Special Issue Paper

Afr. J. Traditional,
Complementary and Alternative Medicines
www.africanethnomedicines.net

ISSN 0189-6016©2007

BIODIVERSITY, GLOBALISATION AND POVERTY*

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Abstract

The erosion of the stock of biodiversity on earth developed historically with the so-called voyages of discovery (and their antecedents), colonial conquests and the accompanying movements of natural products and peoples, i.e. movements of populations and genetic materials. These events happened with the development of technology and the so-called conquest, by man, of his environment and the appertaining development of specialization not only in industry but also in agriculture and environmental management. The development of specialization resulted in the homogenization of processes, products, inputs and input industries; this increased homogenization had the corollary of arrested heterogeneity across the board; what they call globalization is part of this process. The efficiency of homogenization, however, engendered new problems of fragility of human environment and of production and social relations and processes. The effects of this complex situation, in general terms and in terms of biodiversity in particular, have been more devastating for the more vulnerable regions, classes of people, and peoples of the world. A continuous rethinking of the epistemology and the social and political bases of existing policies on environment in general, and of biodiversity conservation in particular, has become imperative.

Introduction

For close to half a century now, there had been a renewal of the concern over the decline of biodiversity on our planet. Within that period, certain social, economic and political events have also become dominant. First, there has been the insistence in certain quarters that what they call globalization is an unqualified phenomenon; in those quarters, the insistence is accompanied by the unequivocal belief that globalization is completely salutary. Secondly, hunger, poverty, and general underdevelopment have surfaced in more virulent forms among more and more peoples and citizens of the world. Thirdly, the crisis of human ecology and environment, often triggering violent conflicts, has become more and more intractable.

The crisis of human environment has, of course, manifested in different forms, at different intensities among different regions of the world and different classes of people in different countries and societies. In its elemental form, the crisis of human environment has been particularly devastating among peoples and societies that depend *directly* on natural resources and products (plants and animals) for generating their needs and for reproducing themselves and their societies. As a major, if not the major, element of the crisis of the environment, the decline in global biodiversity has been most devastating to the most vulnerable of the citizens of the world. Consequently, although it is true that "poverty is the worst enemy of the environment" (Murieta and Andaluz, 1990), the relationship of poverty and the environment is a "loop" rather than a lineal one.

For good or ill, the impression is becoming entrenched that globalization, in all its ramification, is a new phenomenon that is unstoppable and to which peoples and regions of the world must bow. This perception is being

* Update of an invited LEAD PAPER delivered at the 13th Conference of the Botanical Society of Nigeria (BOSON) on the theme "**Plant Resources in Changing Environment**" at Abubakar Tafawa Balewa University, Bauchi: 26th - 30th September, 2004.

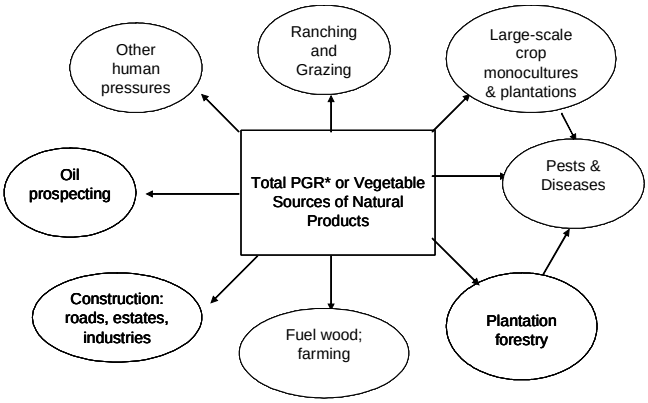

Figure1: Factors enhancing genetic erosion and depletion of vegetable sources of natural products

Table 1: Exploitation and loss of Vegetable (Genetic) Sources of Natural Products-the global historical phases.

	REGION	HUMAN ACTIVITY
Phase I:	Middle-Eastern & European Civilization – endogenous, voyages of discovery 2,000 BC – ca 1, 500 AD	Grain production, deforestation, ranching, mining, spices, minerals, ivory, furs
Phase II:	Slave trade; Plantation, agriculture, mining – largely outside Europe ca 1,400 AD - 2,000 AD	Cocoa, Coffee, tea, rubber, Oil Palm, ground-nut, sugar cane, cotton, tobacco, timber
Phase III:	Gene hunting, New agriculture for import substitution 1950 AD - date	Grain, sugar cane, wheat, rice, sorghum, oil palm, rubber, cassava.

drummed up by the powerful political and economic interests of the world. A critique of this paradigm was done in *African Agenda* (1994), Stalling (1995) and Sachs (1995). The question of the sustainability of a development strategy or process also happens to have arisen contemporaneously with the globalization paradigm. It has been applied in a rather prescriptive way, almost always, to development strategies for developing countries or regions although not entirely exclusively to them. For example questions are often asked as to whether *overall* extant exploitation strategies for the resources of our planet are sustainable (Ophuls, 1977).

