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Indigenous Knowledge and Biodiversity for Sustainable Food Security in South Africa

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ABSTRACT This was an investigation into the role of African indigenous knowledge systems and biodiversity in food security and nutrition. Both primary and secondary sources were used in the research process. Cases from South Africa and KwaZulu-Natal (KZN) province were used in the discussion, especially on the contribution of rural women as subsistence farmers and custodians of IK for biodiversity management. Their knowledge of biodiversity conservation and postharvest for food security tend to be undervalued in research and policy development. It is therefore suggested that in designing food security strategies and policies, this limitation need to be taken seriously.

INTRODUCTION

The Food and Agricultural Organization (FAO) (2011) and United Nations Population Division (2010) indicate that by 2050 the world population will be nine billion. This has great implication on food production because it depends on biodiversity and sustainability of the correspondent ecosystems. An ecosystem in this discussion refers to a community of plants, animals and smaller organisms that live, feed, reproduce and interact in the same area or environment (Schmiedel and Jürgens 2010). The importance of a sustainable ecosystem is due to the fact that the genetic diversity of both flora and fauna, is the foundation for a continuous improvement of crop and animal species necessary for food security (Iltis 2002). The World Bank (2009) and FAO (2004) show that most of the genetic resources are found in local farming systems based on indigenous knowledge systems. One of the challenges facing these farming systems and food production is the loss of biodiversity and associated community-based or indigenous knowledge systems due to environmental degradation.

In this discussion indigenous knowledge systems (IKS) refer to bodies of knowledge developed in local communities over time and are traditionally transmitted orally across and within generations. They encompass the skills, innovations, beliefs, experiences and insights of the people in their respective natural and cultural environments, accumulated over the years and applied to maintain livelihood (Dei 1993). These knowledge systems tend to be marginalized in the search for sustainable solutions to biodiversity conservation. However, there is currently a growing interest in the role of IKS for sustainable development among various stakeholders including policy makers, researchers, academics and development agencies due to its community-based nature, accessibility, affordability, cultural acceptability and failure of western knowledge systems (Briggs 2005; Lwoga and Ngulube 2008).

In spite its being an underutilized resource in the sustainable development process, IK has been characterized as the social capital of the poor because it is the only asset they depend on for sustainable livelihood in health, food security, environmental and natural resource management. There is a growing recognition that learning from local people provides a cultural foundation for the sustainable development process (World Bank 2004; Dewalt 2004; Fujisaka and Prain 2006). A number of initiatives, both governmental and non-governmental have been established in South Africa to document IKS for education, preservation and protection. An example of this initiative is the National Recordal System in South Africa whose mandate is to record, preserve, protect and promote South Africa's invaluable wealth of IK (Department of Science and Technology 2013). This is an initiative of the National IKS Office (Department of Science and Technology) developed and implemented by the CSIR Meraka Institute. Moreover, one of the ten principles of the Global Biodiversity Strategy for conserving biodiversity is the recognition that cultural diversity is closely related to biodiversity (Southern African Development Community (SADC) 2012).

Examples of the various ways in which gene banks are established internationally to preserve genetic information of indigenous species are

provided by the World Bank (2004). These indigenous species which are resistant to pests or diseases or endure harsh climatic conditions are viewed as crucial for future breeding initiatives. However, this study advances the view that preserving genetic traits should go hand in hand with the preservation of the knowledge of their husbandry. This is due to the realization that the seeds and clones stored in seed banks do not carry the instructions on how to grow them. This implies that the gene banks need to work together with local farmers and communities who still cultivate local varieties to preserve such essential knowledge and skills *in situ*.

According to the World Food Summit of 1996, food security exists when "all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (FAO 2011).

METHODOLOGY

Although examples are drawn from different parts of Africa and South Africa in particular, the study concentrated on KZN Province where the researcher resides. KwaZulu-Natal is one of the nine provinces of South Africa. It is predominantly rural. A large proportion of the people, especially women depend on the natural resource and associated IKS for livelihood. This is explains the central role gender plays in this study. African rural women are the custodians of IK for biodiversity preservation for household and community food security and sustainable livelihood. The study used a combination of both secondary and primary sources to examine the role of African indigenous knowledge systems and biodiversity for food security and nutrition.

