

Indigenous Knowledge and Biodiversity Conservation and Management in Ghana

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ABSTRACT An analysis of a series of biodiversity related areas in Ghana, including ecosystem, water and soil management, farming, fishing and hunting practices and the collection of herbal medicines, shows that indigenous knowledge has the potential to contribute to the conservation of species, genes and ecosystems. Moreover, as these traditional rules are owned by the locals, they might be implemented more rigorously than governmental laws. However, in the contemporary fast changing societies of sub Saharan Africa IK is less and less applied and at risk of disappearance. In spite of important paradigmatic differences between IKS and modern science, traditional knowledge is at its best when it is matched with scientific approaches. Eminent examples of this can be found in the development of medical drugs that stem from herbal medicines. Similar approaches are needed and possible for biodiversity conservation. They should focus on questions on effectiveness, efficiency and monitoring of situations where IK is brought in into biodiversity conservation and management. At the governmental policy level it is remarkable that IK has currently no place in biodiversity conservation strategies. Nevertheless there is a high need to involve local communities in such policies. This is illustrated by providing two examples: the urgent need to curb fundamentally Ghana's logging policy of its tropical forest and the need to involve local communities in the management of the Kakum Conservation area.

List of abbreviations:

CSIR	Council for Scientific and Industrial Research (of South Africa)
CSRPM	Centre for Scientific Research into Plant Medicine
IK	Indigenous Knowledge
IKS	Indigenous Knowledge System
IUCN	The World Conservation Union
NTFPs	Non-Timber Forest Products
NTFRs	Non-Timber Forest Resources
UNCED	United Nations Conference on Environment and Development
WSSD	World Summit on Sustainable Development

1. INTRODUCTION

Biodiversity loss has been a major concern to mankind, especially during the last quarter of the previous century. This concern culminated in the "Biodiversity Convention" that was opened for signature at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, June 1992. Since then different international fora, including e.g. the Beijing Conference for Women in 1995, echoed the problems of continuing environmental degradation. In spite of this, ten years after Rio, the World Summit on Sustainable Development (WSSD) that was held in Johannesburg, South Africa, August-September 2002, could only state that in spite of significant efforts, the loss of biodiversity worldwide was continuing at an unprecedented speed and that a reverse in this ongoing decline should urgently be realized (Hens and Nath, 2003).

What are the causes of this continuing loss of species, genes and ecosystems? They are multiple and complex. However, one of the traditionally important ones was the unique focus on the biological reasons of biodiversity loss (Box 1 lists the common biological causes of biodiversity loss). The collateral of this focus was that if pollution would be halted, habitat loss be stopped and (the effects of) the introduction of non-indigenous species be reversed, biodiversity would be safeguarded. In managerial terms this meant conserve biodiversity by creating parks and reserves with minimal to hardly any human influence.

This strategy proved to be insufficient and it was realized that it failed to bring the human factor on board. Demographic changes, economic imperatives, educational and cultural transitions and policies implicitly degrading biodiversity were at least as important for the regression of biological systems than the biological causes

seemed to be (Hens and Boon, 2000). Only, they proved to be much more difficult to be integrated in biodiversity policies.

Next to a more human ecological approach to biodiversity loss, its management is looking for other, new, effective approaches to reverse the current declining trends. In this context attention is given to “indigenous knowledge” (IK). This is about the knowledge that women and men, families and communities have developed themselves for centuries and allowed them to live in their environment for often long periods of time.

In a context of contemporary development, evidence shows that IK can help to solve local problems, that it offers a resource to help grow more and better food, that it adds to maintain healthy lifestyles, that it provides opportunities to share wealth and prevent conflicts (Mkapa, 2004). In this paper the question is addressed whether and how IK can also contribute to biodiversity conservation. The issue is

approached in a three fold way:

- What is the nature of the IK-biodiversity conservation relationship? In this section a number of examples on how IK can contribute to biodiversity conservation are discussed.
- A specific area of academic importance is the tension between IK and science and technology. A description of this tension and a discussion on how to match these two knowledge systems subject to different paradigms is the substance of the second section.
- The last part is about how to introduce IK elements in bioconservation policy.