Professional conservationists and scientists have tended to treat the problems of genetic resources conservation and biodiversity as purely technical issues. They are not! The main purpose of this intervention is to attempt a synthesis of the tradition of a robust conception that ties purely technical scientific issues with the dynamics of their economic, social and political ambience at local and global levels and to, especially, reinstate the centrality of *public* (or *collective*) purpose in the conception and practice of biodiversity conservation.

Plant genetic resources (PGR)

Plant genetic resources, *sensu amplo*, is the totality of the genetic endowment of plants in a specified time or space. Packaged as they are in specific individual plants in conspecific populations, they form the basis of hierarchical categories in communities, ecosystems and biomes. In the fore-going sense, plant genetic resources are conterminus with biological diversity or biodiversity of plants. According to Kokwaro (1994), biodiversity itself is:

> "The totality of genes, species and ecosystems in a region …. The total heritable variation or differences in characteristics that exist in all living things [all plants in as far as we are concerned here], individuals and their species in various ecosystems in different parts of the earth".

Lesser (1994) indeed observed that the potential usefulness of genetic materials is related to their diversity.

The concept of genes (plant or animal) as a resource needs to be placed in its broad anthropocentric and utilitarian perspective. In its extreme form, it has resulted in generalized myopia and the focus on commerce and profit rather than the altruism of *public* or generalized *collective purpose*. These [plant] genetic resources are to be *extracted* from their sources. Once these *resources* are exhausted, their milieu (the community or ecosystem) that produce them are forgotten. Plant genetic resources, therefore, suffer the fate of extractive industries (mining, logging, dams etc.). This is the perception and the actual practice of PGR experts, gene hunters, seed companies, etc. (Ng et al. 1991; Hawkes, 1990).

The foregoing is why professional botanists need to adopt the ample definition of plant genetic resources in the last but one paragraph. This strategy is particularly useful because of the bourgeoning influence of the factors that erode and, therefore, deplete the genetic pool of vegetable resources (Figure 1). An entirely utilitarian perception is unscientific and myopic. As Swanson (1992) observed in this ample sense:

> "The loss of biodiversity means the loss of options for all of us and for future generations …….The variety of microbes, plants and animals that have only recently been discovered to be of human usefulness illustrate the *potential value of the undiscovered"*. (my emphasis).

A further compelling reason for the adoption of a robust definition of genetic resources is what Aylward (1992) characterized as the importance of *ecosystem services or ecological services:*

> "The value of ecosystem services are difficult to appropriate and, like species and habitat existence, tend to be under supplied as a result. Ecological processes support economic activity but acting as a buffer against routine excessive variations in weather, climate and other natural events outside the control of human beings. Most of these ecosystem services are examples of *indirect use* values. They offer support and protection for human activities, but do not themselves directly enter directly into human preferences".

Development, underdevelopment and biodiversity

For a long time since many European states, USA and Japan attained the status of *industrialised* countries or "developed" countries, many countries, including Nigeria, attained the status of "underdeveloped" or "developing" countries. We have also encountered formulations such as *third world* countries, meaning poor countries. Today, we hear formulations such as "thirdworldisation" of East European countries following the triumph of the "market". There have also been a plethora of schemes of characterising developing economies and strategies for economic development. These issues need not delay us here as ample literature exists in these regards (Baran, 1957; Baran and Sweezy, 1966; Frank, 1967; Rostow, 1960; Amin, 1974; Rodney, 1974; Ake, 1978; Krasner, 1985).

One issue that is seldom addressed is some comparison of the processes of the development of the industrialised countries and those of developing countries. It is becoming clear, particularly recently, that the impunity and the manouvering space which today's industrialised countries *had* are not available to the developing countries of today's—enslavement of whole continents, total and complete devastation of flora and fauna of the Mediterranean, most of Europe and large parts of North America, all manners and processes of *primitive accumulation*, unprecedented population growth without any second party moralisation about population growth etc, etc.

