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**Mphil Sustainable Development and Planning - Sustainable Agriculture**

**Assignment: Biodiversity and the Challenge of Sustainable Agriculture**  
**Due 25/04/2005**

**Statement**

**" The application of knowledge other than chemicals is the key to increasing food output on small farms in developing countries. Mixed cropping has a proven success as a strategy that can both produce the food that is needed immediately and is sustainable. "**

In not less than 3500 and not more than 8000 words discuss this statement with reference to themes from literature of your choice or choose a particular case study or both. Examples of themes are: -

- Food Security
- Biodiversity and how to sustain it
- Poverty Eradication
- Sustainable Livelihoods
- Agricultural Productivity

Examples of Case Studies could include: -

- Food Production in Cities
- A Business or Farming Sector
- A Biodiversity Policy

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## **Introduction**

The South African Draft Sustainable Utilisation of Agricultural Resources Bill (hereafter referred to as "the Bill") seeks:

*"To Provide for the sustainable utilisation of natural agricultural resources, including control over the subdivision and change of use of agricultural land and prime- and unique agricultural land, in support of biodiversity and for that purpose to provide for the designation and functions of an executive officer, the establishment of land care committees, the prescribing of standards and control measures, the establishment of schemes and trusts, control over the spreading of weeds and invader plants and to provide for incidental matters thereto."*(South Africa. The Bill. National Department of Agriculture 2003:1)

This, the Bill intends to provide for, while recognising the historical exclusion of black people from the agricultural sector resulting in 'racially skewed patterns of utilisation of agricultural land'. It also seeks to enable land users to be aware of the need to change patterns of usage to provide for the development and regeneration of natural agricultural resources to ensure sustainability now and for future generations.

The Bill elaborates on the definitions of various words and phrases for ease of clarity and also describes the designations and functions of the envisaged executive officer. It further explains the modus operandi in establishing the Land Care Committees and Schemes and Trusts and is very specific on the control of the spreading of weeds and/or invader plants. Chapter seven and eight are dedicated to the utilisation, subdivision and registration of agricultural land while chapters nine and ten concentrate on law enforcement and regulations.

What, in my opinion, is lacking in the Bill is a provision of the sustainable utilisation of natural agricultural resources under the headings of Social, Environmental and Economical. This would emphasize the importance of the legislation and also assist the end user in an understanding of the impact it has on our daily lives. In order to illustrate this further I will concentrate on the impact of the Bill on poverty alleviation, a social aspect, with emphasis on traditional farming as the key to increasing food security on small farms in South Africa.

## **Poverty Alleviation**

There is no disputing the fact that agricultural land is the main ingredient in the alleviation of poverty in developing countries. This is particularly true in the South African context where 70% of the countries poorest households live in rural areas (Food Security-S.A. January 2004). Most of these people reside in the old TBVC states (Transkei, Bophutatswana, Venda, Ciskei), and when one takes into consideration the level of degradation of agricultural land in these areas, the Bill is found to be sorely lacking in the link between sustainable utilisation of natural agricultural resources and

food security. Natural agricultural resources include water, soil, sun, biodiversity, the animals and the indigenous knowledge base of the people. It is my contention that in attempting to address the sustainable use of agricultural resources (including land), government should influence (through legislation) all the following aspects as they have an impact on food security:

- ❑ -Energy management
- ❑ -Soil management
- ❑ -Water management
- ❑ -Biodiversity management
- ❑ -Livestock management
- ❑ -Rural development

I intend to briefly discuss each of the above natural agricultural resources in an attempt to explain why I believe the Bill should incorporate them. My focus however, will be on rural development as a case study of the benefits of government policy intervention in the promotion of indigenous strategies to increasing food output on small farms in developing countries while also ensuring 'support of biodiversity and the sustainable utilisation of natural agricultural resources.'

Pretty, J. et. al.(Course Reader 2005) states that *"the selection of elements appropriate to local livelihoods will best be made by rural people, who know most about local conditions. This participation in planning, implementation and maintenance has been shown to produce highly effective, efficient and sustainable solutions but generally on a small scale. The final element of the challenge for fostering this new revolution lies in the support by national governments in the form of appropriate institutional and legal frameworks and economic incentives to make these islands of success more widespread"*

This sentiment is echoed by Salamini (May 2000:64) who states that governments in both the developed and developing countries should design policies and legislative frameworks in water management, property rights in land and natural resources, earning opportunities and welfare supports for low-income farmers, energy management in agriculture and rural infrastructures.

### **Natural Energy Management**

The sun is a natural source of energy and light and a resource without which agriculture would be well nigh impossible. Besides its uses on photosynthesis in plants the sun's energy can be harnessed to create solar energy which can be used on the farm as a substitute for the more expensive electricity.

