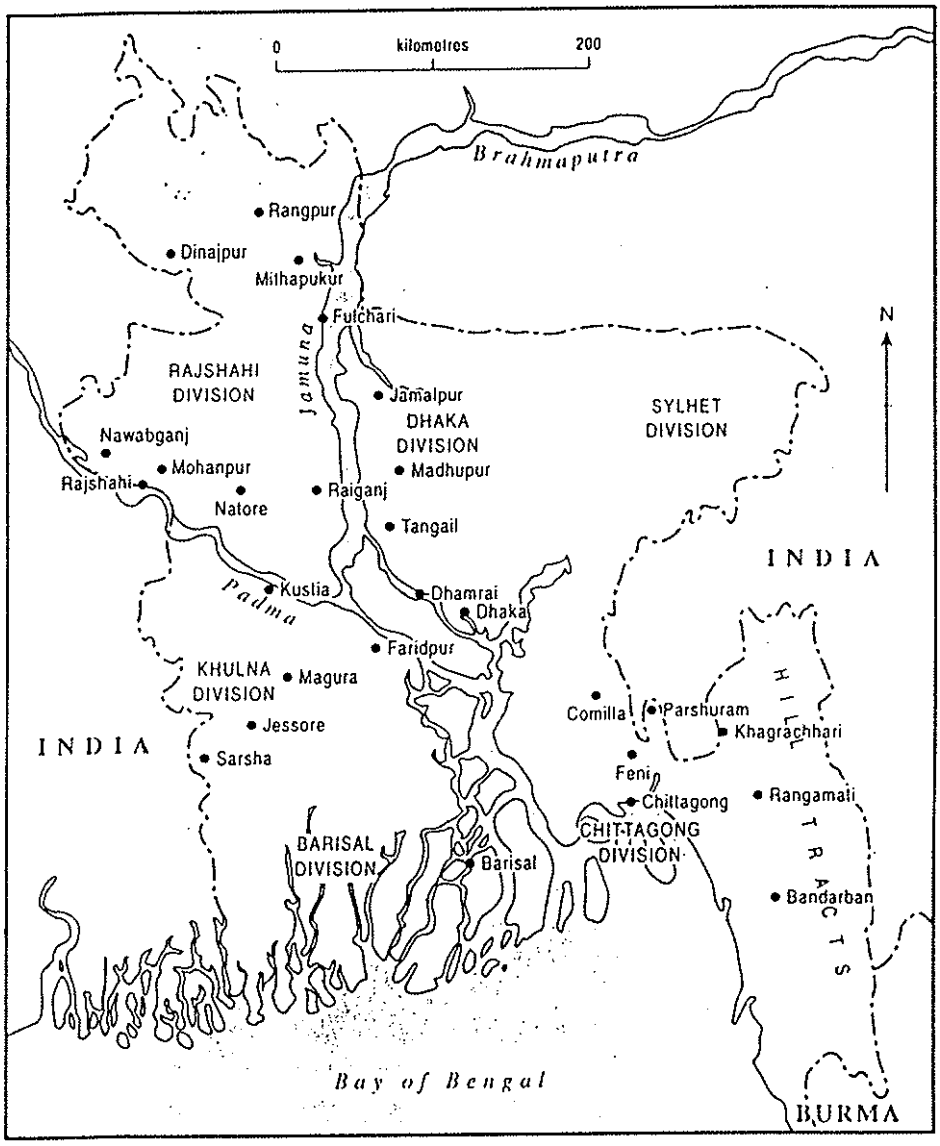

Figure 1.2 Map of Bangladesh showing locations of places mentioned in this book

in the *Bhagavad Gita* to 'Be in truth eternal, beyond earthly opposites', a vivid experience. Life and death, hot and cold, happiness and despair, light and dark, male and female are extreme aspects of the same reality, not separate experiences, for one can only exist in contrast to the other. Revealing contradictions and accomodating them, as we have seen, features centrally in indigenous knowledge enquiries. We see how making space for others' perspectives, whether Muslim Bengalis or Hindus or whomever, can cast new light on problems. This should prove a major contribution of indigenous knowledge research to understanding, when released from narrow technical concerns and set in wider cultural context.

We also have here an inkling of the manner in which indigenous knowledge research, allowing a voice to other cultural traditions, may inform the redirection of development, as argued for in contemporary critiques. The complementarity and interdependence of opposites means that neither pole can achieve dominance — good cannot win over evil. Virtue is to achieve a dynamic tension between the poles, in their interplay (Bhaskar 1994). The balance of relations between the male and female poles of humanity serve as metaphors for the Asian critique of Western notions of development. In Eastern philosophical traditions there is a striving for a balance between female and male aspects, symbolised in androgynous Hindu art, depicting gods as on one side virile and on the other matronly and meeting in a serene union of both. This perspective is potentially subversive, for it is a short step to questioning the very assumptions of development, when thought to be manifestations of Western power. Other traditions of society and philosophies of life may disagree fundamentally about the propriety of development. The argument is that Western society, and hence development, over-emphasises the male, and hence rational thought, aggressive go-getting and competition, at the expense of the female, and intuitive wisdom, caring co-operation and gentleness. The occidental emphasis is sick, an unbalanced relationship between necessarily equally complementary opposites. The Eastern transcendental and Western scientific perspectives should complement one another, reflecting the rational and intuitive intellects. We cannot reduce one to the other, each leads to an entirely different comprehension of the world. Together they give a fuller and deeper understanding (Dallmayr 1996*b*). It is misguided to seek a synthesis, as one cannot be comprehended in the other. Instead the aim might be to seek a dynamic balance between rational analysis and mystic intuition, scientific enquiry and local wisdom. This is the objective of indigenous knowledge research in development. We should not strive to subsume local understanding into scientific analysis, but seek to opitimise the insights of both perspectives, aim for balance and synergy (Bhaskar 1986).

The message of the Asian critique is that we need to strive to get the balance right. There is a deeper reality behind the superficial appearance of day to day life. We are currently out of step. The rational scientific view that dominates our society and the development agenda is unhealthy, as manifest in the destruction and pollution of the natural environment, increasing social unrest and mindless violence, the emergence of strange new viruses and unhealthy living arrangements, both physical and social. The mechanistic and fragmented world view denies nature's complex harmony and wholeness at its peril. But to move towards a more dynamically balanced view will require an occidental socio-cultural revolution. It is to this that the oriental critique points. It indicates that the processes of development and globalisation should not be thought one way, an imposition of Western values on the rest, but a drawing on the

combined strengths of different cultural traditions in this increasingly cosmopolitan world. This is the philosophy that informs the indigenous knowledge movement.

Conclusion

The centrality of contradictions and the resolution of opposites to Eastern philosophy puts these at the heart of Bengali identity. We are increasingly coming to realise that paradoxes characterise the development agenda too, as it seeks to facilitate participation and allow all voices to be heard, with focus groups, workshops and so on. These not only allow the expression of different stakeholder interests but also promote the accomodation of, sometimes conflicting and diametrically opposed views through equitable negotiation. Development is not a clear cut process as depicted in previous modernisation and dependency views, but a disparate and polytheistic one. We should perhaps be wrestling with the incorporation of the Asian perspective into development thinking, not only to ensure that the identity demands of millions of people are expressed but also to further the very notion of development, what it is and what it is trying to achieve. The need to face up to and try to resolve the tension inherent in the paradoxes that characterise development is clear in the movement to incorporate indigenous knowledge into development, which has an important contribution to make to this debate.

This introduction has argued that it is necessary to go beyond the narrow focus of 'indigenous technical knowledge' which currently dominates indigenous knowledge work in Bangladesh, to set local technology and resource management practices within wider socio-cultural context, to advance consideration of these in development programmes and better frame problems for enquiry. The comments on Asian philosophy intimate some of the implications. On the other hand, it is suggested that the emphasis on 'indigenous technical knowledge' is important for contributing to a needed sense of cultural identity and worth in the face of the development onslaught, and furthermore that it may lend support to the growing Asian critique of development, thus helping to advance our understanding of what development itself is all about. The argument is that we should both discourage and encourage work focussing on indigenous technical knowledge! Clearly we need to strive for some resolution, there is a call for the sort of balancing act central to Asian philosophy.

This volume is structured to reflect these intriguing tensions, and hopefully contribute something to their long-term accomodation in development programmes in Bangladesh. It introduces the field of indigenous knowledge research in development and current interest in it in Bangladesh, namely the indigenous technical knowledge focus, with a series of chapters that report on studies in this technological vein. The later contributions point the way beyond these technological studies by expanding on their definition of indigenous knowledge to encompass a more holistic approach with attendant methodological advances, looking to the future and the wider cultural contextualisng of indigenous knowledge research and the fuller integration of its potential into development

Notes

1 An NGO based in the United Kingdom which represents the interests of tribal people worldwide.

2 While this paper emphasises the material side of identity, appropriate to current ideas about indigenous knowledge in Bangladesh, this is not to imply that these

have some priority over other issues. Language, for example, has been a particularly emotive issue in defining Bangla identity, with the Language Movement and Ekushey martyrs through to the Independence War from Pakistan and Urdu domination.

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PART 1 INDIGENOUS KNOWLEDGE AND DEVELOPMENT ISSUES

2 Indigenous Technical Knowledge: Unexplored Potential for Sustainable Development

Abdul Momen Miah

BANGLADESH IS A POOR and densely populated country with approximately 130 million on a land area of 147 570 sq. km. Thus land and other resources are limited. The majority of the population (86%) lives below the poverty line. The continuing population explosion exacerbates the rate of fragmentation of land holdings, resulting in increased numbers of small and marginal farmers and landless people. In 1973 the number of landless poor people comprised 29% of the population, today it has increased to 65% (Bangladesh Bureau of statistics 1998). The population explosion has created enormous social, economic, political and environmental problems. Today's poverty is the accumulated effect. The government, along with development agencies, has taken various steps to combat and alleviate poverty. For example, in agriculture and extension activities, it supports programmes seeking to increase production, to strengthen agricultural education, and to further research.

The country has made substantial progress towards achieving its goal of self-sufficiency in food production, made possible mainly as the result of using modern crops, agrochemicals, engineered irrigation and associated improved management practices. These new agricultural technologies in Bangladesh have been generated by various research organisations, and are transferred to the end users — usually the farmers — by extension agents. The increased agricultural output is essential for the alleviation of poverty as well as for national economic growth. The continuation and improvement of these intensive farming practices is considered necessary. However, continued use of high cost technology has aggravated the social imbalance of many farming communities. It has also resulted in increased pollution of the natural environment to the growing concern of those advocating sustainable agricultural development. Technological intervention in agriculture has exacerbated problems of sustainability (Farouk and Salam 1996). Yield declines are also occurring which are strongly associated with the time intensive production has been practiced. A recent World Bank report found that the overall yield of rice has either stagnated or is in decline. According to several commentators, the possible causes of declining productivity include: nutrient imbalance due to improper use of inorganic fertilisers; concentration on high yielding modern crop varieties; increasing prevalence of multiple cropping; overuse of agrochemicals and inadequate use of organic manure. Policy makers, planners, researchers, educators, NGO activists and development donors are seeking ways to maintain the benefits of technological interventions on the one hand, while mitigating the resulting environmental degradation on the other. The issue of sustainable agricultural development is central.

'Sustainability' is a word that has different meanings for different people. It can be defined in two ways: either from a resource base focus emphasising conservation;

or from an output focus emphasising livelihood or development (Benbrook and Mallinckrodt 1994). "The resource base focus states that natural resources must not lose their capacity to produce, through depletion or pollution. The output focus states that productivity must not decrease" (Wilcock and English 1994). Resource base sustainability is linked to livelihood sustainability, although the relationship is not always clear. A pragmatic definition is given by Reijntjes *et al.* (1992): "... in the context of agriculture, sustainability basically refers to the capacity to remain productive while maintaining the resource base. The environment in a wider sense is uncertain and changing, and sustainability is the ability to survive that uncertainty. In an important sense, therefore, it is a preparation for the future, and it may never be possible to say that a system or community has become sustainable." Sustainability implies achieving satisfactory yields without threatening the environment and usually demands minimal use of external inputs. Firstly, high agricultural production needs to be maintained through the application of scientific technical knowledge, and secondly, the rate of environmental degradation needs to be minimised and kept within acceptable bounds. Increases in food production must be sustainable in the long term.

Efforts to achieve sustainable development in agriculture should take into account indigenous knowledge and technologies to reduce reliance on scientific technical knowledge. The potential of indigenous technical knowledge in the further development of agricultural production systems has recently been recognised (Sillitoe 1998*a*). It has tremendous potential for furthering sustainability. According to Warren (1991) "... indigenous knowledge is local knowledge — knowledge that is unique to a given culture or society. This knowledge is the information base for a society, it facilitates communication and decision making." Chowdhury *et al.* (1996) assert that "... indigenous people and farmers develop their location-specific knowledge and practices of agriculture, natural resource management, veterinary and human health care and many other subjects over centuries. This complex of knowledge, traditional beliefs and practices are generally known as indigenous or traditional knowledge." Indigenous technical knowledge comprises practices derived from past collective experience. It is the knowledge of people living in particular areas, which helps them to address life's problems. It is dynamic and changes through indigenous creativity and innovation, as well as through contact with other knowledge systems. When innovations are found appropriate to the local culture, they are incorporated into the main body of the knowledge system. If alterations and modifications prove non-sustainable they do not survive (Reijatjes *et al.* 1992). We may assume that most of the indigenous technical knowledge and practices of farmers are fundamentally sustainable. The dissemination of indigenous technical knowledge through extension is discussed by Sharland (1991) who states that "... the use of indigenous knowledge in extension therefore involves the recognition that indigenous knowledge is a combination of knowledge created indigenously, together with knowledge from outside. The outside knowledge is incorporated into the store of indigenous knowledge only if it is compatible and considered relevant by the traditional practitioners."

The existence of indigenous technical knowledge and its potential for development is still largely unexplored in Bangladesh. Few attempts have been made to document the indigenous technical knowledge heritage in different parts of the country (see Mallick, this volume). Chowdhury *et al.* (1996) identified two hundred examples of indigenous technical knowledge, practiced by both males and females of various farming tasks in crop production, fish culture, livestock and poultry management.

Islam (1996) cited one hundred examples of indigenous technical knowledge during a study conducted at Dinajpur. He found that farmers generally favoured the advance of indigenous technical knowledge in the development of agricultural production.

Innovations based on scientific technical knowledge have been widely adopted by resource-rich farmers but this has not been possible for resource-poor farmers, a larger segment of the rural population, who are dependent mostly on indigenous technical knowledge. Recently extension agencies have started to advocate the use of some selected indigenous technical knowledge by farmers to mitigate environmental degradation. The practices are many and examples include:

- the use of bamboo sticks or tree branches for insect control;
- the sprinkling of cattle urine or spreading of tobacco dust to control pests (nicotine is an effective insect repellent);
- the use of *Neem* leaves with its active insecticide 'azadirachtin' and *Biskatali* leaves when storing seeds to deter insect attack;
- the laddering of standing wheat crops and pulling of ropes across rice/wheat fields early in the morning to moisten the soil with falling dew drops;
- the intercropping of garlic with potato;
- the use of ash in vegetable cultivation, which contains all essential minerals (in varying proportions) and adds to the water-holding capacity of the soil; and
- the application of poultry excreta to vegetable gardens to provide nitrates.

In ensuring that agricultural development is sustainable scientific technical knowledge should not be abandoned, but rather combined with appropriate indigenous technical knowledge. As Sillitoe (1998*a*: 225) points out, "The assumption is that our scientific tradition has something to contribute to the development process and that indigenous knowledge needs to be conveyed to scientists in such a way that they can appreciate its relevance." An example of this is provided by the National Agricultural Research System (NARS) in India, in collaboration with NGOs, who developed an integrated nutrient management system for crop production in Moharastra to increase and sustain crop productivity whilst also protecting the environment. The system was developed for resource-poor farmers who could not afford expensive agrochemicals in crop production. The system, a blend of scientifically generated technical knowledge with indigenous practices, is flexible in that it can adjust to agroclimatic changes as well as the variable socioeconomic conditions faced by farmers. We should aim to strengthen the potential of both scientific and indigenous technical knowledge by considering the following:

- we should encourage the identification, collection and documentation of indigenous technical knowledge before much of it is lost;
- research should be conducted to determine the performance potential of indigenous technical knowledge. Necessary modifications and improvements to indigenous technical knowledge should be made according to scientific findings and verified in different locations;
- a nation-wide awareness campaign should be instigated to warn people of the harmful consequences of injudicious use of scientific technical knowledge;
- the existing policies and strategies of extension agencies (governmental and NGOs) should be changed to emphasise sustainable issues, and the value of many centuries-old indigenous practices.

3 Towards an Understanding of Indigenous Knowledge

M. Millat-e-Mustafa

THIS CHAPTER PROVIDES a background to indigenous knowledge. It looks at various definitions and discusses how indigenous knowledge contrasts to scientific knowledge. The problems surrounding indigenous knowledge research are considered, notably the manner in which it varies between individuals. Indigenous knowledge is of local people, unique to their cultural heritage. It is increasingly recognised as a resource that should be mobilised to complement scientific knowledge, to promote appropriate plans and interventions for rural development programmes. The importance of involving farmers in the development process is now increasingly recognised by researchers and development professionals throughout the world in participatory approaches to development.

Indigenous knowledge is the knowledge held collectively by a defined community (Walker *et al.* 1991). The term 'indigenous' is synonymous with 'traditional' and 'local', differentiating this knowledge from that developed by formal science in institutions such as universities and government research centres. Warren and Cashman (1988) define indigenous knowledge as "... the sum of experience and knowledge of a given ethnic group that forms the basis for decision making in the face of familiar and unfamiliar problems and challenges".

Whilst distinguishing between indigenous and scientific knowledge is contentious, the principal difference according to Biggs and Clay (1981) is that "... the former concentrates on adaptation of knowledge and is less formal in both its social organisation and its research methods". Howes and Chambers (1980) suggest that "... scientific knowledge and indigenous knowledge may be contrasted and evaluated according to three criteria: as systems of classification, as systems of explanation and prediction and in terms of speed of accumulation". They go on to suggest that "... while indigenous knowledge and science are comparable with respect to the first criterion, science is generally superior with respect to the second and markedly so in respect to the third". Similarly, Walker *et al.* (1991) suggest that "... the differences between indigenous and scientific knowledge are not at a fundamental, conceptual level but in terms of formal structure, institutional framework, technical facility and ability and scale of perspective".

Attributes of indigenous knowledge — potentials and limitations

Indigenous knowledge is especially relevant to sustainable development planning. It is locally appropriate, having been tried and tested through time to meet the demands of local conditions, and it is fully integrated into a region's social institutions (Brokensha 1986). Indigenous knowledge can be said to be both dynamic and adaptive, these knowledge systems having often evolved over many centuries, accommodating to

on-going environmental and social change. It is both flexible and conservative, for while allowing for innovation and experimentation, it also provides risk-minimising strategies which enable rural communities to survive through times of stress (Richards 1985).

The potential utility of indigenous knowledge in research and development contexts has been succinctly summarised by Walker *et al.* (1991): "... the understanding that indigenous people have developed can complement scientific understanding; indigenously developed techniques of investigation can complement scarce scientific manpower; understanding indigenous knowledge and incorporating it into the research and development process can avoid duplication of work; and, understanding indigenous knowledge can help in targeting problem oriented scientific research by providing a firm basis for formulating realistic research objectives and hypothesis".

The dependence of livelihoods in Bangladesh upon localised rural production ensures that indigenous knowledge is 'local' or community specific. This may limit its general applicability to other environments or social circumstances. It informs decisions, which are entirely rational within their own socioeconomic context, but if this context is subject to external pressures then the logic informing the decision making may be compromised. It is in conditions of relatively rapid social and environmental change that indigenous knowledge systems are liable to malfunction, because their coping mechanisms are no longer adequate to meet the changed circumstances. People seldom record their indigenous knowledge but transmit it largely by word of mouth from generation to generation. Once forgotten, it may be lost forever. We should not allow this to happen.

