Indigenous Knowledge and Sustainable Development

Mervyn Claxton

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Biodiversity, indigenous knowledge, and sustainable development are very closely linked. The indigenous knowledge systems of the peoples of the South constitute the world largest reservoir of knowledege of the diverse species of plant and animal life on earth. For many centuries, their indigenous agricultural systems have utilized practices and techniques which embody, what one scientist has called «Principles of Permanence»- principles that permit continuous cropping all year around without the use of chemicals which degrade the environment. Furthermore, not only do they not deplete the earth's natural resources but they often replenish them.

Ecological agriculture, organic agriculture, and conservation agriculture are the names employed by modern science to describe the methods, techniques, and practices which the indigenous peoples of the South have applied for many centuries. Ecological agriculture, or to use its original name, indigenous agricultural knowledge, is recognized by a growing number of scientists as the most effective method of promoting sustainable development. A new term should be coined to give recognition to that important, but little known, fact. I would suggest the term eco-indigenous knowledge - one that I propose to use throughout this evening's address.

Industry, conventional agriculture, deforestation and transport are the four major sources of greenhouse gases which contribute to climate change.

The International Panel for Climate Change (IPCC) has proposed Carbon Capture and Storage (CCS) as an effective method of removing carbon gases from the atmosphere, a proposal adopted by the Copenhagen Conference. However, recent research findings show that ecological agriculture sequesters carbon from the atmosphere more cheaply and more effectively than CCS. Thus, eco-indigenous knowledge should possibly be considered the essential factor in solutions for the problems of preserving biodiversity, promoting sustainable development, and mitigating climate change. Those three problems, arguably, constitute the most important challenges that confront mankind today.

The term «indigenous» means local or native to the country, the people or the society concerned. However, shortly after the beginning of the European colonial adventure, that term gradually assumed a derogatory connotation. In the course of time, it came to be applied exclusively to non-European peoples, who were, and to some extent, still are considered inferior to those of the North. That distorted usage of the term has been so systematic and persistent that most peoples in the South subconsciously came to associate «indigenous» with «inferior». Regrettably, that insidious association appears to have influenced our attitudes, our life styles and, more importantly, our choice of development techniques, policies, models, and strategies.

The assimilation of the «indigenous » to the «inferior» influenced and possibly still does, our choice of development experts and expertise. In the early 1980s, Unesco was chosen to be the Executing Agency for the technical

assistance component of a large development loan project in a Caricom country. Normally, the executing agency would submit, for the government's approval, a prioritised list of three or four experts for each project post. I was involved with that project in a coordinating role and, in that capacity, I received a list of countries from which the government wanted the experts to be selected. Perhaps, because they were considered «indigenous» and, perforce, «inferior» none was from the Global South, although Unesco's roster of experts contained excellent African and Indian experts whose experence might have been more relevant than those eventually chosen. Instead of choosing experts on their merit, the Caricom country in question decided instead to choose countries on their perceived merit.

Whether we like it or not, peoples of the South are all «indigenous» in the eyes of peoples in the North. We can continue to shy away from the use of that term, because we have integrated, into our personalities, its derogatory connotation. Or, we can appropriate it, wear it like a badge of honour and, by so doing, rob it of its derogatory connotation and, thus, restore to the term to its original neutral meaning. That is what French impressionist painters did in the late 19th century. The term, «Impressionism», was coined by a conservative French critic, Louis Leroy, who used it in a satric review of Claude Monet's painting *Impression, soleil levant* («Impression, Sunrise»), after seeing it at an art exhibition in 1874. Instead of shying away from the term, as we have done, and still do, with «indigenous», the impressionists appropriated it. They wore it like a badge of honour, which soon robbed the term of its derogatory connotation. Indeed, the term has come to represent the best in modern art. The paintings of the Impressionists are currently the most sought after, and the most expensive in the international art market.

When we shall have rid ourselves of the stigma of the indigenous, then and only then, will we possess the cultural confidence to deal with the North on the basis of its real merits (and demerits) and not on its perceived merits, and on our terms, not on theirs. Only then will we be prepared to consider our «indigenous» cultures a development resource rather than a development obstacle and, also, the best possible source of solutions for problems of sustainable development. With that newly-won confidence, we would also be ready to borrow and exchange eco-indigenous knowledge, with development potential, with other countries in the Global South.