The original data in this paper relate to Ghana (West Africa). Through research and the organization of seminars (see e.g. Amlalo et al., 1998) this country has shown a continuing and long standing interest and experience with IK. The data for this paper were gathered during

Box 1. Biological causes of biodiversity loss

Extinction of species is part of an evolutionary process. However, during recent times, extinction rates are ten to hundred times higher than during pre-human times (Sinclair, 2000a). The main biological causes for this loss of biodiversity are:

- a) The loss of habitats. On human disturbance of habitats on a worldwide scale data show the significant impact of human activity on world ecosystems; For example, in Europe only 15% of the continent is classified as “undisturbed”, which is the lowest percentage worldwide. loss of tropical forest is the most highly published aspect of this (Sinclair, 2000b). Elsewhere, rivers are impounded, coral reefs destroyed by dynamite, and natural grasslands are ploughed.
- b) The introduction of exotic species. Many are accidental, as with noxious weeds and insect pests. Others are deliberate. Foxes, rabbits and cats, which came to Australia aboard of European ships, have decimated Australia’s indigenous wildlife. In freshwater, the stocking of exotic fish for sport, or (rarely) for food, has caused at least 18 extinctions of fish species in North American rivers. Catastrophic changes in the fish biodiversity of Lake Victoria (East Africa) resulted from the introduction of Nile perch, Eucalyptus, which is indigenous in Australia, has been introduced in many tropical and subtropical regions in the world, where the tree merely behaves as a pest.
- c) Over-harvesting by (illegal) hunting, and the systematic cutting of wood for heating purposes, or charcoal production, are other reasons for biodiversity loss. The use of medicinal plants might illustrate this point. In the semi-arid rural area of Southern Cochabamba (Bolivia) it was shown that out of 132 inventorised plants the local people use for traditional medicinal purpose, 10 were threatened because of their intensive collection (Urena Hinojosa, 2001).
- d) Lesser known causes are due to “knock-on” effects. Species that are co-evolved with another, such as plants with specialised insect pollinators, will go extinct if one of the pair goes extinct; When the last passenger pigeon (*Ectopistes migratorius*) died in the early 1990s, so also did two of its obligate parasites, two louse species. Moabi (*Baillonella toxisperma*) used to be a common tree in West Africa. The fruits are eaten, cooking oil is extracted from the seeds (Karite) and the bark is used for medicinal purposes. For its reproduction the plant depends on the elephants. Only these animals swallow and disperse the moabi seeds. The impressive reduction of elephants in countries as Ivory Coast, Ghana and Benin has an important impact on the distribution of the tree.
- e) Homogenisation in agriculture and forestry. Although an estimated 7000 plant species have been collected and cultivated for food, only 30 contribute over 90% of the entire global population energy needs. The case of the banana (*Musa spp.*) is illustrative. Bananas are the fourth most important food source in the tropics after rice wheat and corn. They are cultivated in nearly 120 countries. farmers use only about 25 edible sterile banana varieties. The number of varieties is diminishing due to the spread of pests and diseases and the deterioration of the resource.
- f) Pollution and global environmental change also threaten the world’s biodiversity. All these causes have one element in common: they are induced by human activity. This makes human activity the most important source of the current decline in biodiversity. Therefore, understanding the many aspects of human influences on biodiversity, and their underlying driving forces, is of crucial importance for setting priorities and counteracting the current negative trends.

interviews with experts (see acknowledgement) in July 2005.

2. INDIGENOUS KNOWLEDGE AND BIODIVERSITY CONSERVATION

The potential of IK to contribute to the conservation of biodiversity is often illustrated using a set of positive examples. Table 1 lists 11 of these examples documented in Ghana in six areas that are relevant for biodiversity conservation.

In the Ashanti region of South - Western Ghana, trees which were regarded as housing spirits should not be felled without performing rituals. This custom had a protective effect on trees as odum (*Chlorophora excelsa*), African mahogany (*Khaya ivorensis*) and tall palm trees as betene (*Elaeis Guineensis*) and osele (*Funtumia sp.*) Also shea butter (*Butyrospermum parkii*) and the Dawadawa (*Parkia clappertoniana*) trees, in the Northern savannah zone of Ghana are subject to the same traditional protection system (Boaten, 1998).