Researching indigenous knowledge

Researching indigenous knowledge from the perspective of the demands of formal science throws up a number of challenging issues. Firstly, indigenous knowledge is difficult to categorise since it is holistic in nature, not disciplinary like conventional science. It is specific in relation to place, having evolved in response to local conditions, yet it is diverse in content, with concepts that may combine agroecology with social relations of production (Fairhead 1991).

Secondly, indigenous knowledge systems have been most studied by social anthropologists who have immersed themselves in cultures other than their own in order to comprehend the knowledge and values of those societies (e.g. Conklin 1954; Gladwin 1970; Sillitoe 1998*a*). The immersion approach is arguably non-scientific, having no predetermined structure or theory, and it can result in the collection of large amounts of field data that are difficult to assess (see Barr and Sillitoe, this volume). Additionally, because anthropologists can become 'experts' in a way similar to the people they study, they may often have difficulty in communicating their experiences to others who do not know what they know (Chambers 1983). This is to the detriment of rural development, since the insights and wealth of knowledge gained through these experiences have remained locked up in jargon-surrounded anthropological discourse and have been of little practical relevance. They need to be made into a form accessible to rural development policy-makers (Sillitoe 1998*a*).

Thirdly, there is the danger that local knowledge may be interpreted in terms of formal scientific concepts, of agriculture and economics (Norgaard 1987). This is grossly distorting and what anthropologists call 'ethnocentrism'. This results in some

researchers portraying local practices in terms of their own external perspective of technical expertise without having a sympathetic understanding of the cultural conditions that have informed their evolution.

Fourthly, informants may find it hard to give formal accounts of their knowledge and how they use it. The process of questioning the 'knowledge provider' can interfere with his or her perception of what is being discussed "... we constrain understanding in reducing everything to words. People transfer much knowledge between generations by tradition learnt and communicated through practical experience and are not familiar with trying to express everything they know in words .... Knowledge is passed on by informal experience and practical demonstration; more often shown than articulated, it is as much skill as concept." (Sillitoe 1998*a*: 229; see also Johnson and Johnson 1987). Much knowledge learnt through experience may be used without a conscious awareness of details (Hart 1986) and even conscious knowledge may not be expressed in terms of rules or procedures (Breuker and Wielinga 1987). This has implications not only for the elicitation process but also for the subsequent representation of the knowledge for use by others. Moreover the 'knowledge provider' may be unwilling to impart information because he or she recognises that holding knowledge gives power or status.

Fifthly, problems of communication are central to indigenous knowledge research, as they are to all cross-cultural work. The familiarity and skill with which words are used to express concepts and procedures will affect the status and quality of knowledge elicited through interview. Although people identified for interview may be 'experts', it is unlikely that they have previously been required to describe their knowledge and decision making procedures. They are not familiar with communicating them in this way.

Finally, the status assumed by the researcher when studying the community will influence the data collection process (see Alam, this volume; Ahmed, this volume). Attempts to reduce social and intellectual barriers and improve understanding will enhance cooperation and thus knowledge elicitation. If the researcher assumes the role of 'learner' informants are more likely to be responsive than if he presents himself as a 'scientist' or 'planner'.

The individual nature of knowledge

There are many variables affecting the type and degree of knowledge held by various members of a community, as well as their ability to communicate this knowledge to others. It is important for development workers and researchers to recognise that indigenous knowledge can vary greatly within a group. It may help them to identify those best informed to assist them in their work. The main variables are as follows:

- age affects an individual's life experience. We may expect that the older members of a community will be most knowledgeable about the history and development of the farming system, including past successes and failures;
- formal education affects the type of knowledge held and particularly the way in which people express information. Social factors influence access to and levels of educational attainment such as wealth and caste;
- gender affects the knowledge held by an individual, particularly where there is a sexual division of labour (see Stokoe, this volume). Gender also affects access to formal education.

- occupation informs the type of knowledge held by an individual. This becomes an issue where particular expertise needs to be understood, in the study of specialist topics, or to verify occupational knowledge gathered from the wider community.
- the environment affects what knowledge an individual has, much of which will be site-specific. Only the more mobile members of a community will have knowledge relating to different locales. Differences in ecological knowledge reflect different perceptions of factors that affect crop production such as climate, altitude, soil type etc. Factors relating to location, such as proximity to markets, may influence attitudes to, and knowledge of, particular crops and decisions regarding cultivation.

Conclusion

Indigenous knowledge is now recognised as an under-utilised resource in rural development. Scholars have pointed out that many technological solutions to problems in rural communities have failed because they did not take into account local knowledge and practice (Chambers *et al.* 1989). Brokensha *et al.* (1980) present several case studies that demonstrate how an understanding of indigenous knowledge of a given group could greatly enhance participatory and sustainable approaches to rural development. This should not mean that indigenous knowledge is superior to scientific knowledge. Understanding indigenous knowledge can help to determine whether or not external scientific alternatives are appropriate, and if so how they may be adapted, and how best to introduce them. It may be possible to adapt indigenous techniques to enhance their benefits. Such an approach may be particularly profitable since farmers may be more open to adaptations of a familiar method than to a completely new technique. It will be by comparing and integrating scientific and indigenous knowledge that the most appropriate solutions will be found for many development problems.

4 Indigenous Knowledge and Sustainability: On the Brink of Disaster or Revolution?

H. Zaman

BANGLADESH HAS DEVELOPED over millennia a knowledge base and agricultural technologies suitable for its subtropical climate. Subsistence focused farming developed with a mixed crop/livestock/fishery culture more or less minimised risk in a land where natural calamities are common. But due to various historical and contemporary factors the farming community has become the victim of social, economic and political injustices that diminish agricultural efficiency. As the population has increased so too has the pressure on land. A population of 120 million limits arable land to 0.33 ha. per family of five persons. Arable land has decreased and continues to decline, reinforcing a vicious circle of poverty and land degradation. Environmental degradation, including gene pool diminution and land erosion, is one result of continuous poverty. Impoverishment is pervasive in Bangladesh, with a mean per capita annual income of Tk. 11,192 in 1995-96 (~ £160) and an energy intake of 2266 Kcal. (Bangladesh Bureau of statistics 1997). Large amounts of foreign assistance, amounting to billions of dollars, have been made available during the last fifty years, but poor management and political instability has resulted in a failure to use it correctly to alleviate poverty. The cynical might conclude that our politicians, planners and administrators have become highly successful at making poverty a sustainable condition to ensure continuing supplies of such aid. These factors have increased instability in farming communities, undermining their indigenous knowledge, technologies, and their ability to cope.

Today 'sustainable' has become a catchword around the world, with particular concerns expressed about developing areas. The penetration of alien and modern high technology into agriculture and local industry has, in many cases, displaced traditional or indigenous technologies. Some of these modern technologies are high-input and expensive and as such are not well suited to the needs of poor local people. Partial adoption of these foreign technologies may adversely affect the local physical and social environment, harming people and their society.

There are a number of examples of farmers apparently successfully adopting high-input modern technology in agriculture only to revert later to their age-old practices because the profit margin is inadequate or the risk too high (Winkelmann 1976). In other words, subsistence low-input technology farming remains the basis of practice, notably where there is no favourable market. But it is questionable to suggest that this subsistence farming is 'sustainable'. There is disagreement as to whether indigenous technologies are sustainable or desirable. For example, the *Jhum* (Slash and Burn) type of farming is described by some as environmentally degrading and by others as positive in both physical and socioeconomic terms. Whatever the truth, people have abandoned this system as population pressure and deforestation undermined its basic principles. Again change has undermined local knowledge and practices.

The nature of agriculture in Bangladesh

The major factors associated with agriculture are land, climate, crops, domestic animals, fish, forest, human population, a society's structure and both local and foreign markets. It is no good seeking to improve one of these in isolation (e.g. breeding higher yielding crops); we need to take into account all of these factors when considering sustainable production (see Wennergren *et al.* 1984).

Bangladesh is a small sub-tropical country (143,998 sq. km.), although the influence of the Himalayan mountain system to the north on seasonal airflows results in a short period of temperate conditions from November to the end of February. The country receives abundant rain (200-300cm annually) with the monsoon, but the distribution is uneven. There are several large rivers draining through Bangladesh from India and Nepal into the Bay of Bengal, which flood much of the country during the monsoon season. The unpredictable climate makes agriculture risky. There is no modern or indigenous technology that can ensure food security for the average family, even with triple cropping. In the face of geographical uncertainties farmers have succeeded in evolving well-adapted crop varieties (e.g. deepwater rice) and appropriate soil fertility management strategies. They developed low external input technologies that minimised risk given their unpredictable climatic conditions. There has been hardly any effort, in either the public or private sectors, to develop and build on this agricultural tradition, facilitating market linkage. Farmers are forced, given their adverse physical and socioeconomic position, to cling on to their low-input based mixed farming, which assures a minimum food supply. But this minimum is insufficient to ensure food security for all the family, let alone provide a balanced daily diet.

Due to the vagaries of nature and the constant threat of flood, cyclones, 'norwesters', tornadoes and hailstorms, farmers find it safest to grow rice throughout most of the year. Historically, rice production was seasonal and the wealthy could engineer famines and earn enormous profits at the cost of human lives and misery. Few rice traders die during famines unlike many rice farmers. Bangladeshi farmers have learnt through bitter experience that a rice stock in the house assures freedom from hunger and starvation and also earns prestige. While agricultural scientists have promoted a revolution in rice culture — the so-called 'green revolution' of high yielding varieties (HYVs) — this has not eased the plight of the poor, and may even have exacerbated it with its high demand for expensive external inputs. The Bangladesh government and aid donors are trying to promote increased crop diversification to break this rice monopoly but progress is slow because they have been unable to ensure a fair price for crops. The current mixed farming does not depend on a diverse range of crops nor ensure maintenance of soil fertility. As long as rice remains people's preferred staple, progress is likely to be slow.

Endangered practices and sustainability

The ancient South Asian civilisations of Mohenjodaro and Ur perished when they fell out of balance with nature and became unsustainable. In these civilisations humans thought, as many do today, that they controlled nature. They failed to realise that in subjugating nature they over-exploited resources and jeopardised their survival. They evolved a fragile and ephemeral material and social security. We are in danger of repeating these errors and need to learn from our history. In 1929 the Royal Commission on Agriculture in India recorded that the sub-continent's soils had reached a serious state of degradation 100 years previously. Due to various

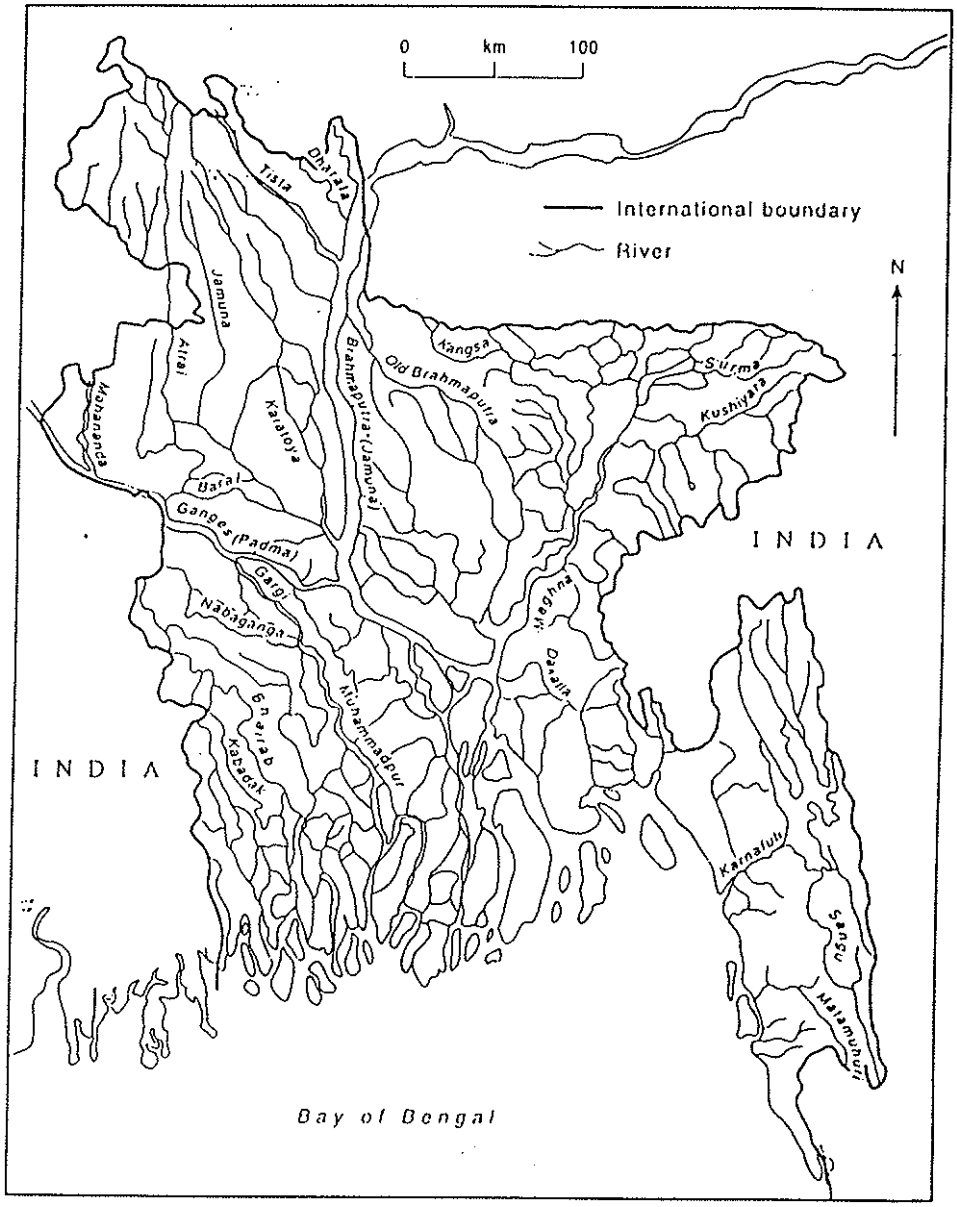

Figure 4.1 Map of Bangladesh showing river system across delta (after Hussein 1992)

socioeconomic and agroecological factors farmers have been forced to continue to follow practices that erode soils, deplete them of plant nutrients and barely sustain growth of crops. We all continue to exploit farmers: the intelligentsia, businessmen, administrators and politicians. This presents a long-term threat to everyone because we all depend on the same natural resources to feed us. We have much to learn from our indigenous knowledge heritage. Maintaining species either in sanctuaries, national parks or gene banks cannot restore nature's fragile ecological balance or the process of evolution in its proper sense. We are currently fighting a losing battle with gene pool erosion and increasingly endangered species. As soil fertility began to decrease farmers had no alternative but to select crop varieties that could stand the lower levels of nutrient availability; they culled out plant genes associated with higher soil fertility and yields. This caused 'gene erosion', and Bangladesh lost many of its higher yielding traditional crop varieties. The loss of rice varieties may be as high as 60% (Zaman 1993, 1997). Continuous selection of hardier lower yielding stock gave rise to today's local varieties. The malnourished condition of both Bangladeshi cattle and their owners illustrates that such a farming strategy undermines even the subsistence level of farming. In these systems domestic animals are reared as scavengers. The present day decline in crop yields and soil fertility in Bangladesh (Karim 1998) is a consequence of the neglect of balanced progress. Instead we have the so-called solutions of both micro and macro economic development. The relentless unilateral efforts of economists, planners and scientists have created a spiral of decline. We have bankrupt intellectual and technological interventions that have made poor farmers the scapegoats.

Crop production, traditionally for subsistence in Bangladesh, was controlled by the seasons. The summer crops were mainly rain-fed, grown using local technologies. However, introduced high-cost technologies, notably irrigation together with the use of fertilisers, pesticides and new varieties have overridden these seasonal constraints to a large extent. Nonetheless some operations, including tillage practices and post-harvest procedures, are still done using age-old techniques and technology. There is a mixture of traditional and modern technologies in the field of agriculture. For example few farmers follow the 'recommended' package of introduced technology in full, using only some urea, triple super phosphate, pesticides and partial irrigation. Otherwise they resort to traditional practices. This hybrid culture does not improve profits, neither is it a sound practice for the maintenance of fertile soil. Farmers have no control of markets and cannot earn reasonable returns. We may have to abandon these modified technologies to get back to a sustainable agricultural regime. The new technologies are beyond the reach of the poor, and no one is investigating the potential of the affordable old technologies for increasing crop production. Many old technologies, passed down to us by our ancestors, remain undocumented. The Bangladesh Academy of Agriculture is urgently trying to document existing local technologies (BAA 1997). This knowledge must not be lost for it is vital to the promotion of sustainable agriculture in the future.

Conclusion

In 1973 a book of agricultural statistics, published by the Ministry of Agriculture, recorded that land productivity was declining for nearly all major crops. This was in the early days of the introduction of high yielding varieties, when the per ha. yield of rice increased dramatically and was more than 6 tons. Yields have subsequently

decreased and at present the mean HYV yield per ha. is 3.5 tons. Various investigators (Sobhan 1997; Planning Commission 1997) have discussed this worrying trend and conclude that it is the result of the following factors:

- Environmental degradation;
- Loss of soil fertility;
- Unfavourable/unpredictable weather conditions;
- Lack of efficient drainage during floods because of unplanned infrastructure (including roads and highways);
- Siltation of riverbeds accelerating flood;
- Farmers' apathy toward flood action plans;
- River water pollution;
- A scavenger livestock rearing system;
- Population pressure;
- Socioeconomic inequalities;
- Low levels of education;
- General disregard by society for the farming profession (which is seen by many as just one rung higher than begging);
- Farmers' inability to use complete technology packages;
- Lack of adequate and easily available credit for farmers;
- Governmental failure to provide adequate market opportunities for farmers, (for example, whenever the rice price increases the Government immediately announces "Open Market Sale" of rice at lower rates);
- Corruption at almost all levels of society and lack of law and order.

All of these factors contribute to some degree to the current instability of Bangladeshi agriculture and loss of indigenous knowledge. They have undermined the sustainability of local agricultural technologies. Action is urgently needed. The contemporary advocacy of participation, of which engagement with indigenous knowledge is one strand, is a step in the right direction but it is unlikely to take us far without considerable social changes.

Bangladesh can trace the start of the degradation and loss of its rich natural resources to the instigation of the caste system by the Aryan invaders, which placed farmers in a low social position. The subsequent Moghul invaders from the Middle East and later European colonial powers failed to rectify this social evil, instead silently supporting it. Although the national constitution does not support this social hierarchy, one can easily find those in the élite social classes residing in the wealthy Dhanmondi, Gulshan and Banani suburbs of Dhaka who tacitly do so. The so-called "Bangla" intelligentsia, supported by the Bangla Academy, coined the word "*chashi*" as a term of abuse for persons of low social status. Some noble-hearted Babus and Sahibs have put *chashi* either before or after their names and made themselves famous. Many Bengali poets have written poems depicting the poverty and helplessness of farmers and become famous too. Yet not one of these exalted persons eradicated the poverty of a single struggling farmer. During recent decades Governments and NGOs have become adept at using poverty to secure large amounts of foreign aid. Instead of alleviating poverty we have instituted it permanently into our society and economy. Only a social, economic and political revolution can rescue poor farmers from this vicious circle.