The vast majority of plant and animal species are to be found in the world's tropical zones. Tropical America accounts for over half of the estimated closed tropical forest in the world, with Brazil being the single richest country in overall species diversity. The second richest is Colombia, home to some ten per cent of all species of terrestrial plants and animals. According to one estimate, there are some 120,000 different species of plant life in Brazil alone, many of which the indigenous inhabitants have utilised, from time immemorial for medicinal and other purposes.

Their eco-indigenous knowledge of the medicinal properties of the region's flora was considered so very valuable that a scientific expedition was sent from Europe, in 1630, to make a methodical description of the plants which the indigenous peoples of Brazil utilised for that very purpose. That indigenous knowledge was, apparently, so considerable that the scientists took twenty-four years to collect and catalogue it. In 1847, more than two hundred years later, another European scientific expedition went to Brazil for the very same reasons. That expedition analyzed the medical properties of

six thousand local plants, the results of which were published in one hundred and fifty scientific papers.

Trinidad and Tobago is yet another example of the much greater biodiversity to be found in the world's tropical zones, as well as their enormous potential for development purposes. A search for antibacterial agents in the extracts of 44 different types of fern found in Trinidad, for example, showed positive results in 77 % of the extracts. (Richard E. Schultes and Albert Hoffman, *Les plantes des dieux: Les plantes hallucinogènes, Botanique et Ethnologique*, 1981). That could be a rich source for the discovery of future antibiotics. Despite its size, Trinidad and Tobago has a far greater variety of tree plants than North America. A study, undertaken in the mid-1960s, of the forest composition in one square mile of Trinidad identified nearly 3,000 distinct species of trees. (Preston E. James & Hibbard V.B. Kline, A Geography of Man, 1966). By contrast, the whole of North America, above the Mexican-US border, contains only 1000 tree species.

FAO estimates that there are roughly a quarter of a million plant varieties available for agriculture, less than three percent of which are currently utilized. Modern agriculture's concentration on a small number of plant varieties, specially designed for intensive farming, has dramatically reduced the diversity of plants available for research and development. The world's food supply depends on about 150 plant species, of which just 12 provide three-quarters of the world's food supplies. Agricultural scientists at CIRAD (International Center for Agronomic Research for Development) in France, have estimated that the environmental degradation caused by the Green Revolution, which has resulted in the levelling off of cereal yields in several

Asian countries, is less serious than the fact that the restricted number of plant varieties in wheat and rice monocultures has led to a loss of biodiversity through the disappearance of traditional varieties. CIRAD considers that although they may have been less productive, their preservation would have offered better food security. *(Les Agronomes Pronent une Révolution Verte Durable,* **Le Monde**, 1 March 1997).

In that respect, eco-indigenous agriculture presents a striking contrast to modern agriculture. It is designed to preserve biodiversity, not to destroy it and, by so doing, it promotes food security instead of undermiming it. The Aymara Indians of Bolivia, who are excellent agricultural experimenters, have developed the cultivation and taxonomy of the genus *solanum,* the plant family of the potato, further perhaps than modern science has done. The Aymara have names in their language for over 250 potato varieties**.** However, the threat to food security is not the only danger posed by the loss of biodiversity in modern agricultural systems. Such loss also has a damging effect on the atmospheric environment. Recent experiments conducted by the Center for Population Biology at the Imperial College in London, have shown that the absorption of carbon is higher in systems with high biodiversity, than in those with medium or low biodiversity. Thus, the eco-indigenous agriculture of the Aymara make a greater contribution to food security, promotes more biodiversity, and preserves the environment better than modern conventional agriculture.

The Aymara are by no means unique, in that respect. The Gurani people of Argentina and Paraguay possess a well-conceived classification system which, in many ways, is similar to modern scientific nomenclature. Their nomenclature was not haphazard. The Gurani classified groups and sub-

groups with great precision. So did the Tewa Indians of New Mexico whose taxonomy revealed their profound technical knowledge of their biological environment. In an article published, in 1916, in the bulletin of the Bureau of American Ethnology, a team of American scientists paid the following stunning compliment to the eco-indigenous knowledge of the Tewa: *"It would be possible to translate a treatise on botany into Tewa...."* (W. W. Robbins *et al*, Ethobotany of the Tewa Indians, Bulletin No.55, Bureau of American Ethnology, Washington, D.C., 1916).