Secondary sources are documents are sources of information written by other researchers and authors on a specific research topic (Huberman 2002; Adèr 2008). The secondary sources used in this study include journal and magazine articles, past research and publications, news reports, books, and internet sources among others. These give background information and offer analysis on the research problem. Taking consideration of the holistic and cultural-based nature of indigenous knowledge related to biodiversity for food security, interactive, participatory research methods such as interviews, direct observations and focus group discussions were deployed in this study. The use of triangulation helped to cross-reference and validate the various sources of information including secondary sources. In order to ensure maximum cooperation by participants, especially rural women, IsiZulu as the local language was used in the research process, from data collection to data interpretation.

RESULTS AND DISCUSSION

The following section discusses the role of African women's indigenous knowledge on biodiversity for food security and nutrition. These aspects tend to be neglected in the food security discourse in Africa.

African Rural Women, Indigenous Knowledge and Biodiversity for Food Security

Various research studies emphasize the role African rural women play as custodians of biodiversity for food security and rural livelihood in general. Through collection, farming and conservation, they contribute to over fifty percent of the dietary requirements of their local communities and households (Altieri and Merrick 2008; FAO 2011). The collection of wild food resources by rural women ensures food security and nutrition during famine, conflicts, and epidemics. These include wild vegetables, fruits, roots, insects, birds, small animals, and eggs (Meinzen-Dick et al. 1997). In most parts of Africa more than ninety percent of the planting materials for household needs are sourced by women. On their small plots of land, they manage home gardens, in which they grow a wide variety of vegetables, relishes and condiments (Bechtel 2010).

Example is given on rural women in the Usambara Mountains of Tanzania where women farmers integrate wild and domesticated species of edible plants and have managed to bring new species of wild plants under cultivation and commercialization. Moreover, through their indigenous knowledge of plant characteristics, they are able to select and preserve seeds which are pest and disease resistant (Adèr 2008). Once the crops begin to flower, these women observe the plants, and later harvest seeds based on their size, grain formation and resistance to pests and insects (Gadgil et al. 1999).

African rural women are also responsible for the biodiversity of animal husbandry. They over-

see small household livestock such as chicken, goats, sheep, pigs and sometimes even cattle. They are also in charge of choosing and breeding for preferred traits based on local conditions, such as available feeds and resistance to disease. Southern African Development Community (2012) show that in Zimbabwe, women keep more than five breeds of local hens, as well as local breeds of ducks in their back gardens. They have a wide knowledge of the characteristics of the best livestock breeds and species. Associated with this knowledge is that of medicinal plants for curing animal ailments while also serving as fodder and fuel or even as manure and pesticide. Research shows that in the Congo rainy forests rural women are able to identify more than thirty species of commonly used medicinal plants (FAO 2004). In an interview, Mrs Kambale, an older village woman, referred to wild medicinal plants in the following terms: "They grow up with no masters". All her friends laughed because what she was really saying was that wild medicinal plants have no husbands to boss them around or to control them (FAO 2011). This implies that human beings need the environment but the latter does not need the former for survival.

The indigenous knowledge on the local biodiversity is acquired by both men and women through interaction with their natural environment in the process of producing the basic needs of livelihood. The knowledge is socially differentiated on the basis of gender, age, marital and social status and occupation. Dlamini (2014) reveals that a study she conducted in UMkhanyakude District (KwaZulu-Natal Province) showed that men demonstrated knowledge of trees used for timber while women had a wide knowledge of vegetables, fruits, medicines and fodder. Women knowledge holders interviewed could name more than 30 uses of trees on fallow land and in forests while men could name less than eight.

Emery (1996) indicates rural women in various parts of Africa improve the quality of their food plants and animals through experimentation with diverse species. This demonstrates their knowledge of diversity and environmental adaptation for food security and climate change. However, this community-based knowledge is not valued by agricultural extension officers and policy makers. A researcher on germplasm in Southern Sudan laments in the following words:

"We came to a village, and after some discussion with the people, we thought we had been granted permission to take some heads of sorghum. But on picking these, a woman came shouting furiously after us."