5 Development Disasters: The Role of Indigenous Knowledge and Practices

Mahfuzul Haque

THIS CHAPTER LOOKS at some of the development projects in Bangladesh and neighbouring countries, which have been turned into "development disasters" due to faulty planning and implementation. Most development projects in and around Bangladesh follow a typical "top-down" approach; that is, they are often implemented with little or no 'grass-roots' level participation. Rural people are typically treated as illiterate and ignorant, without scientific and technological know-how. They may be illiterate, but does this mean they have no worthwhile knowledge? For example: a farmer knows the quality of a soil without scientific tests; a farmer's wife knows how to conserve and store seeds; a fisherman knows where and when to fish; a boatman can give a weather forecast with more reliability than the Met Office; a young girl knows when a hen will lay an egg. Is this not knowledge? It is, and people at the grass-roots clearly receive a form of education and know more about their lives and livelihoods than we do. The projects discussed here include hydro-electricity and forestry projects, the Chittagong Hill Tracts re-settlement scheme, Flood Control Drainage and Irrigation (FCD/I) projects in Southwest Bangladesh and shrimp cultivation in the south. The indigenous knowledge and practices of local people were ignored in developing many of these projects of national importance. Policy planners and executives need to be made aware of the adverse effects of these projects on the surrounding environment.

In general terms, "development" means progress, advancement, improvement etc. Development projects are generally designed to bring about a qualitative change in the lives of the people in a particular locality and country. However, when conceived without paying due attention to local people's knowledge, projects may turn into disasters. In Bangladesh and neighbouring countries we have experienced many such projects that failed to consider socioeconomic, ethnic and environmental issues (see Haque 1997). Perhaps the planning processes were faulty, the grass-roots beneficiaries not consulted, or maybe the implementation of the projects was poor.

Hydroelectricity projects

The construction of hydroelectric dams on rivers to store water for power generation are well-known for their adverse effects on the environment and forced population displacement. Those persons affected by the projects rarely receive any compensation. In India, a dam built under the Subarnarekha Multipurpose Project in Jharkhand, Bihar State submerged 120 villages and thousands of acres of agricultural land. About one lakh people, mostly tribal, were forced from their land and turned into "development refugees". In Maharastra State, Ms Medha Patkar, a firebrand activist, led a resistance group, *Narmada Banchao Andolon* (Save the Narmada) with the *adivasi* indigenous community. They protested against the construction of the massive Sardar Sarovar

hydroelectric dam across the Narmada valley, and due to the local community's resistance the World Bank later abandoned the project.

The Kaptai hydroelectricity project on the Karnaphuli River in Southeast Bangladesh submerged 250 sq. miles of land and displaced around 100,000 people, mostly Chakma sedentary rice farmers. The turbulence caused in the lake by the dam affected the normal growth of fish and caused soil erosion. Is it right for the country to incur such colossal socioeconomic damage to generate electricity? In 1976, in a memorandum to the late President Ziaur Rahman, the hillmen told of their grief: "the vast expanse of water captured by the dam provides a scene that impresses every visitor with its beauty. But could anybody have thought that the immense body of water is to some extent filled with tears of the local people? Through the cables of the electric line not only current flows but also the sighs of grief." The dam adversely affected the self-sufficiency of the tribal economy. Moreover, it failed to create job opportunities for the hill people, as envisaged. The government encouraged the tribal people to take up new occupations such as fishing or horticulture but the response was poor, mainly because of a lack of necessary skills and cultural shock. Such skills and knowledge are not part of their heritage (see Chowdhury *et al.* 1979).

Re-settlement in the Hills Tracts

During the implementation of the "Upland Settlement Project" in the Chittagong Hill Tracts some tribal people took up horticulture and some new cash crops such as rubber, building upon their *jhum* 'slash and burn' farming knowledge. The Chittagong hills settlement programme was an attempt by the government to change the population structure of the region. Around 375, 000 people from the plains were resettled there between 1980 and 1982 and each family was given 2.5 acres of valley land or 5 acres of hill land. The plan was to create a "human wall" on the Indo-Bangladesh border to thwart any insurgency activities, isolating guerrillas from the neighbouring populations. According to the 1991 Census, non-tribal people now constitute just over half of the total population, whereas they were previously only 10%. The tribal people were unhappy with this invasion for it not only ignored their knowledge but also their rights. The settler communities faced armed resistance from *Shanti Bahini*, an armed tribal group. In 1986 the communities were placed in enclosed *Guchcha Gram* (cluster villages) for security reasons, receiving 85kg of wheat or rice per family per month. They became prisoners with ration cards. The accord of December 2nd 1997 between *Shanti Bahini* and the Bangladesh Government has not solved the land problem. The Hill Tracts are over populated; the 1991 Census showed population density to be at 85 per sq. km, the carrying capacity being 18-25 per sq. km. Only 2% of the land is suitable for rice cultivation, 21% for horticulture with the remainder under forest (Anti-Slavery Society 1984: 17). No attention has been paid to the traditional *jhum* system and its relation to the environment.

Forest development projects

Elsewhere forest dwellers have also become victims of government policies and development programmes. For example, the forest dwellers of Jharkhands in the Chotanagpur region of India used to collect honey, timber, silkworms, medicines and oils from their forests. It was a symbiotic relationship. Forest Acts have removed many of their rights and exotic teak and eucalyptus trees have replaced indigenous trees such

as *Saal, Mahua, Kendua* and *Kusum*. The Forest Department took charge and barred their access to the forests. In the Bihar, the forest dwellers, started the *Jangal Kato Andolon* 'movement to clear the forests'. Although the movement did not last long, it was the first protest by an indigenous community against a development project taken without their consent. In Uttarkhand, Uttra Pradesh in India, there was the Chipko movement in which local activists embraced the trees to protect them from felling. In the Madhupur Tract forest of Tangail district in Bangladesh, we witnessed large-scale deforestation by commercial loggers. The local forest dwellers, the Mandi people, had no traditional lease deeds over their ancestral lands, and were stripped of them. Some were forced to cede land to the dominant Bengali community. In the name of commerce, trees were felled and the Mandi people were dispossessed. Paresh Chandra Mree, a Mandi leader said, "... we are the children of the forest. We were born and brought up here. We want to die here. We are so accustomed to forest life and we cannot survive if we get evicted from the forests." Their resistance against the Forestry Department evicting them met with limited success (see Gain 1998*b*). Again, not only is local peoples' knowledge of sustainable forest use disregarded, but so are their rights.

Water logging in Beel Dakatia, Khulna

In the early sixties, the Water Development Board undertook a number of coastal embankment projects in Southwest Bangladesh to protect the area from tidal surges, flooding and salinity. In the past, the natural tidal system played an important role in elevating the sunken *beel* lands. The local practise was to set up submersible embankments, which stored water during the post-monsoon period for irrigation. The establishment of large-scale flood control, drainage and irrigation (FCD/I) projects has resulted in the massive siltation of rivers. The projects were conceived to protect the area from salinity but due to inappropriate engineering, the sluice gates became clogged, riverbeds rose and failed to drain away the excess water. The resulting water logging brought many problems to the people of the area. In Beel Dakatia region it affected an area of 400 sq. miles and 10 lakh people. The Water Development Board has now undertaken another new project, the Khulna-Jessore Drainage and Rehabilitation Project (KJDRP), to correct some of the earlier mistakes. Local people are anxious that this will be another disaster, and when asked, say they do not support the project. They believe that if the rivers are allowed to take their own course the problems of prolonged water logging will be relieved, as this was the traditional practice. Experience has taught them that humans should not tamper with the rivers. Again, people at the grass-roots level have not been consulted during the conception and implementation of the project.

Narayanganj-Narsingdi Irrigation Project

The Narayanganj-Narsingdi Irrigation Project, situated a few kilometers from Bangladesh's capital, Dhaka, is another typical Water Development Board flood control, drainage and irrigation project. The project was commissioned in June 1994 with the following objectives:

- to turn the areas along the banks of the Sitalakhya into flood-free zones;
- to bring the area under intensive irrigation; and
- to drain off excess water to avoid water logging.

A tour of the area shows that these objectives have not been met. Parts of the area remain water logged due to faulty design. The local people were again not consulted during any phase of the project. This typical top-down approach has resulted in the local water-user groups refusing to take over management with the withdrawal of the Water Development Board. They regard it as ill-conceived and at odds with their local knowledge and practices regarding the management of floods.

Destructive shrimp cultivation

In the past one and a half decades shrimp ponds have destroyed a unique mangrove forest in Chokoria Sundarban, Coxs Bazar district, in Southeast Bangladesh. Shrimps, living in brackish water, need large saline ponds to survive. People lease and clear land for shrimp cultivation but this unplanned and unscientific commercial shrimp cultivation is taking its toll on the environment. Faulty fry collection is destructive of biodiversity, disease often attacks the shrimps and fish diversity is being increasingly threatened. Little or no regard is paid to traditional shrimp farming practices. Shrimp cultivation has also changed the social fabric of the area. In return for lease money, local landowners are ousted by outside commercial interests. Some poor rice farmers are forced to become fishermen or work as labourers and the resulting social clashes have been destructive. The local people should have been consulted before the introduction of this commercial product. They support designated areas for shrimp cultivation, building on traditional knowledge of their region and more environment-friendly 'sweet water' shrimp farming. They would have prevented today's problems.

Conclusion

Experience shows that failure to consult people at the grass-roots level results in many development projects becoming "development disasters". The question is are we planning for the people or with the people? We need to evolve a bottom-up planning process, one that recognises indigenous knowledge, experience and practices as a useful resource. We should place people at the centre of their own development. They should be involved in all stages of project planning, implementation and evaluation. Politicians, policy planners and implementers must be made aware of the adverse effects of projects that are planned without the full consideration of the population and local environment.

6 Investigating Indigenous Knowledge: A Review of the Bangladeshi Literature on Natural Resources

Dwijen Mallick

BANGLADESH POSSESSES a rich heritage of indigenous knowledge through which people try to manage their production systems on the floodplain exploiting land, fisheries, livestock and forests, to earn their livelihoods. Their floodplain production systems are unique examples of agroecological systems at the land/water interface, supporting a high-density population (Barr *et al.* 1996*a*). But much of this knowledge has been lost with the 'modernisation' of agriculture and the rapid spread of new technology. This literature review focuses mainly on indigenous knowledge in relation to the natural resources of the floodplain of Bangladesh, including terrestrial and aquatic resources i.e. those exploited in agriculture, fisheries and forestry. It presents information on traditional farming systems, fishing and local environmental management practices and ideas from the resource user's perspective, particularly those of poor farmers and fishers.[1]

There is growing consensus among development practitioners and academics that due respect should be given to indigenous knowledge (IK) whilst planning and implementing development programmes, for different sectors such as agriculture, fisheries, forestry etc., and also for a country or region. Indigenous knowledge is understood here as the local and traditional knowledge used by rural people in all aspects of daily life including natural resource management, agriculture, fisheries, livestock raising, health practices and other activities relating to their livelihoods. There is increasing interest in the contribution indigenous knowledge has to make to sustainable resources management and agricultural development. The indigenous knowledge of a farming population living in a specific area is derived from people's past experiences; it is the knowledge handed down from previous generations together with that of the present generation.

Sillitoe *et al.* (1998) maintain that indigenous knowledge relates to any knowledge held collectively by a population, which informs understanding of the world. It may encompass knowledge of any kind/domain including that pertaining to sociocultural and natural processes. It is culturally relative, being informed by people's sociocultural tradition and history of which it is an integral part. Chambers expressed his interest in indigenous knowledge for rural development from the early 1980s (e.g. Chambers 1983). The main thrust to his argument is that farmers have an intricate and detailed knowledge of their environment from which they earn their livelihoods through experimentation and innovation. Such indigenous knowledge should not be viewed as a constraint, but as a positive resource for development and for social development in promoting participation and empowerment.

Since the 1980s, these has been a growing recognition that indigenous people have their own effective "science" and resource-use practices. Development practitioners can build upon this knowledge. To achieve this goal and improve productivity and sustainability of Bangladesh's agriculture, it is first necessary to understand indigenous knowledge and practices and then integrate this local knowledge with modern knowledge. A meaningful blending of indigenous knowledge and modern knowledge could ensure agricultural productivity and sustainability.

The importance of a literature search on indigenous knowledge

This literature search is an attempt to systematically document people's knowledge relating to their organisation of farming and fishing practices and associated activities to ensure their livelihoods. There is a serious lack of written material on indigenous knowledge and technologies in Bangladesh. Whilst searching the literature, few relevant articles, reports and papers were found. However a summary of the available literature demonstrates how people of the floodplain use their local knowledge in agriculture: to select crops, preserve seeds, manage soil fertility, control pests, manage home gardens and orchard production, to rear livestock and so on; and also in fishing, where small-scale production depends mainly on local fishing gears and associated crafts. In addition, indigenous knowledge plays an important role in rural health, weather forecasting and disaster management (e.g. floods, cyclone, droughts and riverbank erosion).

It is anticipated that the literature search will contribute to a conceptual understanding of floodplain production systems and livelihood strategies set in the context of the land/water interface ecosystem. The people of rural Bangladesh have developed different farming systems and techniques through generations of innovation and adaptation, which have been fine-tuned to the local environment, economy and sociocultural system. This study reveals that people of the floodplains have a rich store of local knowledge and associated practices, but unfortunately this knowledge base is not only poorly documented but is also fast disappearing.

Traditionally people used to live a relatively self-sufficient life in rural areas, growing the crops they needed, raising animals and collecting fuel and fodder within their own domain. But the 'modernisation' of agriculture and adoption of new technologies has resulted in dependency upon the outside world. The local heritage of knowledge is eroding. The changes brought about by the introduction of modern technologies during the last few decades have promoted environmental and socioeconomic instability on the floodplains undermining the integrity of natural resource systems. Small-scale farmers and other rural poor, who depend intimately on these natural resources for their livelihoods, have been the most adversely affected.

Once Bangladesh had more than six thousand varieties of local rice, but due to High Yield Varieties monoculture the local varieties have disappeared at an alarming rate and only 100 are presently estimated to remain (Khan 1998). It is assumed that the same applies to fisheries and forest resources. If anything, the local knowledge base is eroding faster than that of natural resources. The exploration and documentation of people's knowledge regarding natural resources and their management, farming systems and fisheries, has been too long delayed. The rationale behind this search was to contribute to furthering this work in earnest, by demonstrating the richness of the knowledge and the gap in our understanding of it and its potential for our country.

Search method

A checklist was drawn up listing the types of literature and information to be included in the survey and which sources should be explored to find them. A number of libraries were visited including those at the Bangladesh Institute of Development Studies (BIDS), the Asiatic Society of Bangladesh, some departmental libraries at Dhaka University (including Sociology, Anthropology and Bengali departments) and Dhaka Public Library. Relevant government departments were also visited (Agriculture, Fisheries, Environment) in addition to autonomous bodies including the Bangladesh Agricultural Research Council (BARC), the Bangla Academy and the libraries of some NGOs. Seeking information on indigenous knowledge, the literature search focused on accessible published works relating to livelihood strategies and the floodplain environment of Bangladesh.

The initial stages of the study were disappointing because almost nothing was found on indigenous technical knowledge in any of the libraries. However staff from the University of Durham advised me to start working with related materials which gave new direction to the study.[2] Some interesting articles on traditional aspects of farming systems including cropping patterns, seed preservation, pest control etc. were found. We also came across books and reports dealing with the coping strategies of local people following natural calamities such as floods, cyclones, drought and riverbank erosion. I discovered that some books on folklore contained relevant information on traditional agricultural practices, variations over time, the importance of water in local livelihood strategies and related cultural practices of rural peoples.

The present state of literature on indigenous knowledge

The Bangladesh Agricultural Research Council (BARC) undertook one of the earliest extensive works on indigenous technical knowledge in Bangladesh. The book entitled "*Indigenous Agricultural Tools and Equipment of Bangladesh*", published in 1982, describes the various agricultural tools and traditional appliances that have been used and are still being used in many parts of the country. The book provides detailed descriptions of equipment including local names, size, mode of operation, and the materials from which each is made. More recently, Chowdhury *et al.* (1996) compiled one of the most extensive works on indigenous technical knowledge. In their nation-wide study they reported on knowledge relating to cropping, seed preservation, pest control and so on. Approximately two hundred different indigenous techniques and practices used in agriculture, fisheries and healthcare were documented.

In his thesis "*Farmers' Use of Indigenous Technical Knowledge in the Context of Sustainable Agricultural Development*", Islam (1996) identifies a number of indigenous techniques that are still used in agriculture in the north-western part of the country, particularly in Dinajpur district. He explores the relationship between farmers' preferences for different indigenous technologies and the extent to which they are used. Of the indigenous techniques documented, 19% were used regularly and a further 46% were utilised only occasionally; the remaining 35% were rarely employed. It was also found that farmers' ages, family size, farm size and family income were correlated with their use of identified technologies. Furthermore, media exposure related positively to farmers' attitudes towards the use of indigenous technical knowledge.

In 1997 Bangladesh Academy of Agriculture (BAA) published a book entitled "*Indigenous Technologies of Agriculture in Bangladesh*" that includes information on

147 indigenous technologies used in agriculture. Practices relating to community production, harvest, post-harvest operation in crops, animals, forest and fisheries were documented. Efforts were also made to depict the background in which the technologies emerged and in which they are still being used today.

A study on Indigenous Technology for Watershed Management by a group of researchers identified 52 local technologies and practices (Sharma 1998). Most of the technologies are used for forest, water and soil conservation and intensive production systems. The tribal people residing in upland areas have employed such technologies to sustain their livelihoods for generations. The report contains descriptions of some of the tools used by upland people that differ in size, shape and function from those of the plain land people. But technologies are being transferred from the upland people to the plain land people. It was also suggested that technologies being used today should in many cases be refined, revitalised and improved to effectively contribute to watershed management and improve productivity of local resources.

Lewis *et al.* (1996) show that fish traders of Northwest Bangladesh have considerable local knowledge of fingerling collection; from producing to preserving and risk management, to travelling and trading the young fish. Researchers documented the network of fingerling trading and found that the silver seed (young fish) pass through many hands before reaching the final pond in which to be raised. Small traders are the distributors. These traders have to take care of the fingerlings and take risks while travelling by train, bus and on foot. In the process they use their indigenous knowledge. For example, fingerling traders always change the water in the *patil* (a container made of mud) before entering an area of anticipated sale. This makes the young fish appear healthier and stronger whilst also reducing the mortality rate among the fingerlings. The book effectively documents the fish trader's local knowledge and their behaviour, using participant observation as the primary research method. It provides a good understanding of the specific indigenous knowledge possessed by fish traders working within the functioning system of fish-culture.

Chadwick *et al.* (1998) provide a synthesis of previous works in the field of indigenous knowledge and techniques in a recent study entitled, "*Understanding Indigenous Knowledge: Its Role and Potential in Water Resources Management in Bangladesh*". The main aim of the study was to document indigenous knowledge relating to traditional water management practices from a regional perspective. It also reviews related issues, exploring the strengths and usefulness of indigenous knowledge for improved maintenance of local ecosystems as well as production systems.

In a pioneering early study Ahmed (1955) describes and illustrates the major fishing crafts and gears used by the fishing community in what was then East Pakistan. The *donga* used for shallow water fishing is described. The five major fishing boats are the *Balam Nauka, Chandi Nauka, Bachari Nauka, Bhesal Dingi and Kosha Nauka.* The crafts differ from district to district in shape, length, breadth, depth and other details but all share some common characteristics such as being lightly built and highly buoyant.

Tsai and Ali (1997) provide a valuable compilation containing information on different aspects of open water fish and fisheries in Bangladesh. This book deals with tropical floodplain fisheries, riparian rights and socioeconomic and policy issues pertaining to floodplain fisheries set against a historical perspective of organisations relating to inland fisheries in colonial Bengal.