During the late colonial period, the few European agricultural scientists who carried out comparative experiments between indigenous and imported agricultural production methods employed in Africa, generally found the indigenous methods more productive, more reliable, and more effective at reducing risks. They were impressed by the extent of the agroecological knowledge of the indigenous farmers. In a report written in the 1950s, a British colonial official offered the following comment on the Masai: *"The pastoralists know their grasslands. They are, one might say, authorities on grasses….They recognize ecological associations…and can assess their value and stock-carrying capacity at different times of year."* (William Allen, The African Husbandsman, 1967.

As **t**wo agricultural scientists have suggested: *"Much of the world's biological diversity is in the custody of farmers who follow age-old farming and land use practices. These ecologically complex agricultural systems associated with centers of crop genetic diversity include not only the traditional cultivars or 'landraces' that constitute an essential part of our world crop genetic heritage, but also wild plant and animal species that serve humanity as biological*

resources" (Margery L. Oldfield and Janis B. Alcorn "Conservation of Traditional Agroecosystems" in Oldfield and Alcorn (eds), Biodiversity: Culture. Conservation and Ecodevelopment, l991).

It is not only for the preservation of biodiversity that eco-indigenous knowledge is invaluable. It is also invaluable for its enormous development potential. It was the French anthropologist, Claude Levi-Strauss, who revealed to the world that the Americans had learnt a very effective food preservation technique from the Aymara, a technique that was of critical importance to them during World War II. The American army copied the Aymara's technique for dehydrating food, which enabled it to reduce the volume of its soldiers' rations of powdered potatoes to a degree which permitted the equivalent of a hundred meals to fit into a container the size of a shoe box. (Claude Levi-Strauss, The Savage Mind, 1972).

Michael Altieri, the American agronomist, has suggested that the validity of many indigenous agreological techniques practiced in the South have lessons for the industrialized countries. They can, for example, provide valuable insights on sustainable development. *"Successful production strategies (multiple cropping, agroforestry, mulching etc.) in peasant fields of the Third World can suggest new, and sustainable ways of managing agricultural resources for U.S. farmers."* (Rethinking the Role of U.S. Development Asistance in Third World Agriculture, **Agriculture and Human Values**, Vol.VI, No.3, Summer 1989). Indeed, the growing recognition in the North of the validity of many such technologies has already resulted in the beginnings of a two-way technology flow.

Northern knowledge systems, techniques and models of development have been environmentally destructive for virtually all tropical-zone countries of the South, precisely because valuable eco-indigenous knowledge was either ignored or dismissed. In that respect, they have been particularly disastrous for Africa. I shall cite just one of many recorded examples in support of that comment. Some four million square miles of Africa (an area larger than the United States) are infected by the tse-tse fly, which is a major obstacle to livestock farming. Yet, in pre-colonial East Africa, there were large herds of healthy cattle in areas now considered unsuitable for animal farming because of the tse-tse fly.

Contemporary European travellers to the region reported that African cattle stock were, qualitatively, just as good as the best English and Northern European stock. It was because African cattle herders knew how to neutralize the tse-tse threat. Indigenous African ecosystem management, based on an intimate knowledge of the connection between wild animals and the tse-tse fly, permitted African herders to maintain large, healthy cattle herds by isolating them from the wild animals that harboured the tse-tse fly vector. In its 1888 edition, the Encyclopaedia Britannica acknowledged the effectiveness of the African eco-indigenous solution to the tse tse fly problem. But that crucially important knowledge was dismissed by Western scientists, colonial, and post-colonial regimes, alike. In his book, Ecology Control and Economic Development in East African History: The case of Tanganyika 1850-1950, 1996, Helge Kjekshus had the following comment:

"The pre-colonial [East African] economies developed within an ecological control situation a relationship between man and his environment which had grown out of centuries of civilising work of clearing the ground, introducing

managed vegetations, and controlling the fauna. The relationship resulted in an 'agro-horticultural prophylaxis' where the dangers of tse-tse fly and trypanosomiasis were neutralised and 'Africa's bane' was made a largely irrelevant consideration for economic prosperity. The contrast to the twentieth century, when the tse-tse fly has been 'one of the major obstacles to economic development', is clear."

