LOCAL KNOWLEDGE OF SOILS AMONG THE IRAQW IN SELECTED VILLAGES IN MBULU AND KARATU DISTRICTS: IMPLICATIONS FOR RESEARCH INTERVENTIONS

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ABSTRACT

This article reports on some findings from an on-going study in seven villages in Mbulu and Karatu Districts. These are Kainam, Gunyoda and Moringa (Mbulu District) and Kambi ya Simba, Kilima Tembo, Rhotia Kati and Kansay (Karatu District). The selected villages are predominantly inhabited by the Iraqw who are Afroasiatic or Hamitic- Cushitic speaking people. They form 65% of the people in the two districts. Using a combination of Participatory Rural Appraisal (PRA) and formal surveys the study found that there is a wealth of knowledge with regard to soil classification in the area. On the whole farmers use various criteria to classify their soils that also guide land use decisions. However, reliance on local knowledge in the classification of soils, landforms and land use is more common with small-scale agriculture, whereas large-scale farmers particularly in Karatu District rely more on research recommendations communicated to them through the public extension service or by researchers themselves to improve productivity in the area. While acknowledging the wealth of local knowledge in the area, the study recommends for scientific research interventions in partnerships with the local people in order to address existing land use limitations.

Keywords: Local knowledge, gender roles, patriarchal society, partnership , recommendation domains

INTRODUCTION

Available evidence shows that land users in many parts of the world have knowledge andclassification systems for soils and plants (Chambers *et al*. 1989; Bradley 1983; Stocking 1983; Acres 1984; Arrouays 1987; Farrington and Martin 1988; Sikana 1994; Ndyetabula 1995). They use many categories to describe and classify type of land, landscape, crops, wild plants species and other natural resources. However, it is disappointing to note that the knowledge and experiences accumulated over a long period of time not only frequently go unrecorded but also resource mapping done by most resource specialists especially in developing countries do not benefit from them (Arrouays 1987).

The likelihood of recommendations resulting from such efforts being used by farmers is limited due to the fact that the approaches used by specialist (scientists) and farmers with respect to land evaluation is quite different. Acres (1984), Chambers *et al*. (1989) and Sikana

(1994) have observed for example, that soil scientists produce conventional soil map units through deductive methods. Land evaluation is then carried out to give land use recommendations based on these units while land users' approach to land evaluation is an empirical one. This is because they differentiate soils in terms of suitability for cultivation and for various uses on the basis of experience. They may then identify the properties which act as limitations (Malcolm 1953). A possible consequence of the above differences may be that when conventional pedological information is used for further soil map interpretation, the soil characteristics used for building soil management units may not be related to local resource management problems.

This paper dwells on the local knowledge of soils among the *Iraqw* (Wambulu) of Mbulu and Karatu districts. The specific objectives of the paper are to (1) describe the criteria used by local people in clasfying the major soil types, (2) show relationship between soil types and land use as perceived by farmers, (3) describe actions taken by farmers to overcome land use limitations of some of the soils and (4) draw implications for research interventions in the area.

MATERIALS AND METHODS

The Study Area

The study was conducted in seven villages in two phases. The first phase involved carrying out formal survey and Participatory Rural Appraisal (PRA) in five villages in Mbulu and Karatu districts from July 1997-September, 1998. These were Gunyoda (Masieda Ward) and Moringa (Daudi Ward) in Mbulu district; Kambi ya Simba (Mbulumbulu Ward), Rhotia Kati (Rhotia Ward) and Kansay (Kansay Ward) in Karatu district . In the second phase of the study done in 1999 more PRAs were done in two more villages, namely Kainam (Kainam Ward) and Kilima Tembo (Mbulumbulu Ward) in Mbulu and Karatu district respectively, which were not included in the earlier study (Figure 1).