The above implies that she is the one responsible for the selection of seeds and therefore had to grant permission to remove them. This is an example of the tendency in which outsiders who come in African rural communities in various capacities and exploit the knowledge of rural women without the latter's consent. The knowledge is being extracted, patented and sold for the benefit of industry and research institutions, undermining women's autonomy and their access to, and control over vital knowledge resource. The situation is aggravated by the fact that the current patent systems are inaccessible to indigenous communities and peoples, especially women. This includes the fact that large scale commercial agriculture erodes biodiversity and associated local knowledge systems based on subsistence farming (Greaves 1994; Braidotti et al. 1994). The World Parks Congress, held in Durban in September 2003 emphasized the need to address the growing problem of depleting local biodiversity and marginalizing associated local knowledge systems (Zerbe 2003).

Cultural and Bio-diversity for Food Security in KwaZulu-Natal Province

This section discusses the importance of cultural diversity in natural resource management within the context of IKS using cases from KwaZulu-Natal (South Africa). The province is rich in biodiversity of indigenous crops including animal species and associated knowledge systems. These are currently underutilized to ensure food security and nutrition. They are mostly produced to satisfy subsistence needs under various climatic and ecological conditions.

For instance, the indigenous grain crops include: pearl millet (*Pennisetum glauchum*), used mainly as whole, cracked or ground flour, dough, or grain-like rice. They are made into fermented breads, foods and thick porridges, steam-cooked dishes, non-alcoholic beverages and snacks; pearl millet is also grown for silage and hay production. Its crop residue and green plants provide building materials for fencing, thatching and making basketry. *Sorghum bicolor* is mainly

used for making porridge, unleavened bread, cookies, cakes, couscous and malted beverage. Parched seeds are used as coffee substitute. It is also used as an important animal feed. Cowpeas (*Vigna uniguculata*), leaves are eaten as vegetable, either fresh or dried; the immature pods and dried pulse can be used as vegetables. The whole plant may be used as livestock fodder. Bambara groundnuts (*Vigna subterranea*). The immature seeds can be eaten boiled or grilled, while mature ones can be roasted in oil or grinded to make flour. They can also be boiled and mixed with maize kernels (Dlamini 2014).

Examples of indigenous leafy vegetables grown in the study local communities are: Cleome (*Cleome gynandra*), tender leaves, young shoots, and mostly flowers are boiled in stew or as a side dish. The leaves are rather bitter, and for this reason are cooked with other leafy vegetables such as cowpea, amaranth and black nightshade. To reduce the bitterness, milk is added to the boiled leaves and the mixture is left overnight. In other areas, the leaves are briefly boiled, the water is discarded and these are then combined with other ingredients in a stew.

Besides food crops biodiversity the KwaZulu-Natal province is also rich in unique indigenous domestic animals diversity. The Nguni cattle, goat and Zulu sheep and chicken are indigenous to the province. Badenhorst (2008) summarizes the characteristics of the Nguni cattle as follows: they have unique fertility under strenuous conditions; good foraging ability; good walking abilities; resistance to ticks and tick-borne diseases; heat tolerance; ease of calving and good mother ability; placid temperament and longevity.

Apart from being a source of wealth, cattle fulfil a multiplicity of functions in the Zulu culture. Milk is used for the making of dairy products. Beef is occasionally eaten. Oxen are used as draught animals while their hides are used for making thongs, shields and articles of clothing. The animals are used as payment of fines or for payment of bride price (lobola). Cattle dung is used for fuel and as a binding agent for plastering walls and floors. Like in most of other Nguni ethnic groups such as the Xhoza, Tswati, and Ndebele, cattle are used extensively in important rituals and ceremonies. Traditionally, quality in cattle was less important than quantity, such that owning many animals was a symbol of wealth and status. They admired colour, markings and the shape of the horns more than the quantity of milk produced. As they had scant knowledge about cattle diseases, in times of cattle epidemics the Nguni relied on magic and rituals.