Animals in a particular habitat may be regarded as sacred and are therefore protected from hunting. In Ghana this applies to the Black and White colobus (*Colobus polykomos*) and the mona monkey (*Cercopithecus mona*) in the Boabeng- Fiema wildlife sanctuary of Central Ghana (Ola - Adams, 1997). A similar situation is reported for the bats of Wli in the South Eastern part of the country. The overhanging rocks of the mountains that form the border with Togo, house an impressive colony of large bats, that are said to be conserved by the local community.

In Ghana, almost every traditional ruler, chief or King has a totem. Many wildlife species are regarded as totems due to their historical or socio-

cultural significance. Totem animals vary significantly over tribes and clans. They include merely mammals (leopard, elephant, lion, monkey, buffalo) and birds (falcon, raven, parrot). But also turtles, crocodiles, snakes (python), scorpions, crabs and fishes are totems. Some totem animals as the crested porcupine (*Hystrix cristata*) and the patas monkey (*Cercopithecus patas*) are threatened. There is a belief that an intimate relationship exists between the totem animals and the tribe. Therefore, the members do not eat, kill or trap these animals (Conservation International Ghana, 2005).

Sacred groves are pieces of land set aside for spiritual purposes. They are dotted all over Ghana. They range from a few square meters to several hectares. The larger ones often form distinct elements in the landscape. An example is the sacred grove of Sefwi Wiaswo, near the border with Ivory Coast. This hill is a classical example of a virgin tropical forest surrounded by the city of Sefwi Wiaswo and its deforested hinterland. Apart from the collection of medicinal herbs (after the agreement of the elders), and their use as burial ground, the sacred grove areas are untouched. Farming, hunting, burning, tree cutting and firewood gathering are prohibited. The results of a comparative plant analysis (Table 2) showed a richer floristic composition and a more complex ecosystem structure in the sacred grove of Ikire-Ile (Nigeria) than in the surrounding areas (Alabi, 1992).

Traditional farming practices are champions in sustainable land and water management. They involve land rotation and shifting cultivation allowing the land for more than 10 years to restore its natural fertility. In many places in Ghana, this is now replaced by a pseudo-scientific agriculture in which shifting cultivation is still the practice,

Table 1: Examples of biodiversity conservation related practices in Ghana

Area of activities	Practices
Ecosystem preservation	Trees that are regarded as housing spirits: odum, African mahogany, tall palm trees Sacred animals: black and white colobus, mona monkey Totem animals and associated species Sacred groves
Water	Vegetation cannot be cleared along a strip of 30 m at both banks of streams and rivers
Farming	Traditional, 10 year, bush fallow system Traditional crops as cocoa and vegetables
Fishing	Days and periods of banned fishing
Hunting	Periods of banned hunting Do not hunt pregnant females
Herbal medicines	Use of herbs to prevent and treat (common) diseases in humans, animals and plants

but the fallow period is between one to two years only. This calls for nitrates and phosphates to boost crop yield, but the majority of the farmers cannot afford to apply the recommended rates of fertilizers. This unfavorable situation in which farmers do not practice anymore traditional agriculture, nor sound science agriculture, leads to low crop yields and accelerated soil erosion of farmlands (Bonsu et al., 2000). The system is under even higher pressure by the selection of crops. Traditional farming systems use a wide variety of species e.g. of vegetables or rice. Current insights strive towards a higher yield, provided by non-indigenous varieties, as a rule requiring higher inputs. Because of the cost of these inputs, they cannot be provided by the farmer. All this results often in a downwards spiral of erosion, lower yields, more poverty and a destroyed environment. From a biodiversity conservation point of view, traditional farming practices entailed strong elements of long-term land rotation and conservation of indigenous plants. However, these are threatened by the current widespread practices of trying, but not succeeding, in applying agricultural practices according to scientific standards.

Coastal ethnic groups know days where they do not fish. Tuesdays and Fridays are in Ghana often set aside and people and the ecosystem were expected to rest. In addition, many lagoons

have long periods during which no fishing is allowed. This resting period coincides with the period when the fishes lay their eggs. In the Fesu laguna, just West of Cape Coast, the banned period is during the months of May and June. This period is obviously linked to the procreation of the fishes including the youngsters to mature.