The enormous damage done to Africa's development by having almost two-thirds of its potential food-producing areas denied to animal husbandry because of the rejection of eco-indigenous African knowledge of how to deal with the problem, is incalculable. I shall cite three examples, in the second half of the 20th century, of specific knowledge embedded in indigenous cultures in three different continents of the South which, when "discovered" by Western science, had a major development impact in the industrialized societies, in respect of two. There would have been a similar impact, in respect of the third, if that knowledge had been known to the West. I shall begin with an example from our own Latin American and Caribbean region.

The contraceptive pill owes its existence to the eco-indigenous knowledge of peasant women in the Mexican state of Veracruz and to the chance discovery by Russel Marker, an American chemist, of the specific use they made of a variety of wild yam for contraceptive purposes. Marker subsequently demonstrated in laboratory experiments that *diosgenin*, the compound extracted from the yams, could be efficiently synthesized into progesterone, the principal active ingredient in the contraceptive pill. That epochal Western "discovery" was directly reponsible for perhaps the most important social revolution of modern times - the sexual revolution. By giving women control of their own sexuality, the pill fundamentally transformed male-

female relationships forever. That Western ‘discovery’ also, arguably, was the spark that ignited the "second-wave" of the Feminist Movement in the United States.

Rauwolfia Serpentina, an Indian rootplant, had been used for centuries, by Indians, to treat mental illness and insomnia. Its potential as a drug was not taken seriously by modern medicine until 1952 when its active ingredient, an alkaloid called *reserpine*, was discovered to produce profound and prolonged tranquillizing effect. It was also effective for treating a variety of psychiatric disorders. India’s indigenous remedy for mental illness was the basis of the first major tranquillizer, which revolutionized the treatment of the mentally ill and introduced a whole new area of psychiatric treatment - psychopharmacology. Violent patients in Western psychiatric hospitals no longer had to kept in straightjackets. Powerful tranquillizers, derived from that invaluable eco-indigenous knowledge had replaced them. .

Foot and Mouth Disease is dreaded by every country with an important livestock industry. In 2001, the British economy suffered a serious loss of some twelve billion euros, as a result of a foot and mouth epidemic that required the slaughter of seven million farm animals. A large area of the country was placed under quarantine for several weeks, seriously affecting the tourism industry and economic activity in that part of England. It was only after the 1981 epidemic of foot and mouth Disease, in France and Britain, that Western veterinary scientists discovered that the virus could be spread by the wind. Previously, Western scientists were convinced that the disease could be spread only by direct contact with infected animals. But, as Western veterinary scientists now acknowledge, Fulani cattle herders in West Africa had possessed that knowledge for generations, and perhaps centuries before.

(Constance M. McCorkle et al (eds), Ethnoveterinary Research & Development, 1996).

Fulani herders used that knowledge to protect their animals from the disease by keeping healthy herds upwind of an infected one or by partially immunizing healthy animals to the disease by placing them downwind of an infected herd for a very brief period. That remarkable eco-indigenous African knowledge could have been of great economic benefit to Europe, if Western veterinary experts had bothered to find out why the incidence of foot and mouth disease in areas inhabited by the Fulani was lower than elsewhere.

In its primary sense, the term, "sustainable", means capable of being sustained. Sustainable development is possible only if the creative capacities of the society are engaged in the development process, and for that to occur, development action must be rooted in the culture of the country concerned. Those sources of creativity are essentially cultural. It is a society‘s indigenous culture and creative resources which provide the inspiration, the dynamism, the capacity to adapt, initiate, innovate, invent and re-invent.The creativity in a developing society, especially one with a large traditional sector, is to be found in, and is manifested by, its cultural traditions, its eco-indigenous knowledge and techniques, in the ways in which that society has traditionally dealt with the challenges posed by its physical environment, and in its social, political and economic arrangements.