The Nguni goat is characterized by the following features: functionally efficient; and due to antelope-like legs, it is able to move long distances with ease; graze or browse on a variety of plants; resistant to diseases; known for multiple kids and mothering abilities. Among the Zulu people, goats are culturally valued for rituals and ceremonies but are less important mediums of exchange. The community knowledge holders indicated that compared to modern sheep Zulu sheep are disease resistant. For instance, they are able to tolerate both external and gastro-intestinal parasites as well as tick-borne diseases. In addition they are able to walk longer distances and have good foraging ability.

Dlamini (2014) shows that the inability of households to obtain access to adequate food for a productive healthy life is an important characteristic of deprivation. It is on the basis of this consideration that in 2006, the KZN Provincial Department of Agriculture in collaboration with the Government of Flanders unveiled a five-year "Empowerment for Food Security Program" (EFSP) project. The objective of the EFSP project was to improve the livelihoods of poor households by creating sustainable access to nutritious food for all household members in KZN. The main target (beneficiary) groups were subsistence farmers, especially women and people living with HIV/AIDS (Larson 2008).

The objective of the project was to capacitate local communities to produce their own food using local knowledge systems and resources. One of these project activities was the production of Zulu chickens which are very popular in the local communities. They have various socio-economic and cultural functions in traditional, religious and other cultural practices. These include gift payments, source of income and as an important source of animal protein for the rural poor (SADC 2012).

Dlamini (2014) highlights the community advantages of Zulu chickens also known as village chickens: (i) considerable minimal investment on inputs as most of the inputs are generated in the homestead. Indigenous chickens can be fed on cheap, locally available feeds; (ii) labour is inexpensive as it can be drawn from the family; (iii) initial investment is less than that

required to keep commercial breeds; (iv) their meat and eggs are considered tastier and preferred by some consumers compared to those sold by commercial producers (broilers); (v) markets are locally available and there are limited transport costs involved; (vi) the chicken droppings are rich in nutrients and can therefore be used for compost making, garden manure or as feed for livestock; (vii) In the context of climate change adaptation, they adapt well to harsh climatic conditions; more diseases resistant compared to commercial breeds.

In KwaZulu-Natal, subsistence farmers keep village chickens for household production (meat and eggs) and/or to supplement their income. Women dominate the production of these village chickens (World Bank 2009). However, Brouwer (2006) indicates that despite this dominance, extension services use remain low among women. They still depend on their IKS for production. Dlamini (2014) reveals that the majority of the rural women in KZN involved in the production of village chickens are over 50 years of age. This implies that age is a factor that can affect the sustainability of the village chickens farming because the older farmers were less capable of carrying out physical activities. It was also found that younger farmers, particularly women, were quite willing to interface indigenous and modern technologies to improve production. This is due to the observation that as farmers get older, they often become more reluctant to accept risk (Vogel 2006).

African Rural Women and Indigenous Knowledge Systems in Food Security and Nutrition in KZN

One of the issues which tend to be neglected in research and discourses on bio-diversity and food security in the province is the way in which rural women use their community based on biodiversity to ensure food security. This section discusses this issue. Dlamini (2014) shows that rural women in KZN represent more than fifty percent of the population and they are the basis of the subsistence economy of these areas. They are the ones who produce, manage and market most of the food for their families and communities. They also work directly with natural resources such as land, plants, and animals, and hence maintain the biodiversity of the rural areas. In the process of interacting with others within and outside their local communities in a variety of ways including trade, cultural ceremonies, extension services, they learn and adopt new knowledge, technology and value systems for sustainable livelihood including biodiversity for food security and climate change. However, this wealth of knowledge and experiences tends to be ignored in education, extension services, and policy development (Brouwer 2006).

Badenhorst (2008) highlights that due to their wide knowledge of local biodiversity; rural women in KZN are the custodians of the Zulu cultural food habits. In the context of this discussion food habits refers to the way in which different people select, cook, serve and eat food that are available to them. The types of food eaten by people are determined by foods availability, affordability and what people are accustomed to eating (FAO 2011).