## Soil Management

Soil is a mixture of organic and inorganic matter and air and water. The first is made up of dead plants and animals and very small living organisms while the second is made up from minerals, rocks and stones. Air and water account for about 25% each of the total volume, with 45% minerals and about 5% organic matter.

Features of a good soil are as follows:

- Drains well and warms up quickly in the spring
- does not crust after planting
- soaks up heavy rain with little run off
- stores moisture for drought periods
- resists erosion and nutrient loss
- has high populations of soil organisms
- does not require fertilizer for high yields
- produces healthy high quality crops

It is important to maintain the quality of the soil as one of the first steps in the sustainable use of agricultural resources. Without healthy soils there would be no life, let alone sustainable agriculture and thus inadequate food supplies. Primary causes of soil degradation are overgrazing, deforestation and inappropriate farming practices. (Heap, B. and Kent, J. 2000. Pp.59-66). Government policy should be very clear on the sustenance of this very valuable and fundamental resource. This should be clearly elucidated in the Bill. Regulating the building up of soil through practices such as animal manure, cover crops, compost, reduction of tillage and synthetic nitrogen will minimize the occurrence of soil erosion, salinisation and other degenerates, which are not conducive to agricultural production. (Sullivan, P. ATTRA February 2001)

## Water Management

*" To date the world has had a comparatively easy ride on the back of generally ample water resources that had to be developed to meet demands. But now, much of the world is simply running out of water - and much of the rest of the world is facing rapidly increasing financial and environmental costs of developing the water resources they have." (David Seckler and Upali Amarasinghe 2004)*

*"A conscientious co-management of water for agriculture and ecosystems is a basic precondition for sustainability. An overriding challenge is to identify the path towards sustainable consumption and production patterns and to design incentives and other policy measures that could facilitate an effective achievement of the goals" (SIWI & IWMI. 2004.)*

These quotations, both taken from a working document produced for CSD-12, adequately summarize the predicament the world (including South Africa) is in, with regards to the impending scarcity of water. The South African National Water Act of 1998 adequately addresses the question of water usage focusing on the requirement of a basic human needs reserve and an ecological needs reserve.

However, the Draft Sustainable Utilisation of Agricultural Resources Bill would in my mind have made reference to the Water Act in its quest for sustainable use of natural agricultural resources. Heap, B. and Kent, J. 2000. believe that by the year 2050 from 3.5 to 7.7 billion people will live in countries that are short of water resulting in competition for water between agriculture and other activities.

-The Department of Water Affairs and Forestry in South Africa has a program called "Working for Water" which aims at sustainably controlling invading alien species. The invader plants waste 7% of available water, intensify flooding and fires, destroy rivers, cause erosion, reduce ability to farm and can cause a mass extinction of indigenous plants and animals. (DWAF.online 2005)

### **Biodiversity management**

There is an urgent need for taking stock of the earth's biodiversity, a task that is challenging biologists all over the world. As the nomenclature continues the task is complicated by the daily extinction of species due to human based threats such as pollution, sedimentation, alien invasions and over-exploitation. The importance of on farm biodiversity is only now being realised in the practice of sustainable agriculture and more studies need to be conducted in this respect.

### **Livestock management**

Salamini (May 2000:62) states that the modeling of sustainable livestock production is an area that is virtually untouched. Livestock and for that matter wildlife is to me a natural agricultural resource that has to be managed in a sustainable manner that ensures non-extinction and the encouragement of natural breeds.

#### **□ Karan Beef - Conventional Feedlot**

Karan Beef is the biggest feedlot in the Southern hemisphere and is in Heidelberg district in the Gauteng Province of South Africa. It boast 80,000 (eighty thousand) animals at any one time which are confined in paddocks of less than 20 (twenty) hectares depending on their stage of development. They are fed specialised feed with high levels of protein, vitamins and minerals together with the pre-harvested and packed grass for bulk. Growth stimulants are injected periodically behind the ear and the animals are discouraged from moving around as this 'wastes' energy.

This is unsustainable use of these animals as they are bred under unnatural conditions and growth is chemically stimulated. (Nemasetoni,R. Land Bank Manager. Interview April 2005)

#### **□ Benchmark Bonsmara - Organic Large Scale Livestock Farm**

This is an example of a large-scale organic livestock farm in the Free State Province of South Africa. The farm is spread over 38 000 hectares in various locations in South Africa. This would be classified as sustainable use of the livestock on this farm as the animals are encouraged to grow under very natural conditions and less use of artificial stimulants is used. (De Lange, Consultant. lecture February 2005)

## Rural Development

I strongly believe that the South African government through the Department of Agriculture's Draft Bill on Sustainable Utilisation of Agricultural Resources should call for a regeneration of rural agriculture through the policy of traditional or natural agricultural practices.