The question of biodiversity conservation and exploitation seem to have become an issue partly because industrialised states have apprehended a stake in the business—the crisis has become a *global* issue (Swanson, 1992). Data from McNeely et al (1990) cited in Swanson (1992) shows that:

> "A listing of the countries with the greatest number of species reveals several patterns. Many of these countries share common characteristics; they are typically tropical, forested, developing countries.

Swanson (1992) further observed:

> "Perhaps the single most striking characteristic of the distribution of species wealth throughout the world is the extent to which it is located in developing countries. *Virtually all of the most significant sites for diversity conservation are situated in countries with some of the lowest per capital incomes in the world"* (my emphasis)

In relation to the fore-going, Juma (1989) also noted that the poorest nations of the world as a group account for 95.7 percent of the world's crop genetic resources. Specifically Juma (1989) summarised:

> "Latin America has given the world maize, potato, cassava, and sweet potato, while West Central Asia has added wheat and barley. Africa contributes some 4.0 per cent while the Mediterranean and Euro-Siberian regions add 1.4 per cent and 2.9 per cent respectively. The Chino-Japanese region contributes 12.9 percent, Indo-China 7.5 percent and the Hindustan region add some 5.7 per cent.

The "donor" regions mentioned above are also the regions of poverty referred to earlier on. Most of the countries in the regions were also those that experienced colonial conquest and that have since remained what is now referred to as neo-colonies (Nkrumah, 1965; Rodney, 1974). The lingering heritage of the transfer and establishment of plant genetic resources in underdeveloped countries and the subsisting "dependent" primary producer status of many countries like Nigeria was captured succinctly by Juma (1989):

> "Much of what African countries have adopted as modern agriculture is rooted in the way genetic resources were incorporated in the socio-cultural evolution of Western countries. Historical economic botany show the links between economic complexity and the introduction of new genetic resources (as well as the related knowledge and technology) in agricultural production"

Consequently, whether we are examining the hegemony of North America in agricultural production or the phenomenon of *plantation agriculture* (coffee, tea, cocoa, oil palm, rubber, cotton, wheat, groundnut, sugar cane, opium, etc), we are confronted with the development of underdevelopment from about the 15th century A.D. (Figure

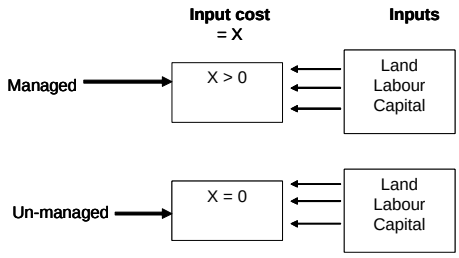

Figure. 2: Natural Resources: Inputs, "Development" & "Under-development"

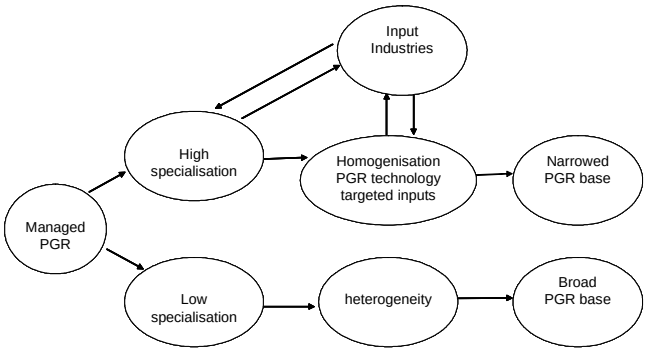

Figure 3: The effect of intensity of specialization on the breadth of PGR base homogenization/biodiversity of environment

2). We are confronted with the history of genetic erosion in indigenous crop production and general diminution of biodiversity.

Iltis (1968), Iltis et al (1970), Ophuls (1977) and, succinctly, Juma (1989) situated the foregoing dynamic of plant genetic resources and environment in the epistemology of environment and expansionism epitomized genealogically in Aristotelian, Baconian, Cartesian and Newtonian world views (Juma, 1989) surmised to imply that:

> "all the expansionist needed to do was to be convinced that other races (creatures) were inferior and they could therefore justify their exploitation and even extermination".

It is left to be said that the massive assault on natural vegetation (construction of dams, lumbering, massive land clearing) in many parts of Nigeria following the tremendous private accumulation by multinationals and members of Nigeria's ruling class since the early 70's all flow from this epistemology.