Climate and Physical Environment

Mbulu and Karatu districts have both temperate and tropical climatic regimes. Rainfall varies between 500 and 1050 mm per annum. Altitudes range between 1000 and 2300 m above sea level. The districts are comprised of high plateaux and escarpments, which are a result of volcanic activity, and block faulting believed to have taken place many million years ago. Thus the area is dominated by volcanic landforms (especially in the north), alluvial landforms and faults (Stonehouse and Duff 1977).

Vegetation and Land use History

Some years back, the two districts were covered mainly by forest. High altitude areas were dominated , among others, by *Fagoropsis angolensis*, and *Khaya spp*. Lower areas covered by savanna woodland and bush were dominated by *Acacia spp*. In the 1940s and 1950s, under the influence of the colonial administration large areas, particularly in the South, were cleared to control tsetse. In the North, land was mainly cleared for cultivation. With time, population growth caused further land clearances to meet demand for land and firewood needs. There has also been an increase in livestock population and currently animal pressure on the land is estimated at 0.3-0.5 Livestock Units per ha (Mollel *et al.* 1993). In some parts of Mbulu and Karatu, the livestock units exceed the carrying capacity of the land by over 200% (DANIDA 1989). This contributes to serious land degradation in form of soil erosion.

Currently natural vegetation remains only on mountain tops and on some steep escarpments where it is maintained as protected forests. Elsewhere, due to constraints of high altitudes, low soil fertility and high grazing pressure, vegetation is confined to short grasses and tough woody shrubs. These include *Cordia*, *Hibiscus* and *Solanum* species and such drought-resistant trees as *Euphorbia* species, *Erythrina abysinica*, and *Combretum spp* (Thornton 1980). Some slopes and lowland parts are covered by woodlots of exotic species such as cypress (*Cupressus spp.*), black wattle (*Acacia mearnsi*), *Grevillea robusta*, and *Eucalyptus spp.*, introduced during the colonial period.

Socio-Economic Environment

The People

The *Iraqw* who are *Afroasiatic* or *Hamitic-Cushitic* speaking people in Mbulu, Karatu, Hanang and Babati Districts of Arusha Region in Tanzania. They are the largest group consisting of 65% of the total population of the Mbulu and Karatu districts. The *Iraqw* are known to have arrived from Kondoa-Irangi in the Central Region of Tanzania, and inhabited Kwermusi village in the Mama Isara area, Mbulu District in 1770 (Meindertsma and Kessler, 1997). Mama Isara is located on the Mbulu High Plateaux. The migration of the Iraqw from Mama Isara to other areas has been necessitated by the need for more land due to their fast growing population.

Economic Activities

The *Iraqw* are by tradition agro-pastoralists undertaking both crop and livestock production. However, as shown in Table 1 a large area of the land in the two districts is under grazing land use system suggesting the importance of livestock production in the local economy. Crop production is done on farms that are privately managed and held under customary land tenure system. Intercropping involving maize and legumes such as beans and pigeon peas is common. In general cultivation is dominated by small-holder farmers. However, large-scale farming is more significant in Karatu District where crops like barley and wheat are solely produced for the market. The main source of household cash income in the studied villages are crops and livestock sales and off-farm activities such as sale of charcoal and local brew.

Gender Roles in the Household Economy

Besides reproductive activities such as child rearing and fetching water, *Iraqw* women with the help of the youth perform almost all crop production activities. On the other hand men are responsible for most livestock production activities including herding. As is characteristic of patriarchal society, men are in most cases heads of the family and therefore make key decisions on family matters. They make decisions on issues such as labour allocation, types of food/cash crops to be produced in each season. They also make decisions on what to market. Men have both access to and control over production resources whereas women usually have access only to those resources.

Data Collection Methods and Analysis Techniques

The study involved carrying out Participatory Rural Appraisal (PRA) techniques to get a thorough understanding of the local knowledge of soils among farmers in general and ethnotaxonomy of soils in particular. The techniques used included group discussions and interviews with men and women farmers, field walks and direct observations. The formal survey involved the administration of an interview schedule to a sample of land users in five villages to quantify key issues related to the study such as household socio-economic data. The obtained data were coded and analysed using the *Statistical Package for Social Sciences* (SPSS).