The importance of wildlife in the diet of the Ghanaians has been well documented. Grasscutter is a delicacy all over the country and one of the most important culinary honors in the North is serving your guests an antelope. Nevertheless, hunting and trapping wild animals is subject to restriction. Some animals are regarded as sacred and therefore may not be touched, killed or eaten. Traditionally, it was a widespread offence to kill a fertile and definitely a pregnant animal. The killing is restricted to male and older animals. Certain species could not be hunted during certain seasons (such as the breeding season). In this way the communities were able to ensure continued population growth of their wildlife resources.

All over sub-Saharan Africa indigenous plants are used in preventing and curing diseases in plants, animals and humans. This equally applies to Ghana. Although the country has established a countrywide network of clinics and other Western health services, the development of the health insurance is still in its infancy. This explains to a large extent the current problems of access to Western medical drugs. In the rural areas, it is e.g. common practice to perform abdominal surgery under local anesthesia, to reduce the cost of the anesthetics. Still today, herbal medicines are more affordable, accessible and used by the majority of the Ghanaians. They are used both for relatively banal indications as digestives or related gastro-intestinal problems, but also to treat malaria, wound care in diabetes patients and even HIV/AIDS. In this context the Mampong - Akwapim based Centre for Scientific Research into Plant Medicine (CSRPM) has a pivotal role. It was most instrumental in the publication of the Ghana Herbal Pharmacopoeia (Policy Research and Planning Institute, 1992). Its herbarium with specimens of reported medicinal plants in Ghana, totals over seven hundred and fifty species. In 1994 it used 64149.50 kg of dry weight of plants and parts of plants to produce herbal medicines for the centre's clinic only. In 1995 the estimated value was 141923.75 kg or an increase of more than 200% (Sam, 1998). The conservation of these plants, offers more and more a defeat for biodiversity conservation.

Table 2: Floral characteristics of arable crop farmland, tree crop farmland and sacred grove at Ikire-Ile Nigeria (Alabi, 1992)

Arable	Crop Farm- land	Tree Crop Farmland	Sacred Grove
1) No. of families	34	46	67
2) No. of species	58	72	155
3) Trees	14	30	54
(a) Mean dbh (cm)	24,31	29,64	23,91
(b) Mean Tree height (cm)	8,19	9,44	11,95
(c) Mean Grown depth (m)	4,92	5,99	7,62
(d) Mean Grown width (m)	3,85	5,6	6,86
(e) Mean Tree spacing	7,07	3,54	3,23
4) Shrubs	14	13	31
5) Herbs	27	21	59
6) Climbers	3	8	12
7) Rainkier's Life-Forms (No. of species)			
(a) Megaphanerophytes	3	8	20
(b) Mesophanerophytes	11	22	34
(c) Microphanerophytes	14	13	30
(d) Nanophanerophytes	16	12	43
(e) Chamaephytes	4	1	11
(f) Hemicryptophytes	7	8	5
8) Complexity Index	1,70	48,95	230,57

Table 3: Instruments and systems underlying IK actions that are biodiversity related.

<i>Instrument/system</i>	<i>Examples</i>
Taboo and prohibition	clearing vegetation along riverside days and periods where fishing or hunting is prohibited
Respect traditional spirits	sacred groves trees that should only be felt after accomplishment of rituals
Common belief	cultivate land in such a way that it can rest afterwards during a period that is long enough for the recuperation of the fertility of the soil
Land tenure	land owned as common, communal, clan or extended - family property

As shown in Table 3, the application and maintenance of these traditional rules is mainly based on taboos that most often have a traditional religious background. More seldom, customs rooted in tradition, as the landownership issue, drive the traditional approaches. In some cases the rules are maintained by physical sanctions. Not respecting the fishing bans in the Fesu lagona, is punished by the chief of the village by killing a sheep and two bottles of schnapps. This charge is sufficiently deterrent to scare people from infringing or breaking the taboos.