Ullah (1996) in his study "*Land, Livelihood and Change in Rural Bangladesh*" documents aspects of the survival and livelihood strategies of small farmers in rural

areas. He examines the dynamics of changes in land ownership patterns. Although not directly related to indigenous knowledge, this book is useful for gaining an understanding of the livelihood strategies of rural people.

In 1996 *Unnayar Bikalpa Nirdharani Gabeshana* (Policy Research for Development Alternative) published a booklet on *Nayakrishi Andjolon* (The New Agricultural Movement) describing a recent initiative by peasants to innovate using indigenous technology. Farmers draw on indigenous knowledge to grow crops in an environmentally-friendly sustainable way. The guiding principles of *Nayakrishi* are: to increase the use of compost fertilisers over chemical fertilisers; to encourage and enhance multi-cropping, inter-cropping and mixed cropping in place of High Yield Variety mono-culture; to promote agroforestry practices; and to facilitate the use of other local familiar methods of agriculture which are eco-friendly. *Unnayar Bikalpa Nirdharani Gabeshana* (UBINIG) also produced posters protesting against the indiscriminate use of agro-chemicals. The posters urge peasants to revive traditional farming practices. The Department of Agriculture has also produced some booklets highlighting integrated pest control methods that involve local knowledge.

There are a number of rhymes and proverbs in Bengali that refer to various aspects of rural life including cropping patterns, nature and climate, seasonal changes, vernacular housing, food habits and heath-promoting behaviour. Ahmed (1974) records many such rhymes that describe how people traditionally cultivated their land, their cropping patterns, how seeds were selected and preserved and how people responded to natural events. Shahed (1988) in "*Bengal Society and Culture Reflected in Rhymes*" describes how in Middle-Age Bengal an ideal homestead had a tank, trees and surrounding cultivated plants. Islam (1990) in "*Folk Literature of Tangail Districts*" describes the seasonal rhythm and variation in the pattern of rural life over twelve months known as *Baromashi.* It includes a depiction of how traditional cropping patterns change over the year.

Key findings

The available literature demonstrates that people of the floodplains have a rich store of local knowledge. The following summary of the findings of this literature search is presented under three broad sections: local knowledge pertaining to (1) farming systems; (2) fisheries and livestock; and (3) local environmental management. It also outlines potential uses of indigenous technical knowledge in development contexts.

Farming systems

The literature shows that people widely use local knowledge and practices in soil conservation and land management, seed preparation, pest control, crop rotation, irrigation and agroforestry. Local knowledge bases and techniques have evolved through time and are adapted according to population demands and socio-environmental changes. Knowledge and skills are transferred from generation to generation. Alim (1981) noted that in traditional society, farmers' sons received an agricultural education from their fathers and neighbours with whom they lived and worked in co-operation. Daughters also received an education from their mothers and other female relatives during the course of their everyday lives.

Soil conservation and land management: Alim (1981) reports that the major rivers of Bangladesh and their tributaries deposit enormous quantities of silt beyond the river

basins and across the entire floodplain delta each year. If the flow of the rivers is obstructed or changed in any way soil fertility may decline. Local communities address the problem of soil conservation by digging drainage canals and building protective *bundhs* (temporary embankments). These *bundhs* also protect crops from damaging inundation. Farmers also plant *Dhaincha* (a shrub) in erosion prone areas. Young plants are sometimes chopped up after serving their protective function and mixed into the soil to add organic matter.

People use logs and banana leaves, stems and roots to prevent soil erosion from rainwater. The logs act as barriers and banana is often planted in erosion-prone areas. Ash is used to improve soil structure and fertility in agriculture. This is practised by upland people in shifting cultivation and plains people in broadcast *Aman* cultivation. Ash mixed into the soil helps to create humus, especially clay humus complex, provided that the clay content is high. This increases the nutrient and water holding capacity of the soil thus improving soil structure and quality.

Seed preservation and pest control: Farmers have used various traditional methods of seed preservation and pest control for generations. Alim (1981) reports that people throughout the country have developed different ways to destroy, or at least to control insects harmful to crops. The simplest and oldest method is to destroy them by hand; farmers pick off harmful insects and pull up diseased plants that nurture pests. These are frequently burned to reduce the chances of pests infesting nearby healthy plants. Many farmers use various natural repellents such as powdered *neem* leaf, tobacco *biskatali (Polygonun hydropiper)* and ash to protect seeds and plants from insect attack. For example, farmers in Gazipur and Rajshahi use *neem* leaf-powder mixed with water that is sprayed onto plants to repel insects from rice fields. Farmers in Gazipur have developed an innovative method for controlling caterpillar attacks on cabbage, cauliflower and *brinjal*, by digging a deep circular trench in the soil around the plants. When the caterpillars approach the plants they cannot reach them because of the trenches, "appear to get frightened" and move on. Householders protect seedlings and saplings of various fruit trees from grazing animals by applying liquid cow-dung to their stems. Potatoes are protected from tuber moth attack by covering them with layers of dry sand and rice husk. Farmers in Joydebpur push bamboo sticks or small branches into their rice fields to attract insect-eating birds to their paddies (Chowdhury *et al.* 1996). Water from *hookahs* (a type of water pipe) is sprinkled onto plants to repel the 'rice bug'. Farmers of Sunamganj control pests by making a thick 'rope' from paddy straw soaked in kerosene, which is then dragged over paddy fields several times. They say the odour of kerosene repels insects. Also in this region women mix ash with kerosene and spread it over the leaves of vegetables to control aphid infestation. Such practices lessen the need to use chemical pesticides.

Seed preservation: Farmers regularly use earthen pots and pitchers to store wheat, chickpea and paddy seed. In Sunamganj and other areas rhizomes of ginger and turmeric and tubers of garlic are spread thinly on bamboo trays and covered with clean dry sand. Farmers preserve bottle gourd seeds by keeping them sun-dried inside the fruit (see also Shah and Nuri, this volume). Selected gourds are kept on the vine and when the season is over they are exposed to strong sunlight for thorough drying. When the inner pulp dries up completely the seeds rattle inside when the shell is shaken. The gourds, with seeds inside, are stored in a dry corner of the house. At sowing time a small cut is made in the upper part of the fruit and the seeds shaken out. In this way germination capacity is fully retained (Islam 1996).

Cropping patterns: Farmers have experimented over time with growing crops in many combinations in mixed cropping adapting to soil conditions, land type and climatic variation in different regions. Cropping systems particularly adapted to rainfall regimes are continuing in areas of the country where irrigation is not available. The practice of mixed cropping helps to conserve soil fertility whilst also maintaining biodiversity in the ecosystem. Chowdhury (1996) reports that farmers in different regions follow various techniques of multiple cropping strategies according to local socio-environmental conditions. For example:

- relaying potato with pointed gourd, sweet gourd or pepper;
- intercropping potato and bitter gourd or leafy vegetables;
- intercropping vegetables like cauliflower, cabbage, tomato, *brinjal* etc. with sugarcane.

Farmers may cultivate a range of crops on the same plot of land in different seasons (Alim 1981). In the past, instead of only two rice crops as today (*boro* and *amon*), many rice varieties and jute were cultivated in the *kharip* (summer and rainy season) and pulses, oil seeds, root crops, wheat, barley, tobacco and many other vegetables in the *rabi* (winter season). Farmers scatter seeds of jute after one or two showers in April and May. The jute is harvested after 3 to 4 months and then *amon* rice is planted during the monsoon. The *amon* rice is harvested in November-December and then pulses, oil seed, millet, and vegetables are cultivated in the almost rain-free winter season.

Chowdhury (1996) reported that farmers of central Bangladesh, particularly in Narayanganj, traditionally practice effective relay cropping sequences; seedling and seeds of pointed gourd, sweet gourd, bitter gourd, water melon and musk melon are planted in the potato field during November and December before the potato harvest. After the harvesting of these vegetables and fruits, local *aman* rice seeds are sown. This practice reduces the time for land preparation and allows maximum usage of land. Farmers also practice intercropping, raising ridges over the potato crop and sowing wheat seeds of the *kanchan* variety and sometimes, *napa sak* and *lalsak* into the furrows. Cauliflower, cabbage, tomato and red amaranth are also grown as short-term intercrops in sugarcane fields.

Irrigation: Hassan (1996) reports that rainwater harvesting is important to supplement water supplies for both domestic and agricultural purposes during dry periods, due to it being technically, economically and ecologically sound. Rural people intercept and collect rainwater in two ways: roof catchment and ground catchment. Reasonably pure water can be collected from house roofs made of corrugated galvanised iron sheets. Such water is used mainly for domestic purposes and for irrigating homestead gardens. Rainwater collected in ground catchments such as ponds and canals is used for agriculture.

Farmers use different kinds of local tools and equipment for small-scale irrigation. A book entitled *Indigenous Agricultural Tools and Equipment of Bangladesh* (BARC 1982) reported that the Swing basket is a common traditional device for irrigating water in rural areas. This is a simple device triangular in shape and generally made of a bamboo woven sheet fastened with sticks. (Today plane iron sheets are sometimes used instead). Two people are required to operate it. Another example of irrigation equipment used extensively by farmers to lift water from ditches and canals is the *done*, made mainly of wood. Its shape is like a channel section a few feet in length with one end slightly curved and closed. The appliance is fitted to bamboo cross bars

with a long bamboo pole which works as a fulcrum. A counter weight is added to facilitate the working of the *done* with minimum exertion (BARC 1982).

Ali (1997) reported that local people of Munshiganj, Comilla and Rajshahi districts use mulch to conserve soil moisture for potato cultivation. After planting seed tubers the farmers cover the fields with rice straw or water hyacinth and allow the plants to grow until they reach a stage of first earthing up. This practice helps conserve the soil moisture and reduces irrigation for potato cultivation.

Sharma (1998) found that farmers and tribal people in upland areas employ many techniques to save water for farming and other income-generating activities. One of the age-old techniques for conserving rainwater is to build a small embankment across a canal or stream with an earth dyke (often 5m wide and 2.5 to 3.5m deep) to create a reservoir. The catchment of the reservoir is often 80-90 ha. In the dry season the water is used for irrigating the lower and nearby agricultural fields. Aquaculture and duckling rearing is practiced along with small irrigation. This indigenous technique enhances efficiency of water use and helps maintain availability of water throughout the year.

The cropping systems practiced until very recently in many parts of the country depended upon natural rainfall (Alim 1981). After one or two showers in the months of March and April, rice and jute seeds were sown. These crops were harvested after 3-4 months during the monsoon. *Amon* was then transplanted in the months of July and August, sometimes sown with *aus* rice as a mixed crop. After the rice harvest, pulses, oilseed, millet and different kinds of vegetables were grown as the monsoon water receded. Good rainfall meant good crops but with little rainfall crops suffered, resulting in famine. In areas of scanty rainfall people would use rainwater stored in tanks and canals to irrigate crops.

During the dry season farmers pull a rope across the rice field early in the morning so that the drops of dew accumulated on the leaves during the nightfall moisten the soil. Raw cow-dung is diluted in water and sprinkled in paddy fields during the dry season thereby increasing the water retaining capacity of the soil (Chowdhury 1996).

Agroforestry: fuel and fodder: Agroforestry in Bangladesh, particularly surrounding the homestead, plays a vital role in providing fuel, fodder, fruits and timber for rural households. People grow trees to protect their houses from severe winds, storms, erosion etc. Homesteads generally have a range of trees and bamboos, although these are recently decreasing due to population growth and endemic poverty, stripping regions of natural resources.

People also cultivate trees and shrubs around the borders of their farmland to mark the boundary, maintain it after floodwaters recede, and to provide fuel and fruit. The trees trap ground water and help alleviate the effects of drought. Traditionally farmers followed a range of agroforestry practices around the country (Chowdhury *et al.* 1993). They cultivated a wide variety of trees around their homesteads and fields. In Tangail as many as 52 different species have been identified around the homestead. The needs and preferences of the family, together with local environmental factors, determine the selection of tree species. Trees and shrubs also produce nutritious fodder for livestock; for example, the leaves of jackfruit trees, provide an abundant supply of valuable feed for livestock during times of scarcity.

Sharma (1998) reported that in home-gardens fruit trees are preferred to timber and forest trees. More multipurpose trees are raised in the homestead. The land around the dwelling houses and huts is more intensively used for cultivating, for example, vegetables, fruits and betel nuts. Raising bamboo and other bushes protects the slopes

around the homesteads. Such agroforestry practices ensure increased productivity as well as conservation of the soil.

Fisheries and livestock

Fisheries: Fish contributes a substantial amount of protein to the Bangladeshi diet, and about 10% of rural people live by fishing. The major fish resources include rivers, and perennial waterbodies (*haors, baors, beels*) on the floodplains. People continue to catch fish using traditional fishing crafts and techniques, developed over generations. People fish with their hands, spears, traps and nets. All the technologies used in the fishing sector are mostly indigenous and to date no modern fishing technology has entered into the arena of inland fishing in Bangladesh.

Alam *et al.* (1997) provide a valuable overview of the indigenous fishing technologies utilised in Bangladesh, including insights into management strategies associated with different waterbodies. A total of 51 types of fishing gear are reported. Gears used change with the seasons, according to flood conditions, target species and size of fish (Tsai and Ali 1997). Ahmed (1955) describes the principal fishing crafts and gears used by what was then the East Pakistani fishing community. All are locally made. Fishing boats depend on rowing, punting and sculling, the current and sometimes sails for propulsion. Fishers use comparatively big boats for fishing in large rivers and open waterbodies and small ones for fishing on narrow and shallow waterbodies like canals and *beels* (Jansen *et al.* 1989). Many different kinds of nets are used (see also Islam *et al.*, this volume).

Indigenous knowledge features in many spheres of aquaculture (Chadwick *et al.* 1998; Lewis *et al.* 1993; Lewis *et al.* 1996). This concerns two broad categories: production and trade. Production knowledge relates to the best locations, times and means of collecting wild hatchlings and how to handle them (i.e., correct temperature, most suitable feed etc.). It also concerns pond maintenance, feeding of fish, harvesting and treating disease. Trade concerns the sale and transport of eggs, fry and fingerlings, and later the harvested fish via formal and informal networks of fish traders and merchants. In many areas fish are dried, salted or fermented as a means of preservation.

In Lalmonirhat farmers frequently grind up the intestines of livestock (cattle, goats and poultry) to use as feed for fish in ponds. In Joydebpur fish are fed on termite eggs; carp sp., particularly *rui, katla* and *thai saputi,* are particularly fond of these. A common practice is the application of lime to ponds and *pagar* (small ponds lacking strong embankments) to clear unclean water. Many people add fragments of banana plant pseudostems to ponds to clear algal growth on the water's surface.

In Sunamganj rice husk is the preferred fish feed. After cleaning poultry runs, the droppings are fed to fish. Further fish cultivation techniques include:

- putting cow-dung into ponds instead of chemical fertilisers to increase fish production;
- stirring up the bottom of the pond by dragging a fishing net across it to increase food availability;
- putting lime, banana plants or *neem* tree branches into the water to prevent fish diseases; and
- spreading kerosene over aquatic weeds to destroy them (Chowdhury 1996).

Muniruddin (1997) found that many fish farmers place and fix a number of bamboo-tops and branches of trees in the middle of the pond where fish are raised. Whilst

swimming the fish rub their bodies against the sticks and branches. It is thought that this rubbing of the body stimulates and enhances growth. Fish farmers also grow water lilies in ponds as they believe that the broad leaf of the lily provides shade and helps to keep the pond water relatively cool. This is congenial for the growth of fish.

Livestock rearing: Livestock supplies a considerable proportion of protein to people's diets. Archaeological evidence shows that people have raised goats and cattle for thousands of years. They not only eat the meat and drink the milk of cattle but also use the animals as draught power for ploughing the land. Livestock and poultry also produce manure and fuel for farmers. People collect snails from crop fields, break the shells and cut the flesh into small pieces to feed to young ducklings. This quality protein promotes rapid growth in the ducklings (Chowdhury 1996).

Farmers have a range of indigenous veterinary practices to treat different animal diseases (see Bandyopandhy and Shah 1998; Chowdhury *et al.* 1996). For example farmers in Tangail feed leafy branches of fresh *Lantana camara* to cattle to cure gas formation and poor digestion. They also use juice extracts of *shati (Cercuma amada)* leaves, raw turmeric and ginger to treat this condition. Warm boiled rice mixed with paddy husk is often fed to cattle to remedy poor digestion. An ointment called *dade* made from *motihari* tobacco and *pathar chun* is applied to cure infected sores on the haunches of draft animals. Two types of medicine are used to treat cattle affected by a disease that causes the throat to swell so that they cannot swallow food; one is applied externally, the other administered orally. The medicine, used externally, is made with the stalks of aroids cut into pieces, mashed and mixed together with mud spilled by crabs. This is heated with water in an earthen pot and then smeared onto the swollen throat 3 or 4 times daily. The oral remedy is made by crushing *neem* leaves and bitter gourd leaves together (1:1 ratio) and stirred into water with a few drops of mustard oil. This is then heated and the liquid fed to affected cows whilst inserting wild aroid leaf stalks into the throat to clear the passageway. When hens develop the habit of sitting in the same place after they have finished laying eggs, their next ovulation is delayed. To prevent this hens are dipped into water several times and a long feather picked from the tail inserted into the nostrils. This irritates the bird and 'cures' it of inactivity (Chowdhury *et al.* 1996).

Nayakrishi

As mentioned above, *Unnayar Birkalpa Nirdharani Gabeshana* (UBINIG), a policy research organisation for alternative development, has established an innovative project known as *Nayakrishi* (meaning 'New Agriculture') to revive traditional farming practices in three rural areas: Tangail, Pabna and Cox's Bazar. It is a peasant initiative motivated and organised by UBINIG that aims to produce healthy food, an unpolluted environment and a better life for rural people. The principal aims of *Nayakrishi* are to increase the use of organic fertilisers instead of chemical fertilisers and to increase multicropping, intercropping and mixed cropping in place of High Yield Variety monoculture. The movement also encourages agroforestry and other eco-friendly local aspects of agriculture (see UBINIG 1996).

The initiative is gaining in popularity among poor farmers. This was seen in an assembly of peasants in Tangail (February 1998) supporting mixed cropping, and the use of organic fertilisers. Mrs Sameda Yasmeen, a representative of the *Nayakrishi* peasant group said, "We cultivate vegetables and fruit trees in the homesteads. We do

not use chemical fertilisers and pesticides, rather we apply composed manure prepared by ourselves" (Baral 1998).

Local environmental management

Flood and weather forecasting: The people of Bangladesh depend on their local knowledge to cope with the extremes of the country's climate such as flooding, cyclones, drought etc. Many believe that floods are a blessing as well as a curse. Rural people are faced with floods every year and are accustomed to living with them. Although usually moderate, floods are sometimes devastating and people have developed a range of coping strategies (e.g. Schmuck 1996). Floods are divided into two types: *Borsha* (normal flooding due to monsoon rain) and *Bonna* (abnormal flood due to heavy rainfall and up-stream flow). People say that *Borsha* is necessary for agriculture and fisheries and view it as good for rural livelihoods, but *Bonna* is seen as harmful. Ullah (1991) and Huq and Das (1989) list a number of local strategies devised to help people cope with natural disasters like floods. When floodwaters begin to rise people move food and essential goods to safer places well above the water level. Children are often sent to nearby public buildings. Communities help each other, adopting common strategies to overcome their difficulties. In this way collective action is taken, providing a source of strength and a guiding principal for survival during crisis. People take shelter on comparatively high land and also move cattle onto the nearest roads, embankments etc. During severe floods, as in 1988 and 1998, people construct *macha* (platforms of bamboo) when the floodwater covers the floor of their home. They sleep and store their important material goods on top of these. The platforms are raised as the water level rises. Cereals and seeds are stored and preserved in large earthen pots known as *chari* during flooding and heavy rain. When the flood level drops the land is quickly prepared for early short-term crops. Farmers take seedlings nurtured on higher land and plant them as the water recedes on lower land.