Table 1: Land use types in agro-ecological zones of Mbulu and Karatu districts

Zone	Total area (ha)	% of land under different land uses		
		Crops	Livestock	Others*
Northern	135 223	24	70	6
Central	188 138	9	74	17
Eastern	98 227	6	63	31
Southern	211 460	7	78	16
Western	41 132	5	87	8

Source: Nkonya *et al.* (1993).
* Others: include forests, land unsuitable for either crops or livestock, water bodies and unused land.

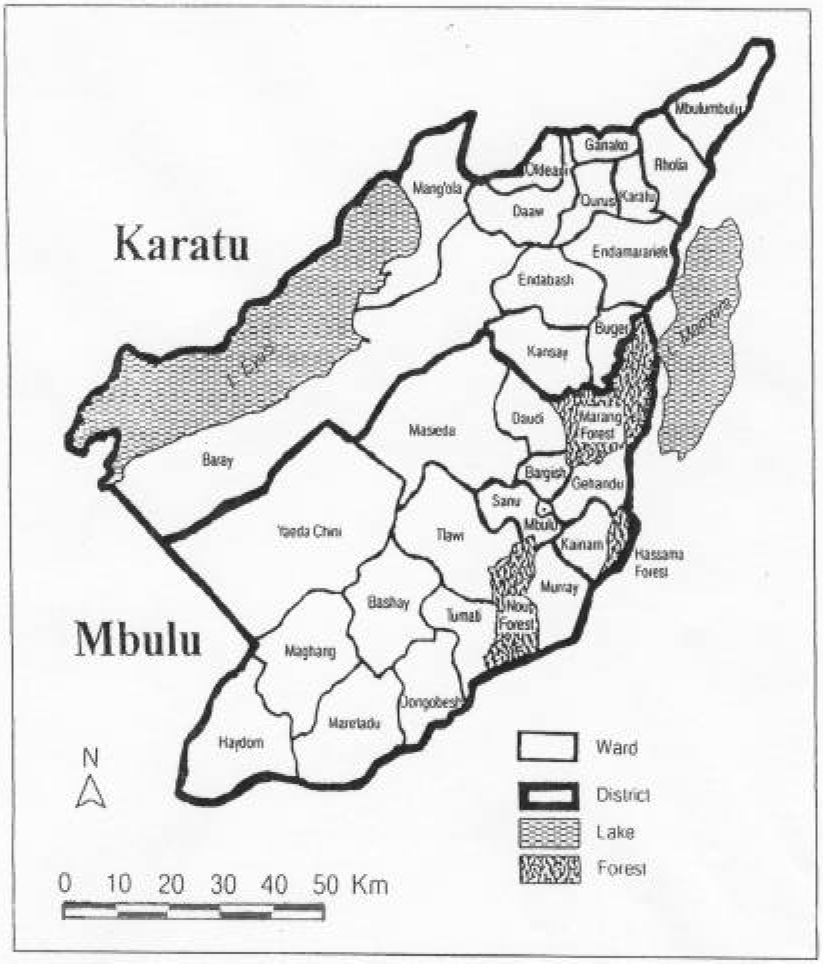

Figure 1. Location map of the study area

RESULTS AND DISCUSSIONS

The results of the study are presented in Table 2 and discussed as follows:

Diagnostic criteria for differentiating soils

Iraqw farmers demonstrated knowledge of soil types existing in their immediate environments. Generally the criteria used by men and women farmers shows that their soil classification is based on topsoil characteristics. For example, the soil type Hhaper Daàten is typically a red soil as observed from the surface. Likewise the soil Hhaper Bo'o is a black soil as seen from the surface. The soil Hhaper Bulgar Bo'o is a heavy textured black soil with deep cracks which can be seen from the surface. This soil type is also characterized by prismatic or columnar structure whose configuration can also be seen from the surface.