In theory, the use of IK in biodiversity conservation finds here one of its strengths. Maintenance of rules based on tradition is stronger and more community owned than governmental rules. This offers an opportunity to involve people in biodiversity conservation using their indigenous knowledge systems. However, Ghana is a country in fast developmental transition. This applies to the length of modern roads, but also to the way traditional knowledge is used and applied. Education brought a lot of scepticism about traditional customs and beliefs. The situation described for agriculture where farmers find themselves in between the traditional and the Western approach, in a situation that can only be maintained at a high societal and environmental cost, also applies the most other areas where interesting aspects of biodiversity related indigenous knowledge can be detected. Hunting taboos, even when they are totem related, are not maintained anymore. Bushmeat from hunted animals can be bought all the year around. In

Why it is easy to buy a bat hunted in the protected area near the waterfall for approximately 5000 cedis (0.50 Euro) per specimen.

Therefore, the possible effects of IK on biodiversity conservation are real, but should not be overestimated. Figure 1 shows a series of problems and their consequences as they are common today in many locally managed environments. Slash and burn practices coupled with fast rotation, hardly controlled wildlife hunting, destructive fishing using e.g. explosives or poisons, illegal logging of trees and ecosystems that are worth protection, fuelwood collection and charcoal production in areas that are less appropriate for these activities, over-collection of non-timber forest resources (NTFR) as snails, mushrooms, honey, fruits and land use to provide the increasing population shelter. All this is only possible at a tremendous environmental cost. This entails e.g. erosion, soil degradation both in quality and quantity, reduced agricultural, hunting and collection yields, degraded forests and depleted water resources.

When comparing the potentials on biodiversity conservation by IK, with the everyday life situation on the field, this points to at least a twofold conclusion:

- attention should be given to document and inventarise traditional knowledge (related to biodiversity) as the available knowledge is at risk of disappearing fast.
- education should give attention to the values (and limitations) of IK, so that it can obtain a fair place in the development paths of countries as Ghana

The basics of astronomy, mathematics, pharmacology, food technology, metallurgy, zoology, botany and forestry at least in part, derive from traditional knowledge and practice. In contemporary science - although most of the listed disciplines have an ethno-component - learning from indigenous knowledge is the exception rather than the rule.

There exist objective reasons for this finding. Table 4 compares essential characteristics of indigenous knowledge systems (IKS) with their equivalents in science. The table shows how fundamentally different the paradigms in both knowledge systems are. While IKS cultivate an authority based, non-systematic, holistic approach; science is essentially systematic, driven by counterdiction, verification, falsification and validation and to a very large extent