By all accounts, poor countries and poor regions of the world have remained poor for the last two hundred years or so; even the "tiger" glimers of the far east have dimmed. In Nigeria, most of the hopes that follow independence have collapsed; even the locally trained man power that could have powered rejuvenation have migrated massively. Sixty-six per cent of Nigerians are estimated to be living below poverty line. The received economic programme (SAP) has accentuated poverty sufficiently that both IMF and the World Bank (the authors of SAP) have incorporated *poverty alleviation* into their *poverty accentuation* programmes.

In specific relation to biodiversity and the environment, poverty has been referred to as "the worst enemy of the environment" (Murieta and Andaluz, 1990; Olorode, 1995). Referring to the massive degradation of tropical forests, Hadley and Dogse (1990) observed:

> "The alarming degradation of these precious areas is in large part due to *poverty*, *debt, ignorance, lack of ownership right and control* and the overall weakness of institutional frameworks to properly manage these zones (emphasis mine).

In a country like Nigeria for example, these situations have worsened considerably with rising unemployment, withdrawal of "subsidies" on fossil fuel (kerosene) and various social services.

Circumscribing biodiversity

Biodiversity is observed at various levels. It occurs among genes; it occurs among individuals within species; it exists between species. It also occurs among ecosystems and biomes. Conservation and utilization strategies need to take all these into consideration because individual genotypes may need to be protected outside their habitats, in their habitats or ecosystems and biomes. Gene variation leads to species variation. Species variation in turn is the basis of ecosystem and biome differences. Mankind has also created conditions which generate considerable biodiversity through humanity's various activities such as use of fire, farming, animal husbandry and plant selection. In this regard, the cloning of the gene in 1973, twenty years after the double helix DNA model was proposed, has also resulted in momentous possibilities for man to change and combine genotypes and literally to create new genotypes. These possibilities have led to the creation of the so-called GMOs and trangenic animals and plants (Nicholl, 1994; De La Perriere and Seuret, 2000).

Without doubt, much still remains to be known about organisms and the welter of variation among them. Consequently, if we pay proper attention to the incredible potentials in the genetic materials of organisms, no efforts can be spared in understanding and conserving them.

The Economics of the decline of biodiversity

Beyond the epistemology of environmental expansionism *(sensu* Juma, 1989), the social and political results they engender, and the consequences for biodiversity, human and social decisions on economic processes create a "dichotomy" in the way natural resources are husbanded i.e. the way in which humans interact with their environment. A seminal clarification in this regard was the work edited by Swanson and Barbier (1992). The contribution by Swanson (1992) deserves copious review; this is attempted immediately below.

When the dichotomy mentioned above arises, natural resources fall into two categories—managed and un-managed (Figure 2). Managed natural resources attract investments (land, labour, capital) they even lead countries to wars such as the Opium War between Britain and China (1839-1842). Unmanaged natural resources on the other hand attract little or no investment; they are not conserved and they become threatened with extinction; they are not utilised, so they are "undervalued". Provision of appropriate habitat for managed resources (species) result in human competition with un-managed species leading to their being threatened.

Differential levels of investment in managed natural resources are controlled by the laws of economic specialization. In respect of utilised (agricultural) species, the law of specialisation has led to the progressive homogenisation of crop species seen throughout the world. Swanson (1992) further observed that *specialisation* produces uniformity and enhanced productivity and that it emerged in agriculture very early in human history leading to elimination of considerable biodiversity for only one crop or a few crops and *substituting homogeneity for heterogeneity* (Figure 3).

The direct consequence of the homogenisation of species is the production of monocultures with the development of appropriate machinery and mechanisation, appropriate and *targeted inputs* (fertilizers, herbicides pesticides, etc.) and enhancement of technical and technological support. All of these further narrow down not only the number of species but also the base of genetic pools of utilised species—genetic erosion.