Signs of impending rain include: thick clouds and lightening in the north-east combined with the moon having a 'halo'; streaks of lightening in the east with a rainbow in the west and high winds from the north; north-westerly and southerly winds; and ants building mounds. No rain is signalled by: a wind from the south-west; the frequent formation of a halo around the sun and moon; a rainbow in the east with the occurrence of clouds followed by the sky remaining clear at night; and the sun 'hiding behind the clouds'. Ahmed *et al.* (1996) discovered some folklore sayings and rhymes about the weather and occurrence of rain. One rhyme states that if the weather remains very dry in the month of *Chaitra* (March to April), storms and thunder will follow in the month of *Baishakh* (April to May). Another claims that if the sky remains clear in the month of *Jaishta* (May to June), there will be heavy rain during the monsoon.

Riverbank erosion: The displacement of population due to erosion is a common phenomenon in Bangladesh. About one million people are directly affected by riverbank erosion every year. People's perceptions and awareness of erosion plays a profound role in their preparation and adjustment, particularly for those living in high-risk areas. These people adopt indigenous strategies to cope. An investigation of indigenous adjustment strategies to riverbank erosion hazards (Mamun 1996) concluded that inhabitants of the floodplain are reluctant to take measures to control or intervene directly, which would often prove futile. Instead, they tend to adopt reduction of loss

strategies through investment in moveable assets and insurance through the maintenance of social ties and group coherence. Many argue that the Government could better serve the population by redirecting resources towards the reinforcement of indigenous adjustment strategies.

Drought management: Drought occurs on the floodplain during the pre-monsoon period of low rainfall when evaporation losses are high and soil moisture is greatly decreased. This hampers crop production. Farmers prepare their land early to combat this problem as they know that young plants need reasonable topsoil moisture levels to survive and once established the plant-roots can explore the soil for moisture. Crops differ in their demand for water and farmers are aware of those that are more drought-tolerant. For example, farmers in many areas of the floodplain grow *aus* rice from seed in preference to transplanted *aus* because it requires less moisture (Brammer 1997). Another technique is to ladder fields of local *aus* rice and wheat when the seedlings are between 15 to 20 days old as this increases yield (Islam 1996). A local variety of *brinjal* with thorns on the stem and leaves that allow minimal water loss through transpiration is favoured in the dry season. Farmers heap extra soil around the plant stems to reduce evaporative water loss.

Rural health practices: Many people in rural Bangladesh depend on local medicinal plants and practices (see Begum *et al.*, this volume; Rahman *et al.*, this volume). The following are a few examples to give the reader some idea of this pharmacopoeia. *Telakucha* (*Coccinea cordifolia*) is a wild herb found in the backyard 'jungle' around many rural homesteads. It keeps the body cool and free from skin diseases. Women gather and cook the leaves with other leafy vegetables and either small or dried fish or mixed with a boiled mash of *lata* fish. People apply the fresh leaf extract to their foreheads as a cure for headache. Dried leaves are stored in tin containers for frying and making a mash eaten with rice. When heated slightly, the leaves aid problems associated with blood-sugar levels. In Tangail region, diabetics consume five to six leaves daily after lunch. Fresh *tulshi* (*Ocimum americanum*) leaf extract is popular as a cure for the common cold. Mothers who are breast-feeding, unless sick or incapable, eat certain foods to increase milk production such as black cumin smash with warm rice, curry made of catfish and bottle gourd and rice made with milk. During the winter mothers frequently massage their babies with mustard oil mixed with camphor or garlic and lay them in the gentle sunlight to cure coughs and aches. They mix burnt, powdered *sohaga* with pure honey and apply to babies' tongues to cure fungal thrush. In many areas of the country, women regularly serve *thankuni* (*Centella asiatica*) runner leaf smash as a lunch time meal as this is an effective preventative against digestive problems. It also helps to maintain a healthy appetite in people of all ages. Women follow many local health and household hygiene practices. They also follow a number of traditional methods of water purification, as they are aware that water taken from tanks and wells is often contaminated with bacteria, silt and floating solid particles (Chadwick *et al.* 1998). They filter water through a filtering cloth and also boil it thus destroying micro-organisms.

Conclusion

This review indicates that Bangladesh possesses a rich heritage of indigenous knowledge, though much has been lost during the 'modernisation' of agriculture. Rural people continue to maintain many practices, beliefs and traditions. Agriculture

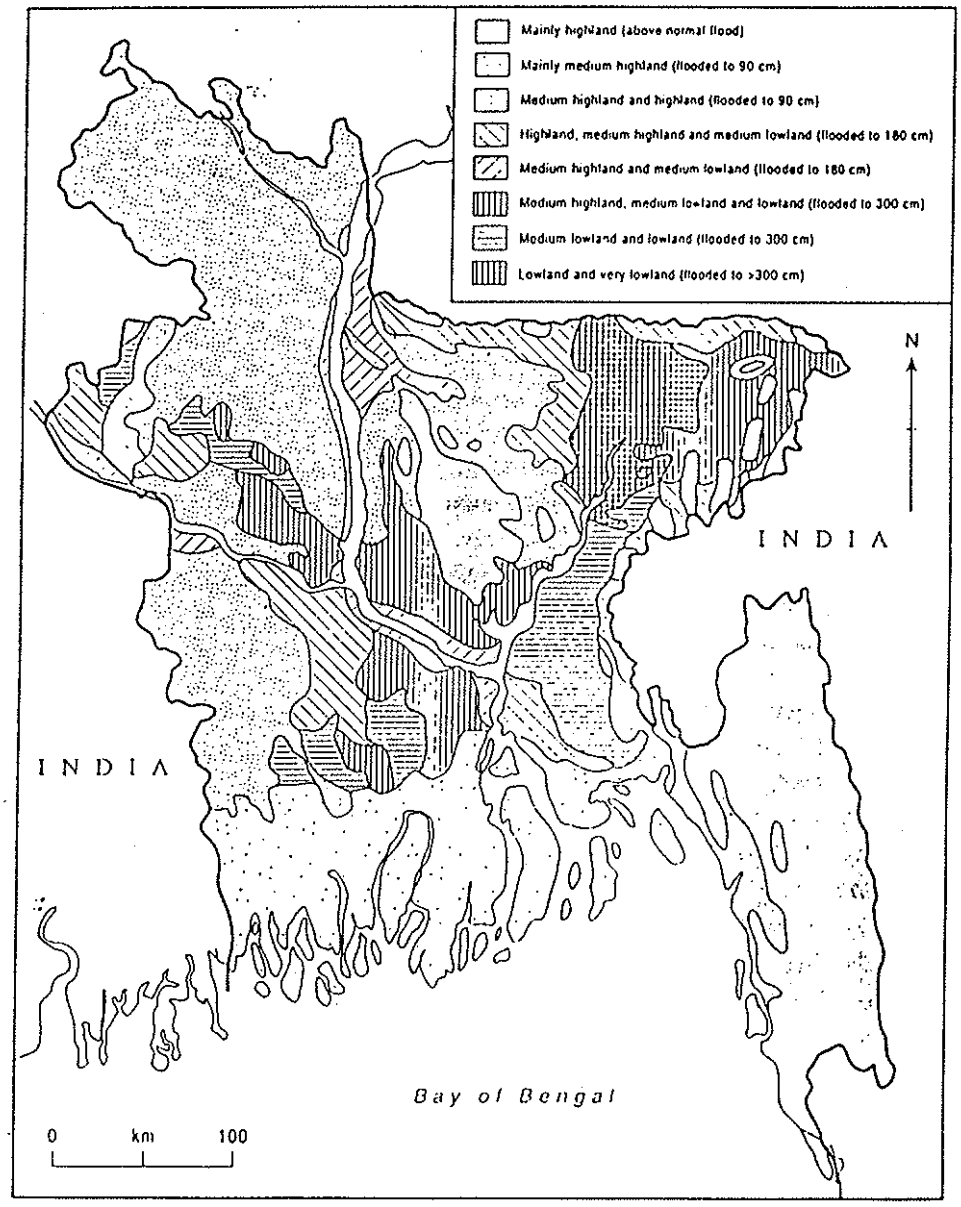

Figure 6.1 Map of Bangladesh showing extent of flooding during monsoon (after Brammer 1996)

remains the main occupation for the majority of the population and technologies that have been practiced for thousands of years continue to be utilised. Indigenous agricultural technologies are characterised by long-term risk-minimising strategies within the farmer's control. These ensure survival even during times of natural disaster such as floods, droughts, cyclones and tornadoes. They can help withstand market fluctuations, a regular occurrence in Bangladesh.

The literature documents how people of the floodplains draw on their local agricultural knowledge in selecting crops, preserving seeds, conserving soil, controlling pests, maintaining orchards, and so on. This knowledge is also employed for livestock rearing practices, veterinary medicine and small-scale fishing with indigenous fishing gears and locally constructed boats. Furthermore local knowledge is important for environmental management and rural healthcare.

In order to feed a growing population, modern agricultural technologies (including High Yield Variety seed, chemical fertiliser and pesticides and tube-well irrigation technology) have been widely adopted in recent decades and have increased crop yields many times over. But the extensive introduction of High Yield Varieties and associated agricultural technology promoted by top-down development strategies and programmes, has destroyed many local agricultural practices and the corresponding knowledge base that was fine-tuned with local ecological systems. It is time to capture and document properly the indigenous knowledge that our ancestors have developed over countless generations. The different ways in which people earn their livelihoods through farming, fisheries and other activities, need to be recorded urgently in order to prevent total loss. The *Unnayar Birkalpa Nirdharani Gabeshana* (mentioned earlier) has taken encouraging steps to revive traditional farming practices. Further action research is required to this end.

Notes

1 This chapter is part of a literature review and annotated bibliography for a project investigating "*Indigenous knowledge and Natural Resources Research in the Floodplain Production System in Bangladesh*". The purpose is to contribute to a more comprehensive understanding of local agricultural and environmental knowledge in relation to the floodplain production systems and rural livelihood strategies in Bangladesh. The study, undertaken by the University of Durham in association with the Bangladesh Centre for Advanced Studies (BCAS), was funded by the Department for International Development, UK.

2 My thanks to Peter Dixon and Paul Sillitoe.

PART 2 INDIGENOUS KNOWLEDGE AND AGROFORESTRY

7 Use of Indigenous Knowledge in the Sustainable Development of Bangladeshi Farm Forestry

M. A. Quddus

IN THE ABSENCE OF SUFFICIENT NATURAL FORESTS, more than 50% of timber, 85% of fuelwood and 90% of bamboo used in Bangladesh comes from trees and shrubs grown by people on their farms, predominantly around their homesteads. This is known as "farm forestry". The homestead plots also provide most of the fruit and vegetables produced and consumed by the country, and contain many medicinal and other under-utilised plants. Unfortunately, due to increasing population pressure and the consequent over-exploitation, these homestead resources are becoming increasingly depleted. This includes the disappearance of many native species of plants, particularly ones that are lesser-known and under-utilised. Many native species are already extinct and many others are under threat. Although the government and NGOs are now quite active in tree planting campaigns, little has been done to restore and conserve the biodiversity of homestead woodlands.

Foresters and agriculturists lack sufficient knowledge of the ecology of the native species of plants to manage them effectively. The rural population's indigenous knowledge should be used in the design and launch of research and development programmes to restore and conserve the biodiversity of these wooded areas and to augment their productivity. This chapter describes some of the indigenous farm forestry knowledge and practices of Bangladeshi farmers and indicates the scope of utilising these to promote sustainable development. It also highlights policy and programme interventions that are needed to achieve this end. The suggested interventions include: identification and documentation of indigenous knowledge, launching indigenous knowledge-based research and development activities, and the training of research and development workers in related research techniques. It emphasises the need for the establishment of a data bank and a network of indigenous knowledge workers for effective research and development.

Bangladesh has only 2.19 million of its total 14.4 million ha. of land (i.e. 15.2% of total area) under state-owned forest. Furthermore, due to over-exploitation and poor management, the state forests have been depleted to such an extent that their actual tree cover is not more than 6-7%. These forests produced less than 50% of timber and 15% of fuelwood used in Bangladesh in the years 1986-87 with the remainder coming from farm woodlands (Bhuiyan 1994). The total area of homestead woodlands is about 0.27 million ha., approximately one-eleventh of the state forest area, yet it produces about four times more in terms of total volume of wood. Aside from timber and fuelwood, the homestead forests supply about 90% of all bamboo (Bhuiyan 1994) and almost all of the tree fruits consumed in the country. The traditional homestead forests of Bangladesh are not only highly productive, they are rich in species diversity.

Abedin and Quddus (1990*b*) recorded 49 different tree species in the homesteads of a village in Tangail district, central Bangladesh, and 34 species in the homesteads of a village in Ishurdi in the northwest. There were many other cultivated and naturally occurring herbs and shrubs in addition to these trees.

Bangladesh currently has a population of more than 120 million. Due to increasing population pressure and consequent over-exploitation, homestead woodlands are being depleted at an estimated annual rate of 10% (Bhuiyan 1994). As a result the gap between the demand and supply for various tree products is increasing. In the face of an acute shortage of fuelwood, people burn cow dung and crop residues, reducing the recycling of organic matter to the soil. This consequently affects productivity and the sustainability of crop cultivation. Bhuiyan (1994) estimates that 34% of the cow dung and 38% of the crop residues produced in the country in 1986-87 was used as domestic fuel. A silent but perhaps more insidious consequence of the depletion of homestead woodlands is the loss of biodiversity.

To combat this crisis, the government and many NGOs in Bangladesh are attempting to increase tree planting in rural areas, including farmers' home gardens, through motivational campaigns, training on nursery techniques, and other extension support. The campaigns have increased awareness, but diversity continues to decline because the species that farmers are now planting are those available from local nurseries where the range is substantially less than that of the traditional home gardens. Nurserymen generally receive training from a government agency or NGO in techniques applicable to common species but not for the lesser-known or rare species. In fact, there is a lack of knowledge among concerned professionals about the ecology, adaptation, and complex interactions on homestead wood plots and appropriate propagation techniques, production strategies and management practices for the numerous native plant species found there. Neither the forestry curriculum in the country or abroad, nor the vocational training facilities of the government and NGOs provide the opportunity to learn about them.

There is much to learn from indigenous knowledge systems. These may help to initiate and guide efforts to restore and conserve the biodiversity of homestead wooded holdings and to augment the overall productivity of the farm forestry sector in Bangladesh. There is considerable evidence that farmers in poorer countries have developed improved and sustainable farming practices grounded in their own knowledge and experience using locally available resources with little assistance from development workers (Haverkort 1991). Indigenous knowledge of forestry includes the farmers' understanding of the ecology, management and utilisation of various herbs, shrubs and trees in their home gardens and the practices and technologies they follow based on their knowledge, trials and experiences.

Indigenous forestry knowledge of Bangladeshi farmers

The efficient production and rich biodiversity of homestead wooded areas, which have evolved and been maintained by farmers without external inputs, are testament to their rich heritage of indigenous knowledge regarding the ecology, management and utilisation of the numerous plant species that grow there. The principal aspects of indigenous farm forestry knowledge of Bangladeshi farmers are as follows:

- farmers have an intimate knowledge of the major species of various herbs, shrubs and trees growing in their homesteads, crop fields and other places around their

villages. Many of these are not known to professional foresters or agricultural scientists. A few elderly or especially interested people in any locality know the rare or minor species, and can readily identify them, locally and elsewhere. These knowledgeable farmers can assist professionals in the identification of minor and rare species, helping to trigger conservation programmes for such species;

- local people have detailed knowledge of the ecological adaptability of different species; for example what kind of niche and microclimate species favour — dry or swampy land, in open places or in shade, and so on. Farmers have developed multi-storey home gardens that are highly productive and biologically diverse based on this knowledge;
- farmers are knowledgeable of reproductive biology and cultivation techniques; for example the best mode of propagation, and the flowering and fruiting time of the different herbs, shrubs and trees occurring in their villages. They also have a heritage of cultivation practices for various plants, including seed preservation, seed treatment, planting time and method, vegetative propagation techniques etc. Much of this is not known to professionals, especially where the minor native species are concerned;
- farmers know various uses for the different parts of various herbs, shrubs and trees. They are well informed about the relative qualities of different species for similar uses and the relative timber, fuelwood, and fodder values of different trees. Some farmers also know special uses (e.g. medicinal) of some herbs, shrubs and trees that are unknown to others, including professional foresters and agriculturists;
- the people of Bangladesh have traditional knowledge and skills regarding the efficient processing of plant products. Some of these practices are widespread while others are restricted to particular areas or known only to a few people within a village. For example, lac culture and manufacture of shellac occurs only in the district of Chapai Nawabgonj. On the other hand, preparation of herbal medicines, the making of bamboo baskets, and so on are known throughout the country, although sometimes only a few people in a village are knowledgeable.

Indigenous farm forestry practices and farmers' innovations

The farmers of Bangladesh have evolved a sophisticated range of farm forestry practices that form the basis of their indigenous knowledge, which are subject to constant updating through trials, observation and experiences. To give the reader some appreciation of the extent and sophistication of this knowledge, the following list gives a sample of some of these practices and innovations. Firstly, some indigenous farm forestry practices and innovations relating to agroforestry and tree management:

- knowledge of preferred vegetative propagation techniques for different tree species e.g., stem cuttings for *sajina*;
- application of soil mulch in bamboo groves in the spring (March-April) to induce regeneration and vigorous growth of young bamboo shoots;
- application of water hyacinth and other mulching materials at the base of coconut and other trees during the dry season to conserve soil moisture;
- the technology of lac culture on Indian plum (*Zizyphus nummularia*) trees in Nawabgonj district (Hussain *et al.* 1991);
- cropland agroforestry practices of the High Ganges Floodplain region include the deliberate retention of naturally growing *babla* (*Acacia nilotica*), date palm

(*Phoenix sylvestris*), palmyra palm (*Borassus flabellifer*) and *khair (Acacia catechu)*. These trees are maintained in sparse stands through thinning operations (Abedin *et al.* 1988);
- some farmers also plant mango (*Mangifera indica*), jackfruit (*Artocarpus heterophyllus*) and *sissoo* (*Dalbergia sissoo*) trees, regularly spacing them around their crop fields (Abedin *et al.* 1988; Aktar *et al.* 1992; Quddus 1996);
- in the Madhupur Tract, farmers plant jackfruit trees along the boundaries of their fields (Quddus 1996).

The multi-storey homestead agroforestry system found throughout Bangladesh features the cultivation of shade tolerant crops under trees in orchards. The species combination varies between locations. Some examples are:

- cultivation of taro (*Colocasia* spp.) and ginger (*Zingiber officinale*) under *sil koroi* (*Albizia procera*) trees in the Chittagong Hill Tract District (NAWG 1996);
- cultivation of turmeric (*Curcuma longa*) and ginger under bamboo (*Bambusa* spp.) and coconut (*Cocos nucifera*) trees in Barisal (NAWG 1996);
- cultivation of turmeric and ginger as under-storey crops on mahogany (*Swietenia mahogani*) plantations in Madhupur (NAWG 1996).

Some climbing vegetables are cultivated to climb up trees. Again species' combinations vary throughout the country. Some examples include:

- country bean (*Dolichos lablab*) grown on *sajina* (*Moringa oleifera*) trees in many parts of Bangladesh (NAWG 1996);
- black pepper (*Piper nigrum*) and betel leaf (*Piper betel*) grown on mahogany trees in raised plantations in Madhupur (NAWG 1996);
- yam (*Dioscorea* spp.) grown on different trees in farmers' homesteads, most commonly on non-fruit and light-crowned trees (Alamgir 1997).