Women used their indigenous knowledge of food biodiversity in the postharvest processing and preservation of variety of foods. The technologies used were simple and of low-cost hence affordable and accessible. They included sun-drying, smoking, salting, and fermentation. They helped to prevent among other things the growth of the micro–organisms that cause foods to decay. These technologies were known to most rural households. Dlamini (2014) provides the following examples: One method used to preserve fresh products is to put the product such as vegetables in salted boiling water for a few minutes and then dry them under the sun for about three days. They are then stored in a safe, and dry place. The method is also used to preserve edible insects and meat. Another method is to directly spread the food crops such as sorghum, pearl millet, beans, maize and groundnuts under the sun before storage in traditional underground store or pits of different shapes and sizes to increase their shelf life. Women are the key innovators, developing new ways to secure food supplies. Women in the rural KZN have developed food sources from watermelon *(Citrullus lanatus)* by drying and then grinding watermelon seeds and using these dried seeds to make porridge. Dried watermelon seeds can be preserved for years (Dlamini 2014).

Larson (2008) reveals that fermentation is one of the oldest methods of food processing among the Zulu people. It is a food preservation technique developed by women and particularly well

suited to the climate and conditions of arid and semi-arid areas. The raw materials from which fermented foods are produced include sorghum, pearl millet, milk, fish, and meat, wild plants, honey, etc. Fermentation enhances the nutritional quality of foods and contributes to food safety particularly under conditions where refrigeration or other modern food preservation facilities are not available (World Bank 2004).

Experience has shown that community knowledge-based food processing and preservation techniques such as soaking, germination and fermentation have been found to reduce significantly the levels of phytates and tannins by exogenous and endogenous enzymes formed during processing. The beneficial effects associated with fermented foods include reduced loss of raw materials, reduced cooking time, improvement of protein quality and carbohydrate digestibility, increased shelf life and microbiological safety of a food and improved bioavailability of micronutrients, general improvement in the texture, taste, aroma and elimination of toxic and anti-nutritional factors (McKiernan 1990; Berlin 1992; Ghosh 2003).

CONCLUSION

The paper discusses African indigenous knowledge systems (IKS) and biodiversity for food security and nutrition in Africa using examples from KwaZulu-Natal (South Africa). The role played by rural women as custodians of IKS on biodiversity for food security was demonstrated. This rich knowledge and experience possessed by women tend to be marginalized in policy development and agricultural extension. This knowledge is derived from their close interaction with the natural environment in collecting, producing, processing and preserving variety of food species for household food security and nutrition. This implies that biodiversity loss and bio-piracy endanger this knowledge and resource base. Women were also affected by lack of ownership and control over production resources, especially land along with limited access to education, credit facilities and extension services.

RECOMMENDATIONS

It is recommended that the designing of biodiversity, food security and nutrition policy strategies including programmes for rural communities should take the indigenous knowledge possessed by rural women seriously. They are the custodians of this knowledge and responsible for household food security and biodiversity conservation. This is due to the realization that only when policy makers and other development agencies understand and appreciate this fact can development policies on food security and biodiversity conservation become relevant and sustainable. This study should encourage more interdisciplinary research on issues related to IKS, gender and biodiversity for sustainable food security and nutrition. The findings of such research should be disseminated through publications and extension workers to benefit the rural communities and other stakeholders.

REFERENCES

Adèr HJ 2008. Phases and initial steps in data analysis. In: HJ Adèr, GJ Mellenbergh (Eds.): (with contributions by DJ Hand): *Advising on Research Methods: A Consultant's Companion*. Huizen, The Netherlands: Johannes van Kessel Publishing, Chapter 14, pp. 333 -356.

Altieri MA, Merrick LC 2008. Agroecology and in situ conservation of native crop diversity in the third world. In: EO Wilson, FM Peter (Eds.): *Biodiversity*. Washington, D.C.: National Academy Press, pp. 15-23.

Badenhorst R 2008. *Vegetable Production under Arid and Semi-arid Conditions in Southern Africa.* Plant Production and Protection Division. Rome: FAO.

Bechtel JD 2010. *Gender, Poverty and Conservation of Biodiversty: A Review of Issues and Opportunities.* New York: Macarthur Foundation.