### High External Input

With the advent of the Green Revolution farmers in the rural areas have lost the natural skills that have sustained them through the years and are practicing agriculture with high external inputs that they cannot afford. External resource farming is not suitable for rural farms due to capital and technology intensity and the need for very high skill levels. Pretty, J. et. al.(Course reading 2005:127) quotes the following as typical requirements in a high external input system:

- ❑ Artificial lights as used in greenhouse food production
- ❑ Water is usually from large dams, with centralized distribution and deep wells
- ❑ Nitrogen is primarily from applied synthetic fertilizer
- ❑ Other nutrients are mined, processed and imported
- ❑ Weed and pest control is by synthetic chemical herbicides and insecticides
- ❑ Seed used is derived from hybrid or certified varieties purchased annually
- ❑ Machinery is purchased and replaced frequently
- ❑ -Labour is mostly hired off farm
- ❑ Capital is usually externally provided via loans and the benefits leave the community.
- ❑ Management decision making is normally from input suppliers and extension officers
- ❑ Varieties of plants cultivated need high inputs to thrive

This distinct type of agriculture was suitable in the Third world for a time where access to credit was not a problem. Pretty, J. et. al.(course reader 2005:129) goes on to state that ***"For high productivity per hectare, farmers need access to the whole package: MV seeds, water, labour, capital or credit, fertilizers and pesticides. This is not always possible."***

### Low External Input

On the contrary farmers in rural areas mainly located in what are known as poverty nodes in South Africa need agricultural systems that are based on culture and tradition that has been passed on from generation to generation and as such have stood the test of time. The

cry of the bird "Cuculus Solitarius" more commonly known as The Black Cuckoo Shrike or 'Piet my vrou!' in Afrikaans, has been used in the Tsolo region of the former Transkei as a sign to start the maize planting season in Sept/Oct for many years. This is an example of a farming practice based on tradition that the government should encourage for the rural farmers. Other characteristics of this type of farming which has low external inputs (if any) are:-

- ❑ The natural sun is a source of energy for plant photosynthesis and solar power.
- ❑ Water is derived from the rain and small-scale irrigation systems

An example of a small scale micro-irrigation system that is being used in parts of South Africa is the 'Drum and Drip System" developed by International Development Enterprises and adapted to suit the South African context by Gerrie Albertse of Farming Systems Consulting Services in Stellenbosch.( T Khosa. et. al., August 2003). This system consists of a 210 litre drum which is connected via a tap to a set of five polyethylene dripper lines of about six meters each. It irrigates an area of thirty-six square meters and the total cost is about R150 (one hundred and fifty rands). This has proved invaluable in the months when nature failed the local farmers. Trials were conducted in the Sekuruwe and Ga-Molekane settlements north of Mokopane in Limpopo Province. This system was very advantageous as it allowed for the recycling of 'grey' or used domestic water in vegetable production.

- ❑ Nitrogen is fixed from the air and recycled in soil organic matter-Nitrogen fixing cowpeas or mung beans are sown into standing rice stubble as a source of oxygen
- ❑ Other nutrients are derived from soil reserves recycled in the cropping system

Before the advent of the Green Revolution methodologies farmers in rural South Africa practiced mixed cropping. This had several advantages such as mitigation against total crop failure as negative conditions that affect one crop may not affect the other. Even though yields were not as high as in monocropping, polyculture ensured a higher and more varied output of food. There is also more efficient use of resources such as water, light and nutrients by diverse plants with differing structures. Some of the plants were chosen specifically as ground cover (eg legumes) and this discouraged weeds, while others complemented each other in warding off pests. In the book "The One Straw Revolution" Fukuoka (2004) describes the extreme to natural farming which he calls 'Do Nothing Farming". He believes that nature left to its own devices balances itself out and even pests and diseases are eliminated. His four principles of natural farming are 'no cultivation, no chemical fertilizer or prepared compost, no weeding by tillage or herbicides and no dependence on chemicals'.

- ❑ Weed and pest control is biological, cultural and mechanical

Fukuoka, M. (2004:36) in "The One Straw Revolution" explains that he succeeds in controlling weeds by ensuring that there is no interval between succeeding crops and immediately after harvesting he ensures that the whole field is covered in straw. He believes that if soil is cultivated it actually gives weed seeds lying deep in the soil the chance to germinate and sprout to the detriment of the farm.