Secondly, some indigenous farm forestry practices and innovations relating to pest management technologies:

- the use of dried *neem* leaves to protect stored grains from insect infestation (Rana 1997; see also Lalon, this volume);
- application of ashes to tree seedlings and vegetables to control insects;
- the use of *gabion* (a bamboo enclosure with four sides but no ceiling) to protect planted tree seedlings from goat and cattle;
- the use of cow dung solution to control damage of tree seedlings and saplings by goat and cattle;
- the use of *kaktarua* (scarecrows) and the beating of tins (as drums) to protect mature fruits in orchards (mango, litchi, banana etc.) from damage by birds;
- seasoning of bamboo by submerging in water for several days before use in construction work to prevent shrinkage and insect infestation;
- protection of bamboo poles and rafts from insect attack by coating them in coaltar or bitumen.

Thirdly, some indigenous farm forestry practices and innovations relating to processing and utilisation of tree products:

- use of timber to make furniture, wheels for carts, agricultural implements, toys and handicrafts;

- use of bamboo and cane to make furniture and handicrafts;
- use of palmyra palm leaves to make hand fans;
- use of the midribs of coconut leaves to make brooms;
- manufacture of molasses from datepalm and palmyra palm juices;
- manufacture of tannin from *khair* tree bark;
- lac processing to manufacture shellac by Nawabgonj farmers (Hussain *et al.* 1991);
- preparation of herbal medicines by *kabiraj* (herbal doctors);
- preparation of pickles from different fruits, e.g., mango, jujube, Indian olive (*Eliocarpus longifolia*) and lemon (*Citrus lemon*).

It is important to note that these indigenous know-hows and practices are not static. Farmers continuously experiment to improve on them. For example, the Village Farm Forestry Project (VFFP) has found some innovative farmers planning and trying alternative tree propagation and management techniques quite different from standard practices (Quddus *et al.* 1998). Some examples are:

- propagation of eucalyptus (*Eucalyptus camaldulensis*) using stem cuttings in Magura district (VFFP 1997);
- propagation of *chambal* (*Albizia richardiana*) through root cuttings in Jessore district (VFFP 1998*a*);
- control of an epidemic disease affecting *sissoo* trees by using diesel and kerosene in Kushtia district (VFFP 1988*b*);
- control of insect infestation in tree seedlings in a nursery by applying extracts of *bishkatali* (*Polygonum hydropiper*) leaves in Dinajpur district (VFFP 1988*c*).

Identification and documentation of such farmers' experiments and innovations may save a great deal of time for researchers and hasten the development of appropriate technological interventions.

Indigenous knowledge and sustainable farm forestry development

There is much scope for utilising indigenous knowledge for the sustainable development of farm forestry in Bangladesh (Mathias 1994). Only some of the possibilities are explored here. There has been little documentation of the occurrence, distribution, biology, use and management of many native plant species that are cultivated or maintained by rural people in different parts of the country. Agricultural and forestry students acquire no knowledge of them in their training which limits their ability to experiment and encourage the potential of these native species in their work. If farm forestry indigenous knowledge is taken seriously and documented, foresters and agriculturists can learn from it and apply any insights in their professional activities.

Indigenous knowledge has an important role to play in our efforts to restore and conserve the biodiversity of village forests in Bangladesh. Immediate steps must be taken to conserve threatened species and to restore species diversity in rural home gardens. We should identify experienced rural persons who know about the ecology and management of the lesser-known and fast disappearing species and document their knowledge. This knowledge could then be disseminated among others through participatory development programmes. The best practices of farmers' could also be disseminated among other farmers to augment productivity, helping them to improve the yield and quality of their woodlands. One area of farm forestry that could benefit from the wider dissemination of indigenous knowledge is the development and

(*Phoenix sylvestris*), palmyra palm (*Borassus flabellifer*) and *khair (Acacia catechu)*. These trees are maintained in sparse stands through thinning operations (Abedin *et al.* 1988);
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Thirdly, some indigenous farm forestry practices and innovations relating to processing and utilisation of tree products:

- use of timber to make furniture, wheels for carts, agricultural implements, toys and handicrafts;

valuable for documentation. A team of two scientists, one with a biological and the other a social science (preferably anthropological) background would be ideal for indigenous knowledge investigations. The selection of reliable informants is the key to successful indigenous knowledge identification and documentation. The gender of those who hold the indigenous knowledge under investigation may be critical, men and women frequently specialising in different domains (see Stokoe, this volume). Innovative farmer workshops could be devised for further authentication (Abedin and Haque 1991).

Further research is needed to advance on indigenous knowledge and develop more useful technology, to further improve on farmers' traditional practices. Ideally such research and development activities should be planned and conducted with the active participation of farmers so that they can evaluate the alternatives for themselves and adopt the best one(s). In fact, farmers have their own research methods, which we should strive to promote. Research and development organisations should be a catalyst for the technological development process by supplying additional information to increase the options for testing and shorten the research time. Researcher-managed on-farm trials and even on-station trials can be undertaken simultaneously when appropriate, to incorporate basic agronomic research procedures such as replication avoidance. Laboratory based research may be undertaken to establish the science underlying indigenous or farmer-innovated practices.

If entrepreneurial confidence and skills are fostered among those involved, some local farm forestry indigenous knowledge practices may be transformed into commercial activities from cottage industries. These may include the manufacturing of shellac from lac insects, making wooden tools and toys, the preparation of herbal medicines, etc. Development organisations, government and NGOs, may promote entrepreneurship helping individuals and communities to prepare projects to secure bank loans where needed. Co-operatives may be encouraged where activities are difficult for individuals to carry out alone. Research and development organisations could help communities to create formal organisations and plan and implement projects based on indigenous knowledge.

The protection of intellectual property rights should be accorded priority. Indigenous knowledge and practices with the potential for commercial use should be considered the intellectual property of the individuals or communities. We should take steps to ensure that property rights should be protected legally. Citation of the names of innovators when documenting indigenous knowledge may be one way of accrediting intellectual property. The entrepreneurial farmer or community may be prompted and assisted to register their patent and trademark so that they can take legal action for unauthorised exploitation of their knowledge and innovations.

The identification and documentation of farm forestry indigenous knowledge needs knowledge and skills in appropriate research methodologies. If such skills do not exist among the research and development staff of organisations, training should be arranged for them (e.g. in participatory methodologies, anthropological techniques, social survey procedures, etc.).

Several government agencies and NGOs are now involved in the development of the farm forestry sector; some are also marginally involved in indigenous knowledge related activities. The experiences and findings of these organisations should be exchanged to avoid unnecessary duplication and efforts should be made to integrate their work. A network for organisations interested in indigenous knowledge research and its

potential for development should be supported. We already have umbrella organisations such as the Bangladesh Agricultural Research Council (BARC) and the Bangladesh Resource Centre for Indigenous Knowledge (BARCIK; see Sen *et al.*, this volume). But they need adequate funding. Interested individuals from various organisations should support one another through a network. The indigenous knowledge network should develop and maintain a database to provide an information storage and retrieval service. It should facilitate networking between organisations, establish a central information service, and serve as a venue for activities of common interest, such as training in indigenous knowledge research methodology.

Conclusion

Research into indigenous knowledge of homestead woodlands should not be undertaken as an isolated or occasional activity; research and development organisations have often limited themselves to piecemeal studies, identifying and documenting isolated knowledge and practices but rarely looking beyond them. Rather, the goal should be to make use of indigenous knowledge to further the sustainable development of rural communities and conservation of their environments. We should strive to identify and document indigenous knowledge and local practices, undertake research to validate and develop them, and work to integrate them into the mainstream development process (Figure 7.1). There is a need here for an umbrella organisation to promote research and the utilisation of indigenous knowledge in various areas of rural development, including farm forestry. We should promote awareness, interest and motivation for indigenous knowledge research in both government and non-government organisations who routinely use a top-down and not a grass roots approach in their development programmes.

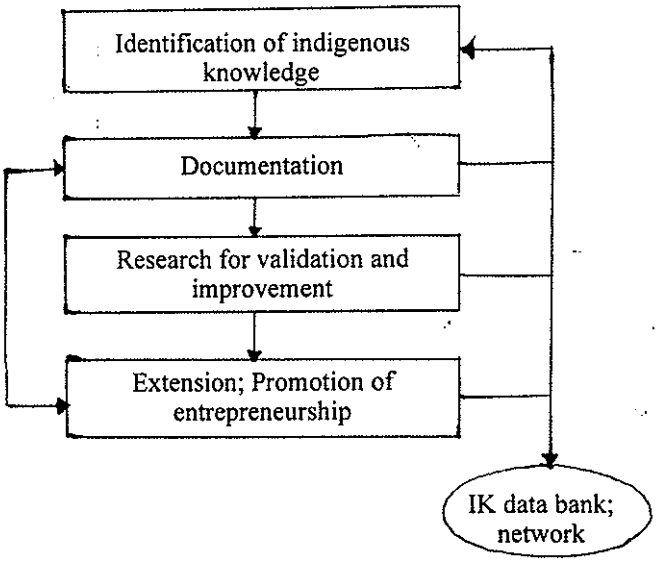

Figure 7.1 *Framework of indigenous knowledge-based research and development programme*

8 Tree Pathology and Bangladeshi Agroforestry Practices

Mohammad Abdur Rahman

APPROXIMATELY 9% OF BANGLADESH'S land is under forest. The forest areas are principally in the Sundarbans (mangrove forest), Chittagong, the Chittagong Hill Tracts and Sylhet (hill forest), Dhaka-Mymensingh (sal forest) and as village wood lots in some of the 68,000 villages scattered across the country.

Bangladesh's continuing population growth, and corresponding shortage of timber and fuelwood, is a major concern for the present and the foreseeable future. Recent research has revealed that nearly 70% of timber and 90% of fuelwood comes from villages. A huge gap exists between supply and demand of fuelwood, timber and other forest products. This has resulted in over exploitation of both state forests and village homesteads. Over exploitation of cultivable land has depleted soil fertility in much of the country. Scarcity of fuelwood has resulted in the burning of cow dung and crop residues. This too has contributed to the depleted fertility of the land.

Agroforestry is thought to be an appropriate strategy for sustainable increases in land productivity under both forest and crops. It can help satisfy people's need for fuelwood, timber and food, whilst at the same time protecting the environment and generating income opportunities (Magno 1986; Singh 1987; Dalmacio 1989). Agroforestry strengthens the economic security of poor people by diversifying their sources of income and staggering harvesting times. Agroforestry around forestland acts as a kind of 'social fencing' which protects the forest resources (Abedin and Quddus 1990*a*).

Indigenous agroforestry practices in Bangladesh include shifting cultivation of the *jhum* 'slash and burn' variety in hill forests and mixed cultivation of perennial trees and annual vegetable crops in homesteads. Additionally *Phoenix sylvestris, Acacia nilotic,* and *A. catechu* are grown on higher areas of the Gangetic flood plain, along with *Artocarpus heterophyllus* and *Mangifera indica,* which have been cultivated for centuries. Recently in the districts of Chuadanga, Meherpur and Kushtia there has been a trend towards planting *Dalbergia sissoo* trees on agricultural land. This is especially true of richer farmers. Some farmers have begun establishing plantations of *A. heterophyllus* and *P. sylvestris*. Also the planting of *A. heterophyllus* on plot boundaries has become popular in the last 15 years, especially in the Madhupur tract (Abedin and Quddus 1990*a*). In Dinajpur a number of fast growing trees are cultivated including *Eucalyptus camaldulensis, Acacia auriculiformis, A. mangium, Cassia siamea, Albizia procera* and *Dalbergia sissoo.*

Researchers from the Bangladesh Forest Research Institute have been investigating the following tree species:

- Long rotation: *Dalbergia sissoo, Eucalyptus camaldulensis, A. lebbek, Azadirachta indica, Mangifera indica and Artocarpus heterophyllus.*

- Medium rotation: *Bambusa* spp. and *Zizyphus jujuba.*
- Short rotation: *Leucaena leucocephala* and *Sesbania sesban.*

On-going research at The Bangladesh Agriculture Research Institute includes assessing multi-purpose tree species for plot boundary plantation in the High Barind Tract. The agroforestry systems promoted by the Government, NGOs and by the farmers themselves on the floodplain can be broadly categorised as follows:

- homestead agroforestry;
- agroforestry on private agricultural land;
- agroforestry in the denuded and encroached-upon public forests; and
- strip-side agroforestry.

Pathological considerations

A serious problem facing the indigenous cultivation of trees is disease. This paper reviews knowledge pertaining to some pathological conditions that affect commonly cultivated tree species and their treatment. Pathological aspects of the trees most commonly used in agroforestry systems are as follows:

Dalbergia sissoo: a large deciduous tree with a loose spreading crown that demands strong sunlight. The principle diseases affecting the tree are:

Wilt disease: A systemic disease that manifests itself during the rainy period *borosha* (July to September). Symptoms include yellowing and death of leaves in acropetal succession. Eventually the entire tree turns yellow. In the later stages of the disease the leaves drop off and the branches become increasingly bare. Affected trees die within a few months. It is likely that the disease is caused by a *Fusarium* sp. The wilting of the tree is most common on plantations with hard soils and inadequate drainage. Many local farmers appear to understand that if *Dalbergia sissoo* is grown on raised sites with lighter textured soils and adequate soil moisture where drainage is good, trees tend to grow free of this disease.

Root rot: Ganoderma lucidum causes root rot in *sissoo* trees of advanced age. The affected trees exhibit a 'stag-headed' appearance, which they may maintain for a number of years before eventually dying. The fungus is spread by root to root contact and therefore spreads most rapidly in plantations. The fungus commonly produces a sporophore at the base of dead trees. Indigenous techniques for combating the disease include digging trenches around affected trees, raising mixed plantations and removing the stumps of dead trees.

***Eucalyptus camaldulensis*:** A number of diseases affect this quick-growing tree. They include:

Damping off: This disease is a fungal rot that causes seedlings to collapse at the collar area of the plant. It is usually *Pytthium* sp., *Fusarium* sp., or *Rhizoctonia solani* that cause damping off. Indigenous techniques to avoid outbreaks include ensuring good soil drainage and avoidance of particular organic manures. Maintaining a soil pH between 5 and 6, and the application of 2% forman/copper oxychloride/Dithane M45 as a soil drench may also be useful.

Pink disease: This disease is caused by the aptly named *Corticium salmonicolor.* Pink disease causes mortality to major branches accompanied by an invasion of the stem cambium by the pathogen with resultant girdling. In severe cases this may affect the whole crown but rarely kills the tree completely. The disease is first apparent when

gum is exuded from stems or young branches. This is followed by the growth of white silky threads on the surface of the bark. As the bark dies the superficial growth dries up and pink masses of sterile mycelium appear as either pustules or crusts. The pustules may form in lines along cracks in the bark, whereas the crusts coalesce separately on the underside of branches. The disease is readily identifiable at this early, sterile stage but subsequent developments are important for the dissemination of the fungus. Indigenous control measures seem to centre on the excision and destruction of infected branches. Treatment of infected areas by fungicides (such as Bordeaux mixture) is also recommended.

Gummosis: Symptoms of this disease include swelling and splitting of the bark, which often exudes a shining golden viscous liquid. In severe cases bark may die varyingly on the main bole, exposing the wood from beneath. If the girdling is partial, the affected trees continue to live; but if complete or nearly so, the plant parts above this region usually die. Bakshi (1976) theorised that gummosis represents a reaction to a wound. With this in mind, plants should be protected from injury where possible thus minimising the risk of gummosis. Species should be planted on suitable sites to avoid damage.

Mildew: A powdery mildew caused by *Oidium eucalypti* can occur on *E. camaldulensis*. The main symptom is whitish, powdery patches on leaves. These spread and are later associated with leaf distortion and necrosis, which leads to leaf cast. Airborne condida are produced on the infected leaves. A spray of a sulphur-based fungicide, an introduced practice, helps to control the spread of the disease.

***Acacia auriculiformis*:** This is an important fast growing species that has been widely planted in Bangladesh, primarily for biomass production. The principal diseases of this tree species include:

Powdery mildew: Up to 50-70% of *Acacia auriculiformis* seedlings may be affected by this condition caused by *Oidium* spp. Although the disease does not cause plant mortality it does affect seedling development. To control powdery mildew, elemental sulphur (dust) or 0.2% MANOB can be applied every other week.

Leaf spot: On nursery seedlings and saplings of *Acacia auriculiformis* small dark brown lesions may form on the foliage. These later coalesce into large dark brown to black necrotic areas. This condition is caused by the *Colletotrichum* state of *Glomerella cingulata.*

***Artocarpus heterophyllus*:** The 'jackfruit' tree is a multi-purpose tree species and is widely planted in agroforestry systems in Bangladesh. Two new diseases of this tree are 'dieback' and 'canker', first recorded in a plantation at Dulhahazza in Chittagong during 1978 and 1979.

Dieback: The first visible symptom of dieback is a change in leaf colour from green to pale green, then light yellow, through to reddish-yellow. The older leaves fall off first followed by younger ones. This may occur on small branches, on one or more of the major branches, or on most of the crown. After the leaves fall off the branches die. Initially the small young branches die followed by the older ones. The transition zone of healthy and dead wood of a dying branch is brown in colour. The older, dead branches dry up and turn greyish white. Dieback in jackfruit trees can cause severe damage but so far no control measures, indigenous or scientific, have been discovered. Further study is required, especially considering the extent of loss due to this disease and the economic potential of the jackfruit tree as a multipurpose tree species (Rahman *et al.* 1987; Rahman 1997*a*, 1997*b*).

Canker: Canker on jackfruit trees starts as a blackening of the bark, generally at the bases of small, dead branches. The dead area gradually expands followed by a light brown discoloration and the death of sapwood underneath. As the tree increases in girth the canker-affected portion fails to show any new growth and a depression usually develops. On the bark of the dead area small, rounded, reddish-yellow fruit bodies of *Nectria haematococca* develop profusely during the monsoon. Again, we have no treatment.

Bambusa spp: Bamboo in village groves is an important resource for villagers. A large proportion of the total supply of bamboo in Bangladesh comes from these groves.

Bamboo blight: Bamboo blight is the principal disease causing severe mortality of young culms in recent years and is most severe in the greater Rajshahi, Chittagong, Comilla and Sylhet districts (in decreasing order of occurrence). *Bambusa balcooa* and *B. vulgaris* are the most severely affected bamboo species. So far, there are no grounds to suggest that cultural practices encourage the disease. Traditionally bamboo blight has been controlled by local methods such as the removal of blighted culms, burning debris in-situ in clumps in *chaitra* to *baishak* (April), adding new soil to culms before the onset of the monsoon in *baishak* (April to May). More recently this has been replaced by the application of the fungicide Dithane 45 as a soil drench (Rahman 1987*a*, 1987*b*, 1988; see also Rahman 1978; Rahman and Khisa 1981; Boa and Rahman 1983, 1987). It should be noted that the simpler cultural practices were in common usage before the popularising of western techniques. This valuable indigenous knowledge is rarely called upon today. These traditional indigenous techniques are effective and the author strongly advocates their use.

***Gmelina arborea*:** The *gamar* tree is often damaged by root rot or leaf spot.

Root rot: A moderately severe root rot of *gamar* seedlings in the nurseries of the Pulpwood Plantation Division, Kaptai occurred in 1978. *Fusarium solani* was found to be the pathogen. The problem has also been noted in strip-side plantations in north Bengal. Control of the disease is achieved by the application of Granosan M applied as a soil drench on dying and apparently healthy seedlings (Rahman *et al.* 1982; Rahman and Alam 1994).

Leaf spot: The most common foliage disease of *gamar* is *Colletotrichum* leaf spot. Initially small pinhead spots surrounded by light yellow haloes appear on mature leaves. Under high humidity, a favourable condition to the fungus, the spots enlarge. Severely affected leaves turn yellow and fall off. Isolation and pathogenicity tests confirm the presence of *Collectotrichum gloeosporioides*. This can be controlled by the application of an industrially produced copper fungicide such as copper oxychloride every week for about three weeks.