Discussions and interviews with farmers showed that occasionally subsoil characteristics are used. For example, the soil type Hhaper Baraduxa (valley bottom soil) is characterized by stratification which can only be seen when the soil is exposed. Another example is where there are deep wide gullies where farmers identify the whitish weathering rock (saprolite) which they call Hhaper Busli Âwak. Other important diagnostic properties used to differentiate soils include soil texture (e.g. Hhaper Tlei for clay soil); position on the landscape (e.g. Hhaper Baraduxa and Hhaper Naari both occupying river valley bottoms); consistence (by which farmers differentiate which soils are easy to work with or otherwise); presence of salts (e.g. the soil type Hhaper Harki used for salty soils). Moreover it was noted that some properties like water holding capacity are indirectly implied by farmers from soil texture.

Relationship between soil types and land use as perceived by armersBased on their knowledge on soil types, farmers decide where to put what type of land use practices. For example, they know that dark coloured soils are fertile and therefore are used for a greater variety of crops. They also know that marshy soils need to be drained before use. Salty soils are avoided for crop production but reserved for grazing. Course textured soils have low water holding capacity and therefore are used more for production of drought resistant crops such as pigeon peas and sorghum or reserved for grazing. Moreover, farmers put alternative use to soils which are not fit for agricultural production. For example, the coarse-textured soils are used for road construction, the fine, sticky and powdery soils are used for wall plastering and pot and brick making.

Land Use Limitations Identified by Farmers

In the discussions with farmers, land use limitations of some soils were identified. One of the major limitations that also affected crop productivity was decline in soil fertility. According to farmers this necessitated the use of chemical fertilisers and manure. It was especially identified as a serious problem limiting the use of sandy soils (Hhasang'w), and some of the Hhaper Daaten (red exposed soils). It was also a problem for overcultivated soils. Traditionally, the Iraqw have had used manure to improve soil fertility. In villages in Mama Isara the use of manure to improve soil fertility is widespread and seems to have been institutionalised. Many factors have helped to facilitate this practice including the fact that almost all households keep cattle and the farms are close to the homesteads. Furthermore, land shortage has forced them to resort to land intensification strategies through manure application.

Table 2.: Soil types in some Mbulu and Karatu villages with their uses and related attributes as perceived by farmers

Local soil name(s)	**Main distinguishing criteria**	**Agricultural and other uses**	**Other identified attributes related to use and management**
Hhaper Daàten	red colour, fine texture	maize, sorghum, beans, finger millet, sweet potatoes, pigeon peas, groundnuts, bananas, wheat, barley, chick peas. Occasionally for plastering and brick-making	sticky and difficult to work with especially when wet, easily eroded by water and wind
Hhaper Sir-daàten	reddish brown colour, fine texture	maize, sorghum, beans, finger millet, sweet potatoes, pigeon peas, groundnuts, bananas, wheat, barley, chick peas	sticky and difficult to work with especially when wet, easily eroded by water and wind
Hhaper Bo'o	black to dark brown colour, humic (high organic matter content)	all crops including beans, sweet potatoes, bananas, maize, pigeon peas, wheat, sorghum, barley, wheat sunflower, sugarcane, vegetables	high fertility status, easy to work with
Hhaper Tlei	black to grey colour, very fine-texture, very sticky	mainly for grazing, also for pot and brick making	heavy to work with when wet, forms hard crust upon drying
Hhaper Busli Bahyen	light brown colour, coarse texture	pasture, plastering, brick making, road construction, tree planting	not fertile, low water-holding capacity, very porous
Hhaper Busli Daàten	reddish brown colour	various crops, e.g. maize, beans, pigeon peas, also for brick making	moderate fertility, easy to work with
Hhaper Busli Âwak	Dark grey colour	not suitable for crop production, used for tree planting	low fertility status, low water holding capacity, easy to work with
Moram	brownish grey or brownish red colour, coarse texture	not suitable for crop production, used for road construction and brick making	not fertile, hard to till, low water holding capacity
Hhaper Sasagwan	grey to black colour, coarse texture	with manuring or fertilization used for wheat, beans, maize, sorghum, cowpeas, finger millet, also for grazing	normally low to moderate fertility, easy to work with
Hhaper Suge	reddish orange soils (lukaria) in valleys (in small pockets)	not used for agriculture, but for plastering and aesthetic uses (hair dying for Maasai and Barbaig young men)	not fertile