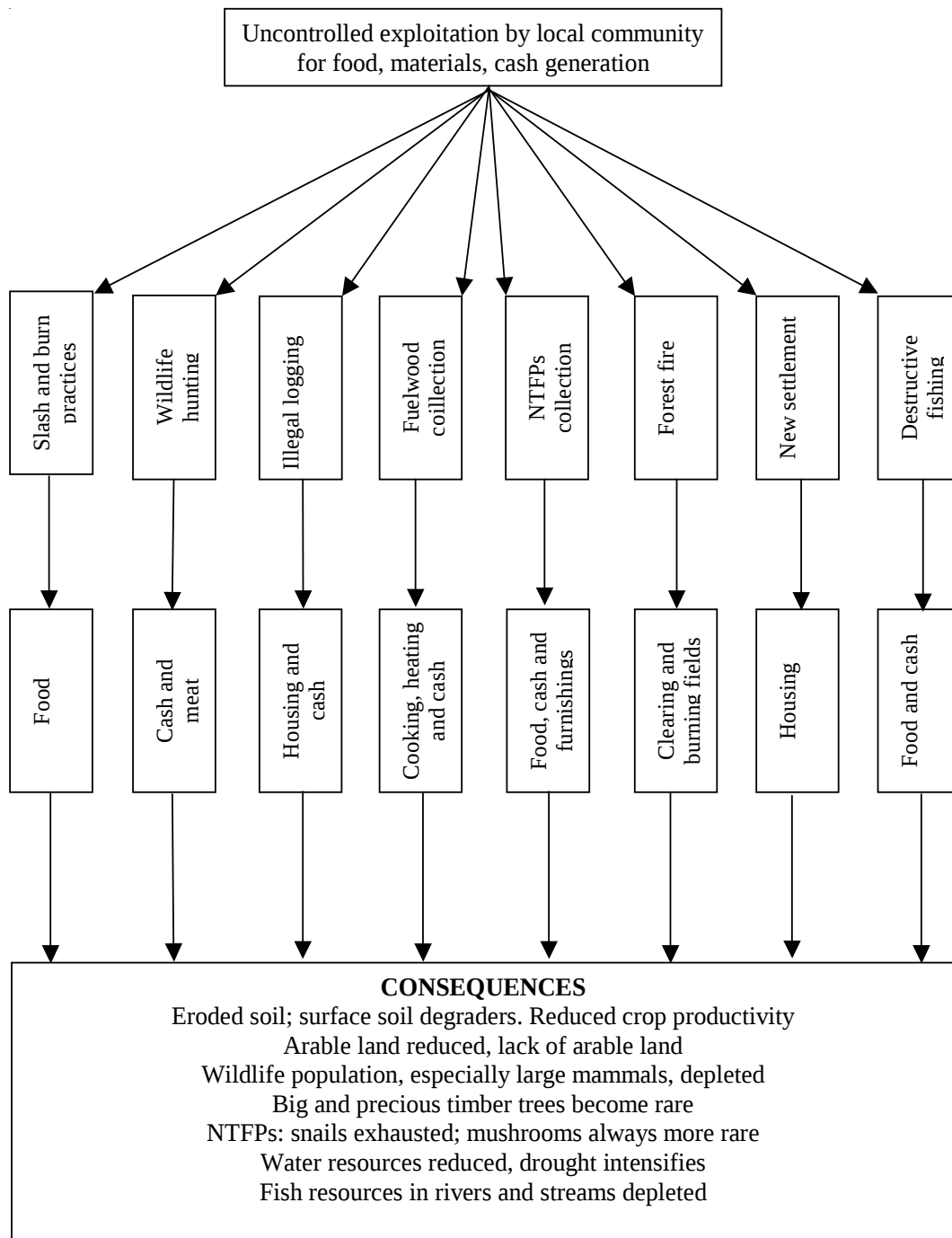


Fig. 1. Problem tree - of current local management practices

Table 4: Comparison of selected essential characteristics of indigenous knowledge systems and contemporary science

<i>IKS</i>	<i>Science</i>
Non-systematic approach	Systematic approach
Holistic approach	Reductionistic approach
Community based	Universal
Value loaded	Value free
Authority based	Counterdiction, verification, falsification, validation
Oral tradition	Written documents

reductionistic. IKS have until now an oral tradition and are to a large extent community targeted; science on the other hand depends on written and published documents and strives to elucidating universal (both spatially and temporally) laws. Most sensitive in the tension between both systems is that indigenous knowledge roots in religion, occultism and transmitted beliefs. These essentials for IKS are align to science.

3. MATCHING INDIGENOUS KNOWLEDGE WITH SCIENCE AND TECHNOLOGY

However, even at this paradigmatic level, both science and IKS are probably closer to each other than hardliners of both sides like to believe. IKS have their own systematic that is often more detailed than the scientific one. Quaye (2005) collected in an ethno-botanical survey among 100 farmers in Upper West and Upper East regions of Ghana, data on the way they classify their plants. The local farmers growing *Arachis hypogaea* L., recognize varieties on the basis of morphological, ecological, agronomic and even culinary characteristics. The results of this study show that a more detailed and informative approach than the one installed by the Linnaean system is possible. Moreover this approach is important from a biodiversity point of view. The study gives credence to call for incorporation of indigenous knowledge in biodiversity conservation programmes in general and in crop germplasm conservation projects in particular.

Science, in particular its policy applications, has a strong local, regional character, just as IKS have. Moreover a holistic approach is not counterdictory to science. In particular in most biodiversity and human ecological issues, a holistic approach is even recommended.

Science, as any human activity, might strive towards value free and universal statements and laws. The history of science shows it is not. Science, just as IKS, is characterized e.g. by the options in the subjects and questions that are researched (and those that are not). In medicine the attitude of the practitioner and the researcher is guided by the question: "What is the benefit for the patient?". Analogously, in biodiversity research the quality of the environment should prevail over e.g. industrial and other social agenda's.