Mistletoe: Infestations of mistletoe, an angiospermic parasite, have been found to be most severe on *gamar*, teak and *malakana koroi* (*Paraserianthes falcataria*). These parasitic bushes have green foliage and small branches in rather dense clusters and are seen to grow on various parts of the crown of affected trees. The parasite is quite distinct from the host foliage. Mistletoe produces its own flowers and fruits. It absorbs water and nutrients from the host plant by way of inserting an extensive system of sinker roots into the xylem of the host. This hampers the growth of the host. As the parasite grows it engulfs the host branch and ultimately kills this part of the tree. The greater the shade and thicker the canopy cover, the less likely *gamar* will be affected by mistletoe. It is difficult to control.

***Melia azedarach*:** This tree species can be severely affected by both collar rot and heart rot.

Collar rot: Nurseries of *Melia azedarach* seedlings are sometimes affected by collar rot after a period of heavy rain. Infection occurs directly at the base of the main stem causing a rapid wilt of foliage and the subsequent death of the infected seedlings. Surviving seedlings produce new growth below the dead region. Mortality is not high but the high infection rate makes this disease problematic. Water logging must be avoided to reduce the severity of any damage. Application of 2% formalin as a soil drench may also limit damage.

Heart rot: Heart rot of twelve to fourteen year old *Melia azedarach* plantations has been reported. The pathogen is a *Phellinus* sp. The degraded logs can only be used for hardboard chips instead of veneer. Dieback caused by *Graphium* sp. also occurs. Indigenous knowledge of the problem suggests that avoidance of wet sites and selection of resistant varieties is beneficial. Heart rot affected trees should not be allowed to over mature because this serves to encourage the spread of the disease.

***Calamus guruba*:** Known locally as '*jali bet*' this species is particularly susceptible to leaf spot.

Leaf spot: This disease, first noticeable as light brown spots on leaves, is caused by the fungus *Guignardia calami*. The spots on the leaves gradually enlarge and coalesce to form dead areas. Foliage lower down in the tree can be severely affected. Outbreaks of leaf spot have been recorded on *jali bet* in nurseries at BFRI campus, Hazarikhil, among other places. The disease can be controlled by the application of the fungicide Dithane M 45 (50g in 16 litres of water) sprayed onto the foliage of the seedlings until they are soaked. Generally 2-3 weekly applications are enough to control the disease if it is diagnosed early (Rahman 1997*a*, 1997*b*).

***Anthocecephalus cadamba*:** Known locally as '*kadam*', this species can be severely affected by 'dieback'.

Dieback: In December 1987 a severe case of dieback in seedlings of *kadam* occurred in Rajshahi and a number of other nurseries under the Pulpwood Plantation Division, Kaptai. The disease began with the rotting of a certain amount of foliage. The rotting areas quickly coalesced to form a larger necrotic area that killed both young and old leaves. Since affected seedlings exhibited healthy roots it was concluded that infection was foliage-based. The fungus *Rhizoctonia solani* was found to be the cause of dieback. A specific control measure has not yet been devised for this disease but it seems likely that the application of a fungicide such as copper oxychloride in the early stages of the disease would be effective.

Conclusion

There are a range of diseases affecting commonly cultivated trees in Bangladesh and only a limited range of indigenous control measures. The control of tree pathogens is a promising area for the combination of scientific research with indigenous knowledge of forestry. Local agroforestry practices are effective but control of diseases could substantially increase production of trees, which is sorely needed. Demand for fuel, biomass, timber and so on is increasing relentlessly.

9 In Praise of the Indigenous *Neem* Tree

L. Mohammed Lalon

THE INHABITANTS OF BANGLADESH have known about the *Neem* tree since time immemorial. From the dawn of civilisation in South Asia people from all walks of life have depended on *Neem* for its beneficial qualities. Historical documents tell that the early settlers of Bengal thought of *Neem* as a life saving tree, depending on it for many purposes. They used it to combat various diseases, in addition to using it in routine household tasks. During the early period it served as an all-purpose drug. The *Neem* tree was respected by Hindu and other indigenous communities. Indeed it became an object of worship.

Knowledge about *Neem* is ancient. The oldest known texts on South Asian medicine provide information on it. In the traditional *Ayurveda* system of Indian medicine *Neem* plays a central role. There is also mention of *Neem* in the rural communities in the region. Subsequently, during the middle ages, the *Unani* system of medicine continued to recognise the beneficial effects of *Neem* in preventing and curing different diseases. In recent times *Neem* has created something of a sensation as a wonder tree; scientists from different disciplines recognise its many values. It has been discovered as a source of natural wealth for all humankind. It has many uses in addition to its traditional role as a medicine. For example, people use it as a contraceptive and also to control insects; being natural it does not have the undesirable effects of biocides.

The potential for *Neem* in Bangladesh

At present there is little scientific research on *Neem* in Bangladesh and few commercial uses have been developed for day to day life. Indeed use of *Neem* is on its way to extinction in parts of Bangladesh. Neither individuals nor any institution is preserving this traditional natural resource. We should take appropriate measures now to protect existing *Neem* trees and encourage plantations throughout the country. We should declare *Neem* a national asset of Bangladesh and encourage its many uses. The government should play a pioneering role in achieving these objectives by starting a social movement to promote awareness and motivate people to relearn about *Neem* and its uses. The entire tree is useful. The following are among the multifarious uses of *Neem*:

Leaves: These are effective against skin diseases and scabies in particular. The leaf extract is traditionally used in Bangladesh for bathing chicken pox patients. The extract also controls crop pests and insects. Tea prepared from the leaves is effective in preventing fever. Fried leaves serve as a de-worming agent.

Fruits: A favourite food of domestic fowl, meeting their nutritional needs. Oil extracted from *Neem* seeds has various traditional uses: treating skin diseases, controlling lice, and curing certain diseases in domestic animals. It also has commercial industrial uses, being used in the preparation of soap, shampoo, pesticides and a medicinal drug.

Neem *Cake*: This is used by betel leaf cultivators to prevent viral infections. It can also be used to protect crops from insect pests; spread on the land it has no harmful effects on crops or nature.

***Bark*:** An important ingredient in some drugs and medicine.

***Wood*:** Toothpicks and toothbrushes made from new growth have long been used in rural areas. *Neem* wood is in demand for making furniture and particularly doors and windows because it is so resistant to all sorts of pests.

***Honey*:** *Neem* flower honey is considered very high quality.

Neem also has a role in conserving the environment of our planet by reducing erosion, desertification and excessive temperatures. We at Rajshahi Niskrity NGO intend to start a social movement to help *Neem* to help us, now that we understand its many varied uses above other trees to the benefit of humankind. In addition to its traditional role in pest control and its wonderful capacity to heal, it can also help us to control the excessive growth of our population with its contraceptive properties. We cannot afford to lose this natural resource and associated indigenous knowledge. We must act now to preserve them.

PART 3 INDIGENOUS KNOWLEDGE AND PLANT RESOURCES

10 Indigenous Knowledge of Plant Use in a Hill Tracts Tribal Community and Its Role in Sustainable Development

M. A Rahman, Aditi Khisa, S. B. Uddin and C. C. Wilcock

IN BANGLADESH there are about nineteen major tribes of which fourteen live in the Hill Tracts districts (Chakma 1992, 1993). They include the following tribal groups: *Chakma*, *Marma*, *Murong*, *Tripura*, *Thanchumga*, *Chack*, *Bhome*, *Pangkhoa*, *Kheyang*, *Rheyang*, *Rhakhain*, *Lushai* and *Kuki*. The lifestyle, culture and language differ between each tribe (Rahman 1997*c*). These tribal communities remain dependent on the natural resources available in the forests of their hilly region for their livelihoods. They have a long historical association with the area and a rich cultural heritage distinct from the dominant Bengali population. In Bengali they are called *Pahari*. The tribes make extensive use of the biological resources of their homeland, including many wild plants. We have yet to fully document their vast store of knowledge, which together with associated indigenous practices is being lost, day by day with the advance of development and modernisation. For example the establishment of community health services in the hill areas is resulting in people discarding traditional herbal cures.

This chapter presents the results of an investigation conducted under a Biodiversity Link Project between Chittagong and Aberdeen (U.K.) universities in the Rangamati, Khagrachhari and Bandarban districts. We worked with the *Chakma* tribe, focusing on tribal knowledge and practices regarding the use of wild vascular plants, thirty-four of which were used in the treatment of diseases. We conducted an ethnobotanical survey among these tribal hill people to explore and document their indigenous knowledge of wild plants, particularly as sources of medicine but also as food and for other products. The tribal and scientific names and traditional uses of forty plant species are listed in Table 10.1.

Table 10.1: Catalogue of Chakma plants

A. Medicinal uses

	Chakma name	Specific name	Family/Colln.no	Uses
1	*Bhuti tida*	*Hedyotis corymbosa*	Rubiaceae/L654	Leaf extract is used to alleviate abdominal pains
2	*Kuduk junjuni*	*Crotalaria verrucosa*	Papilionaceae/ L1314	Leaf extract is applied to soothe skin allergies
3	*Udul pata*	*Sterculia villosa*	Sterculariaceae/ L2742	Water extract of petioles is given with sugar as a treatment for rheumatism

(Contd.)

(Continued)

	Chakma name	Specific name	Family/Colln.no	Uses
4	*Bhutta ladi*	*Dioscorea pentaphyla*	Dioscoreaceae/ L1542.A	Paste of the plant, when mixed with oil, is used to treat rheumatic diseases
5	*Aash mul gach*	*Vitex* sp.	Verbenaceae/L656.B	A paste prepared from the bark is used in the treatment of jaundice
6	*Khona gach*	*Oroxylum indicum*	Bignoniaceae	Extract is taken as a cure for jaundice. Young shoots and fruit are considered foodstuffs
7	*Ga urbo*	*Vitis* sp.	Vitaceae	Bark extract is used in a cure for jaundice. Fruit is eaten
8	*Aada thora*	*Buddleja asiatica*	Buddlejaceae/ L659.A	Paste prepared from leaves is applied to the forehead during fever
9	*Fessya gach*	*Hoya parasitica*	Asclepiadaceae/ L667.B	Leaf extract and paste are used to alleviate fever and body pains
10	*Dumurjja*	*Derris robusta*	Leguminosae/ L2473.C	Broken or wounded limbs are treated with slightly warmed leaves of these plants to reduce pain and aid healing
11	*Kuruar gach*	*Mallotus philippinensis*	Euphorbiaceae/ L2473.A	–
12	*Monriccha*	*Grewia laevigata*	Tiliaceae/ L2473.B	–
13	*Jharabbya hogoiya*	*Thevetia palmate*	Araliaceae/ L669.A	Paste prepared from roots is applied to child's penis when swollen and painful
14	*Bangori bhanga*	*Phyllanthus* sp.	Euphorbiaceae/ L1744	Leaf extract is used to treat snakebites and allergies
15	*Tengbhang gach*	*Ficus* sp.	Moraceae/ L2470	Paste prepared from roots and fruits is applied to snakebites
16	*Kura tethoi*	*Maesa ramentacea*	Myrsinaceae	Fruits are eaten. Leaf juice is given to children with symptoms of diarrhoea
17	*Shinguri phul gach*	*Nyctanthes arbortristis*	Oleaceae/ L664.B	Stem extract is taken against dysentery
18	*Asam ludi*	*Mikania micrantha*	Compositae/ L2342	Leaf extract is used to stop bleeding
19	*Ketaki*	*Mallotus roxburghii*	Euphorbiaceae/ L1554	The crushed roots of *Ketaki* and *Amaranthus spinosus* are taken with water to stop bleeding through nose and mouth
20	*Bhuth shan*	*Piper longum*	Piperaceae/ L671.A	Stem extract with hot water is given to children to treat mumps
21	*Bilai lengur*	*Uraria* sp.	Leguminosae/ L662.A	Root extract is taken to treat epilepsy
22	*Cheodhima*	*Rhynchotechum ellipticum*	Gesnariaceae/L1560	Leaf extract alleviates coughs in children
23	*Kala sona*	*Eclipta alba*	Compositae/ L1741	Paste prepared from leaves is applied to boils
24	*Koba rashun*	*Crinum asiaticum*	Amaryllidaceae/ L663	Paste prepared from roots is applied to boils

(Contd.)

(Continued)

	Chakma name	Specific name	Family/Colln.no	Uses
25	*Kobabena*	*Morinda angustifolia*	Rubiaceae/ L2466	Stem/root extract is taken with hot water to treat some urinary diseases
26	*Keta boitta shak*	*Cardiospermum helicacacum*	Sapindaceae/ L1547	A hot water extract of whole plant is given to treat chicken pox
27	*Kam gach*	*Nauclea sessilifolia*	Rubiaceae/ L1546	Paste prepared from leaves is used for the treatment of fungal or bacterial infections between toes
28	*Khar tedoi*	*Begonia roxburgiana*	Begoniaceae/ L669.B	Stem extract is used against abnormal conditions of the tongue in children
29	*Chonga dana*	*Hyptis suaveolens*	Labiatae/ L2329	Seed extract is taken for the remedy of urinary complications
30	*Deldi pata/ Del ladi*	*Thunbergia grandiflora*	Acanthaceae/ L658.A	Watered down sap of the stem is used to treat eye diseases
31	*Hajjang ludhi*	*Vitis* sp.	Vitaceae/ L1713.A	Leaf extract is applied as a remedy for eczema
32	*Hoti gach*	*Leea* sp.	Leeaceae/ L672.B	Warm paste, prepared from leaves, is applied to painful joints
33	*Jungailya shak*	*Sarcochlamys pulcherrima*	Urticacea/ L1174	A paste prepared from the leaves is used for the treatment of boils and blisters on the lips
B.	**Foods**			
34	*Bigal biji*	*Solanum torvum*	Solanaceae/L1815	Fruits and seeds are eaten
35	*But batta shak*	*Commelina diffusa*	Commelinaceae/ L1803	Leaves and stems are eaten
36	*Dutta ludi*	*Euphorbia* sp.	Euphorbiaceae/ L1179	After childbirth mother is given cooked leaves to increase lactation
37	*Kekrak shak*	*Alternanthera sessilis*	Amaranthaceae/ L1208	Vegetable foodstuff
C.	**Commercial uses**			
38	*Chakkogach*	*Acacia farnesia*	Leguminosae/ L2815	Bark extract is used as a light brown dye
39	*Ful jumuri gach*	*Anogeissus acuminata*	Combretaceae/ L2816	Bark extract is used as a brown coloured dye
D.	**Religious use**			
40	*Khila tak*	*Entada phaseoloides*	Leguminosae	A water-based extract of the seeds is sprayed on individuals to purify them after having witnessed the cremation of a dead body

There is a rich wealth of knowledge and associated practices regarding the indigenous exploitation of plant resources, unique to tribal communities and unknown to the wider Bengali community. It is imperative that this knowledge is investigated and documented. The knowledge may have potential industrial applications, leading to pharmacological developments that could help many people across the world. But care

will be needed to protect indigenous intellectual property rights (Quddus, this volume), especially in view of the gross violations of Hill Tract people's rights until recently by repressive Bangladeshi governments.

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11 Wild Vegetables: A Valuable Natural Resource for the Rural Poor

Jane Stokoe

"*Kachu-ghechu kheye bechey achi.*"

THIS IS A SAYING FREQUENTLY used by the rural poor in Bangladesh who own no land and survive on a very low income. The phrase, which refers to the collection and use of wild plant foods (which I will hereforth term 'vegetables'), means "hardly surviving on" and indicates an extreme lack of money and low social status. In the eyes of many Bengalis, these people are outcasts in society.

Despite a growing body of literature relating to development issues in rural Bangladesh, most of the research by both Bengali and Western natural resource scientists has tended to centre on rice, crop and cultured (i.e. pond aquaculture) fish production (e.g. Biswas and Mandal 1993; Mandal and Dutta 1995; Shah 1995; Ali 1997; Tsai and Ali 1997; ITDG n.d.; Gain 1998*a*). Such studies have often failed to recognise that for a growing number of rural people, research of this kind can be of little help since the poorest of the poor (the socioeconomic group most in need of help from development projects) are landless and have limited access to these resources. In addition to day labouring, rickshaw pulling and so on, these people are often dependent upon the daily collection of wild vegetables for their family's survival. That is, their food security is dependent upon food bought in the *hat* or market and/or supplemented with wild vegetables.

During the summer of 1997 I conducted field research in two rural villages: Ujankhalshi (Rajshahi District) and Agcharan (Tangail District). My objective was to examine the livelihoods of women in the homestead environment[1] paying particular attention to local woman's indigenous knowledge. During this time, the significance of wild vegetables for the daily survival of the landless poor became increasingly apparent. My informants were predominantly women from a range of socioeconomic backgrounds (defined in terms of wealth, status, and religion) and of different age classes. I collected preliminary data on the seasonality, whereabouts and usage of a variety of wild plant foods (Table 11.1). Previous research by natural scientists, often trained in botany, has not focused on wild vegetables, but rather on the biodiversity of plant life in general (e.g. Khan 1994). As far as I can ascertain no research has focused solely on wild vegetables from an anthropological perspective, i.e. to explore how these foods relate to people and their livelihoods and paying particular attention to the indigenous knowledge pertaining to this resource. This neglected area of study clearly requires further examination.

Collection of wild vegetables

A family's socioeconomic status determines how often and the reasons why wild vegetables are collected. For the very poor, these foods comprise an essential part of

Table 11.1: Preliminary data on some types of wild plant foods collected by rural people in Bangladesh

Bengali name and/or local name (LN)[a]	English translation and/or description of plant	Locality	Seasonal availability: Bengali months[b] (with English translations)	If domesticated	Usage
Bathuashak[c]	Not known (leafy green plant)	Village[d]	*Magh-Chaitra* (January-April)	No (?)	Food
Dhep (LN Agcharan)	Not known (a type of *shaluk* [seed] found inside the bud of a lotus-type aquatic flower)	Waterbodies (e.g. *beels* and ponds)	Not known	No	Food. Seeds are dried and then puffed on hot coals, stored, and eaten as a snack either loose or mixed with *gurr* (molasses/ brown sugar) into a round cake
Fen (or *Fenkhoto* or *Fenkachu*)	Not known (thin leaves)	Village, esp. by ponds, low lying ditches and dug pits	All year	Sometimes	Food
Gadha puia	Not known	Village	*Baishak* (April-May)	No (?)	Food
Ghechu[e]	Not known (a type of tuber)	Grows under water in paddy fields (needs monsoon water to grow)	Not known	No (?)	Food
Gima	Not known	Village, grows naturally in the homestead	Not known	Rarely	Food
Kacha kola	Green Banana	Village	All year	Yes	Food and Medicine, e.g. eaten during pregnancy; used to alleviate stomach upsets
Kachushak & Katchulata[f] (or *khotoshak & khotolata*)	Not known (a type of tuber, Aram and/or Taro? with green, leafy shoots)	Village and field (widely available)	*Sravan-Kartik* (July-November)	Rarely	Food and Medicine, e.g. eaten during pregnancy for high iron content; root used to cure dysentery

(Contd.)