Yamuraàt	dark reddish colour, medium texture	maize, sorghum, pigeon peas, finger millet, sunflower, cassava, also for tree planting	low fertility status, slightly sticky, moderate water holding capacity
Hhaper Hhasang'w	coarse texture, light colours	sorghum, pigeon peas, groundnuts, sweet potato, cassava, finger millet, also grazing	low fertility, high rate of leaching of nutrients with heavy rain, looses moisture easily
Hhaper Bulgar Bo'o	black colour, heavy texture, deep cracking from the surface to the subsoil, prismatic or columnar structure	grazing	expands when wet, shrinks and cracks upon drying, very sticky, very plastic, very difficult to till, presence of salts
Hhaper Baraduxa	dark colour, medium texture, alluvial material, stratification	various crops including maize, beans, vegetables including cabbage, tomato, onion	generally soils have high fertility, easy to work with
Hhaper Hharki	grey to black colour, presence of salts	not used for crop production, used for grazing (very much liked by animals)	-
Hhaper Burki	black to grey in colour, coarse texture	not used for agriculture, but for road construction, brick making	not fertile, low water holding capacity
Hhaper Naari	Water-logging characteristic of marshy soils	when properly drained used for production of vegetables, maize, beans, peas, bananas	variable colours sometimes whitish/grayish (Yamu Âwak), generally high fertility

Although farmers in villages other than those located in Mama Isara covered by the study indicated that they used manure for the same purpose, in some cases, it was found that its use was far limited than earlier reported (Nkonya *et al.* 1997). Discussions with farmers in Kansay village, for example, revealed that uneven distribution of cattle among households meant that only those households with cattle could afford to use manure while those without couldn't. Even households with large herds of cattle do not benefit much from the manure because they are forced most of the time to graze them far from their homesteads in search of pasture and water.

Water logging was a limitation identified for soils in valley bottoms. Drainage of soils prior to their use was a common practice especially in Mama Isara. Other limitations identified were rapid loss of moisture in the *Burki (Bahayen)* and in the *Hhasang'w* (sandy soils) leading to wilting and drying of crops due to moisture stress. Hard consistence and presence of salts particularly in the *Hhaper Bulgar Bo'o* (heavy clay cracking black soils) was also noted. Whereas the decline in soil fertility and rapid loss of moisture were widespread, the presence of salts in soils was somehow localised. As pointed out earlier such areas are set aside for grazing.

Despite its use, local knowledge guided farmers to avoid using some land areas with limitations for crop production. However, with the ever increasing population land will become scarce and farmers will inevitably have to learn and invest in profitable land improvement techniques using the existing knowledge on soils complimented with elaborate scientific knowledge.

CONCLUSION

The study has revealed the wealth of knowledge on soils possessed by the *Iraqw* farmers as earlier reported by Ndyetabula (1995) and Msanya *et al.* (1999) and thus confirming findings from studies conducted elsewhere (Integrated Management of Agricultural Watersheds - IMAW 1991, Dialla 1993, Sikana 1994). Land use decisions made by farmers are based on their knowledge of the soils. However, it was apparent that in some cases local knowledge and its practice on its own cannot overcome some of the land use limitations identified by farmers for improved agricultural productivity. To this end, there is need for the establishment of partnership between scientists and farmers for purposes of developing interventions to deal with those problems taking into account existing recommendation domains.

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