It is important to emphasise that the consequences of plant genetic resources homogenisation is not just in relation to food provisioning, but in provisioning for various industrial raw materials. Consequently, homogenisation of crop production has also deepened the homogenisation, specialisation and productivity of capital goods production. All these, with the aid of political and military backups, have further enhanced the exploitation and expropriation of developing regions and nations of the world. It is needless in these regards to call attention to

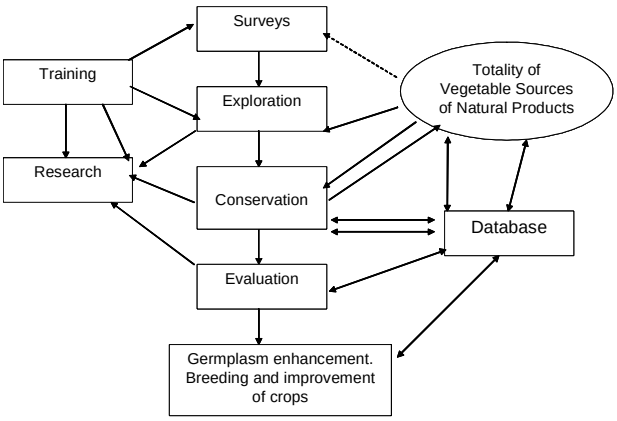

Figure 4: (Plant) Genetic Resources Impact Chain: Modified from Hawkes (1990)

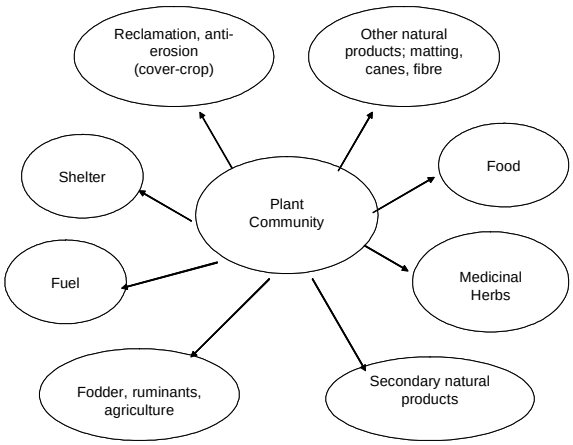

Figure 5: Competing demands on vegetable sources of natural products

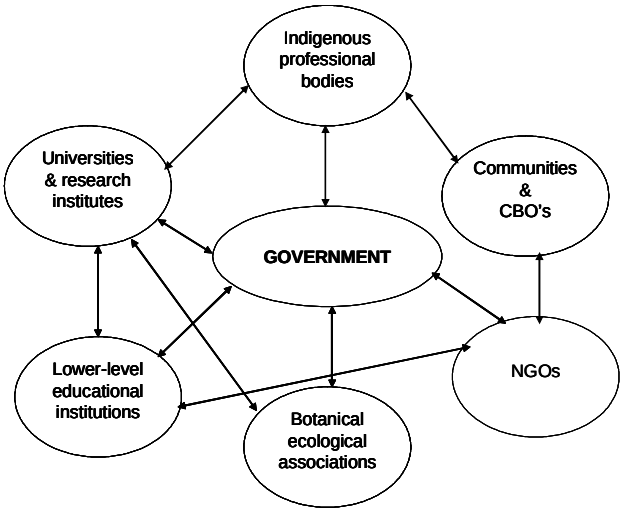

Figure 6: Possible institutional interactions in capacity building for understanding and managing the sources of natural products

the overarching powers of political, commercial, financial and military institutions like the G8, EU, IMF and WTO, and NATO!

In spite of the epistemological and ideological pressure to promote and homogenise globalisation as an altruistic paradigm, the role of corporate interests and corporate manipulation, the overarching influence of profit and regional controlling formations have become palpable with respect to the fate of biodiversity in the world. The number, location and power of seed and agricultural input corporations, the nationalities of the major seed hunters, the role of International Agricultural Research Stations (IARS) as ideological institutions; the power and audacity of biotechnology companies, the territories of the custody of the major seed banks, the owners and locations of patents on GM foods, and the programmed elimination of small farmers (De La Perriere and Seuret, 2000) even in USA, and the control of the media by these organisations all attest to the contradiction of the *regional and the national* control in an allegedly *globalised* world (Mooney, 1983; Juma, 1989; Swanson and Barbier, 1992; De La Perriere and Seuret, 2000).

This section of this paper will conclude with an examination of the notion of *sustainable development* and its renewed currency. The World Commission on Development and Environment, in 1987, defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Swanson and Barbier, 1992). This definition clearly assumes a monolithic world in what he termed "the notion of *intergenerational equity"*. We have amply demonstrated regional historical inequity however. Beyond that, the UN and other international development agencies data have demonstrated growing intergenerational inequity *(*African Agenda, 1995). A notion of sustainable development that maintains the *status quo* in which the majority of the peoples of the world is marginalised is neither feasible nor defensible although it can be contemplated and it is probably implicit in certain development programmes; those where historically expropriated surpluses and on-going ones are retained in the custody of the expropriators.