(Continued)

Bengali name and/or local name (LN)[a]	English translation and/or description of plant	Locality	Seasonal availability: Bengali months[b] (with English translations)	If domesticated	Usage
Katakhura or *Motmoti* (LN's Ujankhalshi)	Not known (a type of Amaranth with spines. Botanical name: *Amaranthus spinosis*)	Village and field (widely available)	*Jaishtha-Ashar* (May-June) or *Sravan-Bhadra* (July-September)[g]	Not known	Food and Medicine. Mixed with leaves of *panboti* (LN Ujankhalshi; unknown plant) to cure thrush. Used to treat dysentery and tonsillitis; also used as a diuretic (pregnant women use it to reduce swelling in ankles)
Kulmigach[h] or *Kulmishak*	Not known (a tree, type of *Ipomea* ?)	Edge of *beel*[i] (widely available)	*Jaishtha-Kartik* (September-November)	No (impossible, tree is reliant on water body for growth)	Food, 2 types: 1. used as animal food; 2. used as a vegetable and as fuel
Lail (LN Ujankhalshi) *Mukhi* (LN Agcharan)	Not known (a type of tuber, Aram ?)	Village and field	All year	Yes	Food and Medicine, e.g. root used to cure dysentery; eaten during pregnancy (high in iron)
Lota or *Loti*	Stem of Aram	Village and field, esp. fallow land, ditches, dried canal beds (widely available)	All year	Yes	Food and Medicine, e.g. eaten during pregnancy (high in iron)
Mankuchur-pata	Not known (A type of Aram)	Village and field	All year	No (?)	Food and Medicine, e.g. root used to cure dysentery; eaten during pregnancy (high in iron)
Nata (LN Ujankhalshi)	Not known (similar to Amaranth)	Village and field	*Magh-Falgoon* (January-March)	Not known	Food
Pipularpata	Not known (similar shaped leaf to betel leaf but smaller and hot tasting like *morich* [chilli])	Village	All year	No (?)	Food

(Contd.)

(Continued)

Bengali name and/or local name (LN)[a]	English translation and/or description of plant	Locality	Seasonal availability: Bengali months[b] (with English translations)	If domesticated	Usage
Puchupar	Not known	Village	Not known	Not known	Food
Sanchishak (LN *Helencha*, Ujankhalshi & Agcharan)[c]	Not known (an aquatic weed; a type of *Ipomea*)	Village and field, esp. on banks of *beel* and homestead	*Chaitra-Sravan* (March-August)	Yes	Food
Shapla 2 types: 1. *Rocoto* 2. *Shada*	Lotus 2 types: 1. Blood red 2. White All is eaten, the flower head, seed & stem. The seed (*'shaluk'*) is found just behind the flower head beneath the water level	Waterbodies (e.g. *beels* and ponds)	*Bhadra-Aswin* (end of monsoon; September-October)	No	Food
Thankuchir-pata (means stomach problems)	Not known (A type of Aram ?)	Village and field	All year	Rarely	Food and Medicine, e.g. root used to cure dysentery; eaten during pregnancy (high in iron)
Thankuny	Not known (possibly the same plant as *Thankuchir-pata* ?)	Not known	Not known	Not known	Food

Notes: [a]***Naming wild vegetables:*** It is difficult to identify a standard name across Bangladesh for many wild vegetables as many only grow in certain parts of the country and hence only have a local name. Also in many instances it is not possible to establish a homogeneous spelling when translating from Bengali into English, probably because the translation is from another language comprising of a different phonetic script. For the Western researcher this can be confusing because the same person may give different spellings in English on different occasions. Consequently a plant may be recorded as two different plants.

[b]See also Figure 11.1.

[c]*'Shak'* means 'leaf' and/or vegetable. Generally, town people take *'shak'* to mean a 'cooked vegetable' whereas rural people take *'shak'* to mean 'leaf'.

[d]'Village' broadly refers to all areas in the near vicinity of where people live and includes homestead areas, local pathways, *jongla* scrub, ponds and ditches. Unless stated, availability is unknown.

[e]This wild vegetable, which is always boiled, although not very tasty is well known to be nutritionally rich. '*Ghechu*' is commonly fed to pigs, which are thought to be dirty, ferocious creatures (according to Islam). Therefore any persons eating *ghechu* are known to be very poor and unable to afford oil or spices with which to cook. For this reason *ghechu* is boiled on its own and eaten purely to get rid of the feelings of hunger.

[f]'*Lata*' means 'stem'.

[g]There was differing opinions as to when this plant was available; this may be due to regional variations in availability.

[h]'*Gach*' means 'tree'. *Kulmigach* is referred to as both a 'tree' and a 'plant'.

[i]'*Beel*' refers to a body of water rather like a lake, which increases and decreases in size in accordance with the seasons.

[j]My informants told me that these two names refer to the same plant. However a botanist told me that *'sanchishak'* and *'helencha'*, whilst similar are not the same and that rural people are aware of this difference. Perhaps the villagers thought that it would be too difficult to explain any differences and subsequently grouped these two plants as one. Interestingly however, the villagers readily distinguished between other very similar plants, and *all* of the villagers that I spoke to told me that these two names referred to the same plant.

their daily diet. This is particularly true for families who own no land, have a meagre or no homestead garden and little money to purchase meat, fish and vegetables from the local *hat* 'market'. For much of the year wild vegetables effectively substitute for meat and fish, although poor families are often less dependent upon them during the main fishing season (the Bengali months of *Ashar* until *Kartik*, see Figure 11.1). The poor *must* collect daily out of necessity unlike wealthier families (i.e. land owners) who *choose* to gather wild vegetables perhaps once or twice a week as they consider these foods rich in both nutrition and taste. Evidence suggests that the poor have a greater knowledge of and about the different wild vegetables than do wealthier people as a result of their need to access them throughout the year. In this sense the indigenous knowledge relating to this resource is to some extent structured by wealth (see below).

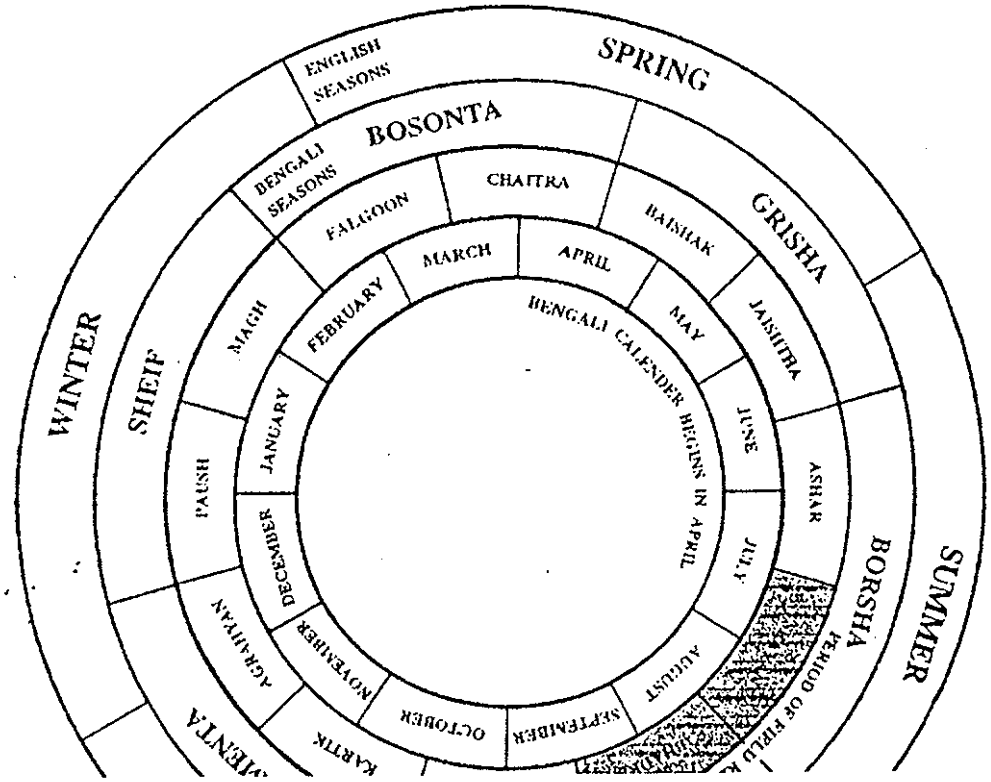

Figure 11.1 *Bengali calendar*

Indigenous knowledge of wild vegetables in Bangladesh is also structured by gender roles. For example, the strict practice of *purdah* (literally 'veil') in accord with the koranic injunction, which keeps women in seclusion to guard their modesty and purity,

is not widely practised in Bangladesh.[2] Indeed, for the rural poor the costs involved in observing this ideal are simply too high; economic necessity forces landless families to abandon this practise. My research indicates that it is invariably women, and to a lesser extent children, who are primarily responsible for the collection of wild vegetables. This valuable resource is collected from *ashi pashi* 'near and far': from along roadsides, village pathways and riverbanks; from around ponds and *beels*; and from fallow land, woodland, *jongla* scrub and field peripheries. Some species such as *kachushak* grow naturally in and around homestead areas (Table 11.1). If no wild vegetables are available in the immediate vicinity poor women, free from the constraints of *purdah,* may travel far to collect them. By contrast wealthier women, who are often more restricted to the confines of the homestead and nearby area, may send a child or servant to search further afield. However, this distinction between wealthy and poor (and it's effects on female mobility), whilst apparent, is by no means a hard and fast rule. For example, one wealthy lady told me that although women are not supposed to leave the homestead, they sometimes do and will collect any wild plant foods that they find.[3] If a husband asks "where did you get the *kulmishak* ?" (a type of wild vegetable), the wife may reply "oh, so and so brought me some this morning," or, "I sent so and so to collect some earlier today." In summary, whilst very poor women are predominantly involved in the collection of wild vegetables, wealthier women sometimes will collect this resource, but for the most part social implications serve to sanction their participation in this activity.

Knowledge of wild vegetables

Indigenous knowledge is difficult to define (Sillitoe 1998*b*; Sillitoe, chapter 19). Unlike much scientific knowledge it is not fixed or standardised. Nor is it homogenous; whilst some knowledge is shared by a community, often it is specific to particular individuals or groups in a society (Marsden 1994). For example, factors such as age, gender, status, wealth, religious orientation, experience and occupation will influence the body of knowledge held by an individual. Although men, women and children consume wild vegetables, their collection is for the most part a female pursuit, as indicated above. Consequently women are generally more informed about this natural resource than are men. The body of knowledge surrounding wild vegetables includes information concerning their nutritional and medicinal properties, preparation, seasonality and whereabouts. This knowledge is acquired from a number of sources: *kaviraj*, *piranee*,[4] family and village elders, doctors, health centres and so on. The interviews I conducted with informants revealed an age and wealth related difference in knowledge about wild vegetables. The older generation learnt about the benefits from family and village elders. By contrast, younger people, particularly from wealthier families apparently gained their knowledge primarily from local doctors rather than a family source. At first sight the latter's claim seems curious given that their parents and grandparents are undoubtedly willing to pass on such information as *their* parents and grandparents had done to them. The relatively recent introduction of Western medicine into rural Bangladesh however, has resulted in a general shift in people's perception of health care. It would appear that the younger generations increasingly have more faith in the wonders of the modern doctor than they do in traditional herbal practitioners (i.e. *kaviraj*, *piranee*, family and village elders) whom they often regard as outdated and immersed in superstition. It takes the authority of the doctor to convince them of

the benefits of including wild vegetables in their daily diet. However, for the poorest of the poor, those most reliant on wild vegetables, a visit to the doctor is often impossible and consequently knowledge of this resource is largely acquired through word of mouth, particularly from mother or mother-in-law to daughter or daughter-in-law. In addition, individuals may obtain knowledge from media sources (such as T.V. and radio) and through involvement in training initiatives set up by Non Government Organisations (NGOs).

Decline in the incidence of wild vegetables

The majority of my female informants agreed that wild vegetables have become increasingly scarce in recent years. Women from poor households have to travel greater distances in order to find sufficient amounts of wild vegetables to feed their families.[5] The additional time involved is frequently at the expense of other equally necessary daily activities such as fuel collection. If women are unable to provide enough food to feed their family each day, many will face mental and/or physical abuse from their husband. The considerable pressures experienced by poor landless women in trying to sustain their families may have been intensified by the increasingly patchy nature of wild plant foods in rural Bangladesh. The women put forward a number of reasons for this apparent decline: population growth; a decrease in the amount of uncultivated land; heightened awareness of the nutritional and medicinal value of wild vegetables and perhaps most importantly the fact that they represent a free food source under increasing demand. Interestingly, most of the men I spoke to reported that wild vegetables were abundant and readily available everywhere. Recent scientific research and public consultation however has pointed to a general decline in the biodiversity of plant life in rural Bangladesh (NEMAP 1995; Zuberi, this volume; see also Gain 1998*b*) supporting the opinion of most women, that wild vegetables are increasingly in short supply. This suggests that either men are unaware of the true situation concerning the scarcity of wild vegetables because they are not primarily involved in their collection; or they dogmatically maintain this position in the face of counter-evidence for other reasons whatever these may be.

The above supports the point that women are more involved with wild vegetable collection than are men and further demonstrates that indigenous knowledge is gender-structured. It is also influenced by age. Generally speaking, older people (i.e. those with grandchildren) were more inclined to consider wild vegetables a dwindling resource, than were younger informants (i.e. those with no children or very young children). This probably reflects the greater time span against which the older generation can measure any decline. Furthermore, many women from relatively wealthy families who do not *depend* upon wild vegetables, also appeared largely unaware that these foods may increasingly be in short supply. Poor landless women, by comparison, were clearly more aware of this possibility. This is understandable if we consider the latter's dependency and hence greater involvement in the collection of wild vegetables. Thus, taken together older women from poor families were most likely to view wild vegetables as an essential but declining resource.

Domestication of wild vegetables

In response to diminished supplies, many women have begun to cultivate wild vegetables within the homestead in addition to the *shaks* or leafy plants (especially

varieties of *Aram*) that grow naturally here (Table 11.1). There is a noticeable overlap between plants that are truly *wild* and those that have been *domesticated*, thus illustrating the emergence of 'new' indigenous knowledge practices in response to a changing environment. When asked whether they distinguish between notions of domesticated and wild, many people associate the former with hard work and money, whereas the latter is seen as 'free' in terms of financial cost and labour to produce. For these reasons, many families consider wild vegetables a preferable resource. On the other hand, for poor families who depend upon wild vegetables for their survival, the domestication of these plant foods can be seen as a response to the increasingly less available and unpredictable supply of this valuable resource in the wild (cf. IDS 1989 for Kenya). However, in rural Bangladesh, the poorest of families (often those of fishermen and day-labourers) typically inhabit marginal areas within the village where the land may be prone to flooding and subsidence and the soil is less fertile and where land for homestead gardens is very constrained. Consequently the domestication of wild vegetables may not be an option for some families even though this would be preferred given the loss of wild habitat for these plants to farmland.

The innovative establishment of *communal* gardens in an attempt to localise plant resources is taking place in a few villages. Apparently, the ideology behind this development is to empower the rural poor by giving them the incentive to take responsibility and hence control over growing their own food and medicinal plants. In practice however, this may not always be the case. The running of these gardens, at least in Rajshahi, seemed to be primarily co-ordinated by men in positions of power (seeking to further their status within the village) and not by the very poor.[6] Indeed because of the hierarchical nature of Bengali society, women from the poorest families (or women with no family at all) were perhaps inhibited from participating in these collective projects. This situation serves to highlight the often desperate plight of the rural poor and in particular of women.

Discussion

For many families in rural Bangladesh, wild vegetables comprise a significant part of their diet. Indeed for the very poor they are an essential resource often collected daily. To date there has been little or no research conducted on the incidence and use of wild vegetables in Bangladesh. As the population increases at an alarming rate (Bangladesh Bureau of Statistics 1995), so too do the numbers of landless poor dependent upon this resource. If we wish to improve the livelihoods of the rural poor it is crucial that this neglected area of study be accorded attention equal to that of rice and fish research.

As mentioned above, it is a widely held belief that wild vegetables are becoming increasingly scarce. The present lack of research means that it is difficult to establish the rate of decline and in turn predict the consequences of these ecological changes for those people reliant upon this resource. Attention needs to focus on issues relating to the long-term conservation of wild plant foods in order to prevent further depletion and ecological degradation. However in a developing country such as Bangladesh, with an ever-growing demand for land this objective will not easily be realised. New coping strategies must be devised.

Intensified efforts to promote domestication of wild vegetables could alleviate scarcity by relieving pressure on natural supplies, thereby giving wild areas time to rejuvenate, and in turn reduce time spent searching for such foods out of necessity.[7]

However, not all wild plant foods lend themselves easily to domestication as many require specific ecological conditions for growth. For example, the *shapla* or lotus, grows exclusively on waterbodies. Moreover, domestication in response to dwindling local supplies is an option only for those fortunate enough to own a homestead garden with sufficient fertile soil and the rural poor generally do not have access to this resource. Perhaps development projects should explore the potential for commercial cultivation utilising *khas* or state land such as roadsides and *dosha jaiga* or communal land, thereby giving access to those who do not have the opportunity to grow their own plant foods. However, it may prove difficult, for local 'political' reasons, to ensure that such areas remain easily accessible to the very poor (Brokensha 1998). The many issues relating to domestication of wild vegetables represent an important future area of research.

My research has shown that knowledge pertaining to this resource is structured according to gender, wealth, status and age. Such sociological considerations cannot be ignored in any indigenous knowledge related research and development endeavour. This also suggests that the role of the anthropologist or social scientist, armed with the methodological tools needed to extract such information, is central (Sillitoe 1998*a*). In the case of wild vegetable research in rural Bangladesh, where access to women's knowledge and activities is largely impossible for male researchers to attain, the benefits of employing female social scientists are clear. The exclusion of the anthropologist from development projects will often compromise the validity of the data obtained thereby jeopardising the long-term success of any enterprise. A multidisciplinary, participatory approach linking indigenous and Western perspectives operating at the 'grass-roots' level may be a fruitful way forward in this area.

Notes

1 The rural people of Bangladesh live in what is known as a '*bari*' or homestead, commonly situated on *vita* or man-made land raised above the flood level. The homestead refers to the *ghor* 'house' or 'shelter' and adjoining houseyard occupied by a family. Homesteads come in a variety of shapes and sizes depending primarily upon the socioeconomic status of the family. They will typically have four to six separate houses (each inhabited by an average of five to six family members) surrounding an *uthan* 'houseyard'.

2 *Purdah* (or *parda*) is a social and religious ideal in rural Bangladesh. Strict practice means that a woman stays within the *bari* 'family compound' and is never seen by any males but those within her immediate family. Ideally, the woman is free from any menial work, which instead will be done by domestic servants. In reality however, only a small proportion of families are able to afford this ideal (see White 1992).

3 It is clear that Bangladeshi women regularly leave the confines of the homestead, but as White (1992:78) points out "... notions of 'inside' and 'outside' are open to complex manipulation." The social implications of the relative freedom of poor rural women to move around differed between the two villages where I conducted field research. The conservative attitudes of people living in Ujankhalshi, an all-Muslim village, means that the wealthier sector are particularly scathing of women whose economic circumstances forces them to disregard *purdah*. Such criticism was less apparent in Agcharan where people were generally more liberal-minded.

Even relatively wealthy people (for the most part Muslims) were more relaxed in their adherence to the values of *purdah* when compared to their Ujankhalshi counterparts. (This may partly be explained by Agcharan's closer proximity to Dhaka, the capital city). Consequently poor women (mainly Hindus) were able to enjoy relative independence free from disdain whereas in Ujankhalshi they were more likely to view their freedom as a curse.

4 *Kaviraj* and *piranee* refer to male and female herbal practitioners respectively.

5 When out collecting it may not be possible to find sufficient amounts of just one wild vegetable and so a variety of wild plant foods '*lata pata*' will be collected. This variety may be collected by choice, even if sufficient amounts of one wild plant food can be found, in order to obtain a wider range of nutrients and a tastier meal.

6 Brokensha (1998:236) comments that instead of reaching the poor, the benefits of development projects are often captured by wealthy rural people, usually men, "... no matter what safe guards are put in place."

7 It is important to note however, that for many women collection is not necessarily an unpleasant task, but may represent a welcome break in the day and a chance to socialise with family and friends.

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