Berlin B 1992. *Ethnobiological Classification: Principles of Categorization of Plants and Animals in Traditional Societies*. Princeton: Princeton University Press.

Braidotti R, Charkiewicz E, Häusler, Wieringa S 1994. *Women, the Environment and Sustainable Development: Towards a Theoretical Synthesis.* New York*:* Worldviews.

Briggs J 2005. The use of indigenous knowledge in development: Problems and challenges. *Progress in Development Studies,* 5: 99-114.

Brouwer J 2006. On indigenous knowledge and development. *Current Anthropology,* 39(3): 351-373.

Dei GJS 1993. Indigenous African knowledge systems: Local traditions of sustainable forestry. *Singapore Journal of Tropical Geography,* 14: 28-41.

Department of Science and Technology (DST) 2013. *The National Recordal Systems*. Pretoria: DST.

Dewalt BR 2004. Using indigenous knowledge to improve agriculture and natural resource management. *Human Organization,* 53(2): 54-69.

Dlamini N 2014. *Gender, Food Security and Biodiversity in Rural KwaZulu-Natal.* Unpublished Manuscript. KZN: Provincial Department of Social Development.

Emery AR 1996. *The Participation of Indigenous Peoples and Their Knowledge in Environmental Assess-*

ment and Development Planning. Ottawa, Canada: Centre for Traditional Knowledge.

FAO 2004. *The State of Food Insecurity in the World-Addressing Food Insecurity in Protracted Crises*. Rome: Food and Agriculture Organization of the United Nations.

FAO 2011. *Biodiversity for Food Security*. Rome: FAO.

Fujisaka S, Prain G 2006. *Indigenous Experimentation and Cultural Diversity*. London: IT Publications.

Gadgil M, Berke F, Folke C 1999. Indigenous knowledge for biodiversity conservation. *Ambio,* 22: 151-156.

Ghosh S 2003. The traditional terms of the traditional knowledge debate. *Columbia Journal of Asian Law,* 17: 73-117.

Greaves T 1994. *Intellectual Property Rights for Indigenous Peoples: A Sourcebook*. Oklahoma City, OK: Society for Applied Anthropology.

Huberman M, Miles M 2002. *The Qualitative Researcher's Companion.* London: SAGE Publications Ltd.

Iltis HH 2002. The impossible race: Population growth and the fallacy of agricultural hope. In: A Kimbrell (Ed.): *The Tragedy of Industrial Agriculture.* San Francisco: Island Press, pp. 35-39.

Larson J 2008. Perspectives on Indigenous Knowledge Systems in Southern Africa. *World Bank Discussion Paper* No.3, Washington D.C.

Lwoga ET, Ngulube P 2008. The Management of Indigenous with Other Knowledge System Agricultural Development: Challenges and Opportunities for Developing Country Scientific and Technical Information and Rural Development. *IAAD World Congress*, France, 26 – 29 April 2008.

McKiernan G 1990. Preserving the wisdom of the ages. *Garden*, 10-15.

Meinzen-Dick RLB 1997. Gender, property rights, and natural resources. *World Development,* 1303-1315.

Schmiedel U, Jürgens N (Eds.) 2010. *Biodiversity in Southern Africa: Patterns and Processes at Regional scale*. Göttingen and Windhoek: Klaus Hess Publisher.

Seager J 2005. *Mainstreaming Gender in Environmental Assessment and Early Warning.* New York: United Nations Environment Programme (UNEP).

Southern African Development Community (SADC) 2012. *Towards A Common Future*. Gaborone, Botswana: SADC.

Vogel C 2006. Living and responding to multiple stressors in South Africa—Glimpses from Kwazulu-Natal. *Global Environmental Change*, 16: 195–206.

World Bank 2004 Using IK for Agricultural Development. *World Bank Discussion Papers* 127. Washington DC: World Bank.

World Bank 2009. *Indigenous Knowledge for Development – A Framework for Action.* Washington, DC: World Bank.

Zerbe N 2003. Contested ownership: TRIPs, CBD, and implications for Southern African biodiversity. *Perspectives on Global Development and Technology*, 1-25.