Pretty, J. et. al.(Course reader 2005:132) believes that pesticides are not a perfect answer to controlling pests and pathogens. Besides them damaging natural resources and the environment, pests become resistant to pesticides resulting in repeated application, which renders the whole process 'useless'. Low external input systems use the agroecological process of predation, and parasitism in six broad strategies of pest control:-

1. emphasizing natural enemies of pests and pathogens
2. breeding crop plants or livestock for resistance to pests and pathogens
3. using locally available insecticidal compounds to reduce pests
4. increasing agrosystem diversity to reduce pest or pathogen numbers
5. disrupting pests reproduction
6. the selective use of pesticides, with low toxicity and little environmental hazard

□ Seed varieties produced on farm and genetic stock is encouraged

The 9<sup>th</sup> International Training Workshop on Sustainable Management, Development and Utilization of Plant Genetic Resources was held in Lesotho in 1998. Mr. Masilo, the then permanent secretary of agriculture had this to say:

***" Let me implore you to recognize the role of local farmers in the conservation of plant genetic resources .By conscious and continuous selection they have created the immense genetic variations on which agriculture depends. Not enough use has been made of farmers indigenous knowledge acquired through long years of practical agricultural activities. It is time this knowledge is harnessed to save food security"***

Other participants from a dozen African nations told of setbacks to plant genetic resources in their countries. For example Emmanuel Antwi of the Ghana Organic Agriculture Network, noted that the Sasakawa 2000 aid program of hybrid maize (coming complete with subsidized fertilizer and pesticides) had produced good yields for a few years in Ghana. But soils were soon depleted and salinated, and fertilizer costs soared when subsidies were cut. Meanwhile local farmers had abandoned their traditional seeds. His network was trying to conserve and multiply the surviving seeds, with help from the national gene bank's collection. The Basotho people of Lesotho are acutely aware of the disappearance of their genetic resources: even their national flower, the spiral aloe, is in danger of extinction. One gleam of hope lies in the slow but steady success of one farmer who has popularized a system of intensive intercropping on one-acre farms with year round harvesting of seven crops. (IDRC May 1998)

- ❑ Machinery is very minimal and usually bought collectively and shared by the community. The use of cattle to plough is encouraged, as the negative impact on the soil is not as great as it would be with a tractor. The cattle droppings serve as natural manure encouraging a rich complexity of organisms that are essential for soil health.
- ❑ Labour is mostly provided by the family with assistance from the community if needed on a rotational basis. As the younger men are usually working in the mines and seldom come home the women gather together and work in each others fields on a rotational basis. Twice a day the children will bring bread baked early that morning with 'sweet-aid' (cool drink powder) that is easy to make as one just adds water or 'amasi' (sour milk).( Mbabama, T. personal experience as a child every December holiday). Norberg-Hodge et. al (1993) explains that agricultural work in the rural Ladakh is performed at a leisurely pace and seen as a social occasion where family members interact with each other and neighbours.
- ❑ Capital- the source is from the family and community where 'stokvels' or microlending is encouraged. The barter system is also used where families exchange produce. The young men who typically would be working in the towns are a source of income with the remittances that they send on a monthly basis.
- ❑ Management decisions are usually made collectively by the elders in the community with the local chief presiding. In a small village in the former Trankei called 'Engcolosi' or St. Cuthberts as the missionaries named it, my cousin is a chief. Although younger than most men in the village he came to be chief through ascendancy and he calls an 'Imbizo' or meeting of the elders when any management decisions have to be taken. This has a great advantage in that the wisdom of the elders is used for everybody's benefit and it also encourages information sharing.
- ❑ Varieties of plants thrive with lower moisture and fertility

## Conclusion

Traditional systems of agricultural production may not compare to conventional farming when it comes to yields per hectare in the short term but governments of developing countries should encourage them because of the following reasons:-

- ❑ Traditional systems are the only time-tested models of sustainable agriculture
- ❑ Multi cropping allows for intensive production despite limited land resources
- ❑ The diversity of crops contributes to a varied diet and self-reliance on fuel, fodder, fertilizer medicine and fibre.
- ❑ Polyculture is an effective strategy for mitigating the risks of crop failure
- ❑ Traditional agriculture tends to be integrated with the social bonds of the community and strengthens kinship ties, meets reciprocal obligations and encourages self-sufficiency.
- ❑ Traditional agriculture generally ensures an adequate supply of nutritionally balanced food for the whole community
- ❑ Because the earth is treated with great reverence and honoured as a source of life agricultural practices tend to regenerate and sustain the soil and ensure the passing on of lands that are as fertile as those received from generation to generation.
- ❑ Traditional agriculture is low in external inputs which makes it much less expensive and therefore affordable to rural resource poor farmers.
- ❑ Research and Development is a natural process in that traditional farmers are constantly experimenting and adapting their practices to fit local conditions.
- ❑ Developing countries have always been at the mercy of their counterparts in the developed world and if their governments could promote this type of farming through legislation they would regain their dignity and not be so vulnerable on the world arena.

(School of Public Management and Planning.2005)

It is clear from the above that science does not always have the answer. It has totally failed at growing food in marginal areas and governments in the developing countries need to acknowledge this and through consultation and legislation agree that: "**The application of knowledge other than chemicals is the key to increasing food output on small farms in developing countries. Mixed cropping has a proven success as a strategy that can both produce the food that is needed immediately and is sustainable.**"

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