Also the sources of financing the scientists accept and the socially and legally defined contract terms the researchers have to obey to, entail value components.

Nevertheless, essential differences exist. IK will only be more widely accepted and e.g. applied in policy when it can be matched with scientific data. That IK and modern science can complement each other, has until now, be most convincingly demonstrated in use of and research on herbal medicines.

Worldwide ethno-pharmacists have inventarised and mapped traditional, merely herbal medicines and their diagnoses. They have searched for new active substances and a number of them have been validated using the regular research phases a medical drug should pass. Often cited in this context is P57, a CSIR- (Council for Scientific and Industrial Research - South Africa) patented pharmaceutical formulation for obesity control (Sibisi, 2004). The active substance is derived from a succulent of the genus *hoodia*. This plant was in rural South Africa used by the San for centuries as a substitute for food and water. The development of the drug took over 30 years. Main bottlenecks proved to be:

- the analytical chemical identification of the active substance. The research finally led to the discovery of a new family of molecules with anorexic properties.
- the discussion on licensing and royalties, which resulted in benefit sharing with the San.

Other examples are Gracino kola that has been shown to be effective in the treatment of glaucoma and hypertension. Extracts of the root of *Xanthoxylum zanthoxyloides* improve the crisis in sickle cell anemia.

For biodiversity research the model to match science and indigenous knowledge is not as evolved as for the herbal medicines. Nevertheless, the essence of the research is simple: when a

biodiversity resource is used, do not deplete it. Fish, but do not empty the river, the lagoon or the sea. Hunt, but do not threaten the species in their existence. Research should demonstrate to which extent IK rules are able to realize these targets of sustainable use. Complementary to this are the questions on effectiveness and efficiency of community based approaches to biodiversity conservation and management. In theory, when biodiversity can be maintained and monitored through customary laws, this is preferable over maintenance through codified law. However in fast modernizing societies where short-term profit often prevails over traditional customs, questions on effectiveness and efficiency should be at the core of the research.

4. POLICY IMPLICATIONS

At an international level, the integration of IK in biodiversity policy has repeatedly been advocated. IUCN - The World Conservation Union - is a traditional leader of this international debate. It found its echoes in Rio's Agenda 21 and the Johannesburg Plan of Implementation. Also the Biodiversity Convention - that was opened for signature in 1992 and became operational one year later - initiated a debate and action on the issues related to the wider application of indigenous and traditional knowledge beyond local communities. All these calls are driven by the idea that IK is useful and valuable in natural resource management and that consequently, its wider application would be of benefit to the entire world.

However, as equity and justice are cornerstones in dealing with this issue, mechanisms should be found to guarantee a fair economic reimbursement for the wider application of IK to its owners. The clause in the Biodiversity Convention on royalties for the country that provided the species which was used to extract the recDNA of a new medical drug, is interesting in this respect, but is also felt as insufficient. As long as this issue is not solved in international agreements, there will be a resistance on the side of the developing countries to share their knowledge with industrialized countries, and they will continue to stress on mechanisms to keep this knowledge indoors.

But the problem is more complex. In 1998 the World Bank launched the Indigenous Knowledge for Development Programme. The

activities focused on three key areas (a) raising awareness of the importance of IK; (b) enhancing local capacity to document and exchange IK; and (c) applying IK in development programmes. The evaluation (Gorjestani, 2004) mentioned four lessons learned and challenges. They are listed in Table 5.

Next to the intellectual property and previously discussed validation issues they stress on an interdisciplinary approach to IK. This refers to learning about the bio-physical environment, the social fabric, the local economy, culture and history, as well as the knowledge embedded in a community. Such a holistic approach can help to: better understand the local situation in its entirety; design more effective and sustainable programmes; learn from communities and help them to learn to adapt global practices locally. A main problem with this approach is that at least the scientific part has limited experience with integrating, holistic approaches. As mentioned before, contemporary science is in essence reductionistic.

Table 5: Barriers in combining IKS with policy (Gorjestani, 2004)

1. Learning about IK enables an interdisciplinary approach to development.
2. IK is highly context specific and as such not easily replicable unless leveraged with other knowledge systems.
3. Validation of IK is necessary to confirm replication. This requires protocols that fit the specific nature of IK.
4. New protocols to protect intellectual property associated with IK.