Conservation of Plant and Animal Genetic Resources: General considerations

In this section, we discuss the issues concerning, and the strategies for, the conservation of plant and animal genetic resources. Most of the material in the section is only slightly modified from a related exposition presented a few years ago (Olorode, 1997). From the ensuing discussion of the issues and strategies in the conservation of plant genetic resources, it should be obvious that the conservation of natural ecosystems and communities is pivotal also for the preservation of the diversity of animal genetic resources.

The issue of biodiversity and conservation tends to be circumscribed entirely in relation to species and speciescomplexes in natural ecosystems and to the exclusion of agricultural ecosystems. Consequently, the contemplation of conservation tends to exclude genetic resources that have become domesticated or semi-domesticated. For the avoidance of doubts, we emphasize that the biodiversity and conservation of domesticated

genetic resources *also* fall fully within the genre of resources that need to be conserved. It is in this regard that strategies also need to be evolved which sustain the diversity of *land races* of the major and minor crops (cocoa, kola, citrus, oil palm, maize, rice, yams, melons, guinea corn(Figure 4).

Clearly, the maintenance of land races of plant and animal genetic resources will require ingenuity and commitment on the part of public and private organizations that are interested in conservation. This is because, first we are witnessing the disappearance of the last generations of the custodians of these resources. Secondly, the invasion of 'improved' varieties, the 'triumph' of mono-cultures and the economic pressures on those who live on land are bound to further endanger the land races. Concretely, then, some programmes of subsidy and inducements may have to be organized through public agencies and NGO's to encourage farmers to collect, exchange, augment and maintain the land races and varieties of crops and domestic animals in their custodies. After all, if government in 'advanced' economies can pay farmers not to grow crops, it would be more doubly reasonable to induce the custodians of our own genetic resources to sustain that heritage! Such efforts can be reinforced through cooperatives, festivals, competitions and exhibitions.

In a previous contribution on the problems and prospects of conservation of plant genetic resources, (PGR) (Olorode, 2004), the basic strategies and modes of conservation of PGR were addressed in some depth: these included *in situ* and *ex situ* strategies and the problems of introductions and afforestation. Since an extensive literature citation was provided in that contribution, the present paper will not address the aforementioned issues.

Utilization of Biodiversity in Plant Production

In general regard to the issue of conservation, the utilization of genetic resources has come to be a concept with different meanings and interpretations. Consequently, utilization has come to imply (1) a frantic search for alternatives to the more widespread traditional plant and animal genetic resources, (2) a means of sustaining utility of certain plants and animals that have widespread but not intensive traditional use, (3) a means of replenishing and/or invigorating the more widely-used genotypes and varieties, and (4) a concept of overall ecological balance in which human needs take a space in nature that is rational and sustainable.

As humanity has become generally confronted with the drastic reduction in the number and variety of cultivated crops and domestic animals, and as serious food and nutritional crises have hit the large majority of human beings in the world (particularly the poor peoples of the world), attention is being directed towards neglected (largely wild) sources of plant and animal products (Figure 5) in the underdeveloped world (Mooney, 1983, National Academy of Science–Washington, 1975; Moore, 1990). It may turn out that these efforts do not achieve more than palliatives and attempts at mitigation because the activities of agribusiness and "market forces" are intensifying the circumstances that generated the crises in the first place especially in the third world (Fedder, 1976; George, 1979; Mooney, 1983; Lesser, 1994). Twenty years ago, about 7, 000 seed companies control about 10% of seed trade; today 10 companies control 40% of the trade. Monsanto alone controls 80% of GM (genetically modified) crops and about seven companies in three countries or so control 100% of transgenic seed market! Half of the world eats rice everyday; a single company is reported to control the genotype of the golden rice (with β-carotene) and holds *seventy patents* on golden rice alone! With specific reference to biotechnology patents, most of the countries of the world are onlookers. According to Swanson (1992):

> "In the EC for example, the US holds 36 percent of such patents, EC states hold 32 percent of them and Japan 23 percent leaving 9 percent for the remainder of the world. In Latin America, only 11 percent of biotechnology patents are held by residents; the remainder are held by developed countries"

However, in-spite of this nuance, we should participate in this search for alternatives but with our eyes wide open. This is because the logic of development will require more than these "alternatives". Indeed, a dogmatic approach to these alternatives may become a recipe for the exclusion of the majority of the peoples of the world.