By definition IK is context specific. What works successfully in one location or for one community may not for another. The defeat is to extract from the knowledge that applies in a particular context, the more general aspects that can be applied elsewhere. Experience and case studies show that this is possible, but at the same time that it necessitates a careful approach.

While the discussion on the international policy front develops, governments in sub-Saharan Africa fail to incorporate IK in their policies. The "National Biodiversity Strategy for Ghana" (Ministry of Environment and Science, 2002) does not make any reference to IK. This supports the idea that during recent years substantial lip service has been given to the value of IK, but few - if any - concrete policy results emerged.

There is nevertheless an important and unmet

need especially in Ghana to involve communities more explicitly in biodiversity conservation. Two examples might clarify this point: the conservation of the tropical forest and the current management of nature reserves. For decennia and since the colonial era, Ghana is an important exporter of tropical timber. However, today only small remnants of the tropical forest in the South Western part of the country have been left. The official policy of selective logging has failed in this respect that areas that were logged half a century ago cannot be logged again, as there are hardly commercially interesting trees. To avoid that the country will become an importer of timber within a relatively short period there is only one solution with two main components:

- conserve the forest that is still left and halt the current selective logging policy of Ghana's tropical forest.

- promote agro-forestry of indigenous species

To do so, the authorities urgently need partners among the villagers, chiefs and elders living in the logged areas. To realize such partnerships a proper land policy, microcredits and programmes raising additional income (e.g. through the commercialization of non timber forest resources) are needed. Next to these targeted instruments specific attention should be given to the general development condition of these deprived communities: their needs for sanitation, curative health services and social and educational amenities. This might be an important complement to the existing forest biodiversity policy of using environmental impact assessment, permits and other legal regulations, that has been proven to be unable to halt the degradation of what once was one the countries main natural resources: Ghana's tropical forest.

Kakun Conservation Area is a 360 km² large nature reserve near the Southern city of Cape Coast. The tropical park is precious because a population with an estimated number of 240 to 300 forest elephants is reported to live in the park. There are 51 communities living around the conservation area which directly interfere with the biodiversity conservation policy in at least two ways:

- farmers regularly report destruction of their fields near the conservation area by the elephants.
- poaching of bush meat in the conservation area.

Currently, the communities are in no way

involved in the management of the conservation area. They are just told to stay out of it. Nevertheless, there is an obvious need for partnerships with these communities that should go further and deeper than just refunding them for the reported damage to their fields. They should be educated on the importance of the reserve. The conservation area should gain more locally owned social acceptance. They should be involved in monitoring and maintenance of the park. They should contribute to the establishment of transition zones between the park and the communities. They should be involved in solutions to ban poaching. Today these community partnerships for biodiversity conservation is almost in existent.

5. CONCLUSION

This paper shows that IK can play a role in biodiversity conservation. Traditional water, soil and ecosystem management prohibitions on fishing and hunting and the ecological value of sanctuaries provide keys to involve traditional knowledge and practice in a more explicit way than before in biodiversity conservation and management. However, there are serious indications that with development and modernization this knowledge and its application is lost fast. Therefore, it is urgent to collect and systematise this knowledge, taking into account the specific context in which it developed and exists. To avoid fossilization, IK should be part of the terms of reference of the school system.

Indigenous knowledge is not only at its best when it is matched with contemporary science; this match is also a necessary requirement to incorporate it in policy approaches. When it comes to IK on biodiversity this matching process probably is not that much in need of scientific validation (the forecasted effects are almost trivial), but raises merely questions on effectiveness and efficiency.

At the policy level, a most interesting international discussion has been initiated e.g. during the implementation of the biodiversity convention. A lot of this discussion culminates in the need to develop new approaches to protect intellectual property associated with IK. This is however insufficient. There is also a need to build capacity among local communities to develop, share and apply their traditional knowledge; to monitor the effects of actions based on IK, and

for means to allow research in this area. There is equally a high unmet need to develop national strategies to support the use of IK. This should result in partnerships between local communities, governments, civil society and academia. It looks like today IK is at the beginning of a new cycle to learn from communities and helping communities to learn.

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