The second category of interpretation of utilization is rehabilitation and improvement of *neglected crop genetic resources.* Such crop plants include subsistence types of *Pennisetum* and *Sorghum, Oryza, glaberrima, Digitaria exilis, Eleusine coracana, Dioscorea dumetorum. D. alata, Voandezia geocarpa* and various wild and semi-cultivated leaf-vegetable species (*Solanum, Launnea, Vernonia amygdalina, Crassocephalum* spp. etc). Some of these issues are extensively documented and discussed by Okojie and Okali (1993) and NRC (1996).

The third category of interpretation of the utilization of biodiversity in crop production is in regard to the potential they have as adapted germ plasm *by themselves* and as sources of genetic material for the improvement and invigoration of the world's progressively genetically homogenous crops. This is because this genetic homogeneity has often become a liability in crop and animal husbandry. In this regard, it is the genetic resources of land races, local varieties and wild relatives (of crop plants in particular) that are implicated in this category. Hawkes (1990), Heywood (1990), Ingram (1990) and NRC (1996) discussed and exemplified these issues in regard to plant genetic resources utilization.

The fourth category of the conceptualization of utilization has to do with the overall opportunities and possibilities offered by a conserved ecosystem or biome in regard to the needs of a people concerning their crops, their livestock and their capacity to avail themselves of the undomesticated flora and fauna of the environment. The promise of this genre of utilization is completely contingent on a genuinely "public" definition of public ecological policy and commitment of public institutions to public purpose.

Conclusions

We have shown that in relating the notions of PGR conservation to biodiversity conservation, utilisation and development, our own policy makers, scientists and intellectuals need to be very critical. Most of the policy thrusts that will conserve biodiversity are still executed within national boundaries and aspirations. This is because, so far, globalisation has largely rendered certain regions and countries hopeless; and the hopelessness is deepening.

Clearly from our discussion, the ideas that propel concern for preservation of biodiversity whether they are private or collective, profit or non-profit, commercial or communal, "nationalist" or "globalist", will also influence the policy formulations that will underpin the social and political arrangements and institutions that are considered appropriate for implementing and advancing the policies (Figure 6).

We start by saying that the biodiversity of agricultural species and biodiversity of wild life or un-managed species both fall within our purview of a scientific and historically conscious biodiversity conservation programme. Secondly, they both fall within the framework of the overall social and economic policy of a nation—developing nation with tangible historical fetters.

We have already addressed the technical problems of biodiversity conservation. What is usually absent in technical discussions as this is the social and political imperatives of what we know to be technically required. Indeed in many cases, the problems that confront humanity are usually not technical problems and/or they have no technical solutions. They require social action or political solutions.

If, as we have noted, the crisis of biodiversity has an economic dynamic, what are the social and political imperatives dictated by them? We suggest that in particular regard to biodiversity of the wild, we identify what Swanson (1992) called total economic value (TEV) in relation to the totality of the population that have a stake in, and a right to, that value. Once we do that, a *collective imperative* for economic decision-making on those resources arises spontaneously. The meaning of this is that the kinds of devastations that arise from individual or small-group interests, or perceptions of ecosystem management that lead to massive destruction of biodiversity can be prevented or mitigated. An issue that is closely related to the general matter of management of the ecosystem is that the regular strict reserve strategy of biodiversity conservation is problematic and hardly sustainable. Consequently, its equity is called into question at both intergenerational and intragenerational levels. What is required, therefore, is a conservation strategy that is pivoted not only on sustainability, but also on equity.

In terms of economic decision-making concerning the options for using wild-life and biodiversity, Swanson (1992) showed from examples in Peru, from Nigeria's Hadejia-Jama'are River Basin experiment and from the Korup National Park (Cameroon) management, that the original states of the resources were better and more economically viable options than the consequences of their transformation. The vast acreages of destroyed land abandoned by millionaire farmers in some parts of Nigeria, for example, also resulted from the triumph of individual profit motive over public welfare. The triumph of the market and profit and the weakness or absence of institutions for defending public interest, especially in this age of transgenic crops and animals, has created renewed urgency for public action in defence of the environment and biodiversity especially. The task is how to respond collectively and institutionally to this urgency within development strategies that are pivoted on *genuine public purpose*.

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