The crucial importance of rooting development action in a society's indigenous culture was recognized by the the United Nations Joint Inspection Unit, in its 1995 evaluation of the U.N. New Agenda for Development of Africa

in the 1990s. Taking note of that programme's failure to achieve its goal's, the Inspection Unit arrived at the following conclusion:

"While the indigenous institutions [in Africa] *are vibrant and gaining ground in many countries, the institutions born of modernisation (as now included) appear to be running aground, incapable of internal regeneration. This fact confirms that Africa's development process, as now conceived and implemented, does not seem to strike a responsive chord in the majority of the African population because the process is not taprooted in their indigenous system of rationality and creative impluses."* (Evaluation of the United Nations Agenda for the Development of Africa in the 1990s, 1995)

Unfortunately, that very percipient analysis of the fundamental reasons why international development policies have failed to produce the desired results in Africa, and elsewhere in th developing world has been totally ignored by the international community, with predictable results.

When the development process is "*taprooted in* [a given country's] *indigenous system of rationality and creative impluses"*, the solutions that will emerge from such a process would, more often that not, be quite different from those that other countries would have adopted..

Karl Polanyi, the distinguished Austrian-born thinker posited that, historically, a country's economic arrangements were "embedded" in its culture and social relationships. (The Great Transformation: The Political and Economic Origins of Our Time, 1944).

Eighteenth-century Dahomey was one of several examples which Polanyi used to validate his theory. He demonstrated how centrally-important Dahomey's indigenous culture and traditions were in the design of its unique

system of political management and public administration, and in the high level of excellence they achieved. 18th-century Dahomey drew upon its traditional culture in its choice of a dual structure of state administration and, also, in the manner in which checks and controls on administrative power were institutionalized. The ideal structure of every group in the divine world of the people of Dahomey was a set of twins of mixed sex, which provided the inspiration for its original system of public administration. (Dahomey and the Slave Trade: An Analysis of an Archaic Economy, 1965).

Every male official in the kingdom had a female counterpart whose duty was to familarize herself with the work of her male counterpart and to keep a close check on his work and performance. Polanyi noted that Dahomey's public administration system ensured *"institutional checks of a rare effectiveness"*. Although Polanyi did not mention it specifically, it is clear that Dahomey's dual administrative system also ensured gender equality. Despite the cumbersome bureaucratic structure which such a system implied, contemporary foreign observers all acknowledged Dahomey's outstanding efficiency in public affairs.

Putting the sexes on an equal footing was not only far in advance of prevailing practice in Western countries at that period, but it also places 18th-century Dahomey well in advance of **all** countries in the 21st century, none of which has yet succeeded in ensuring genuine gender equality in the work place. It is interesting to note that it was the female who occupied the position of "controller" vis-à-vis the male in the country's public administration. The remarkable success of Dahomey's innovative, culturally-rooted and precociously advanced system of gender pairing, is also illustrated in its achievement of the highest standards of public probity, as reflected in the

following comment of Polanyi's:*"The administration of Dahomey attained excellence in the way of honesty,"* What a striking contrast to the country's present system, which is modelled on that of France.

If Dahomey's system of public administration had been adopted by any other country, it would probably have led to adminstrative chaos. The conclusion to be drawn from Polany's effective demonstration of his theory is that excellence in development can be achieved only if such development is rooted in the eco-indigenous knowledge, values, and socio-economic system of the country concerned. That conclusion is even more applicable to sustainable development.

In Western countries, decisions on management policy are taken at the top. It is the exact opposite in Japan where decisions are taken by consensus and the process begins at the bottom. Modern Japanese decision-making is directly patterned on the traditional village meeting *(yoriai)*, which made preliminary consultation *(nemawashi)* an essential requirement. When an informal consensus is finally reached, the whole group is convened to formally adopt it. Modern Japanese decision-making is rooted in that indigenous practice, one that has influenced the style of Japanese leadership. Indeed, a leading Japanese sociologist has pointed out that there is no word for leadership in Japanese. (Chie Nakane, Japanese Society, 1972)

Contrary to Western practice, the role of a Japanese leader is essentially to oversee the implementation of "collective" decisions which emerge from below, following an organization-wide consultation. That system of consultation is known as *ringisei* or *ringi*, which is the Japanese name for the seal or stamp which the Chief Executive of a corporation or a government

minister puts on the document containing the collective consensus on a given issue, when it reaches him. (Kiyoaki Tsuji, "Decision-Making in the Japanese Government: A Study of *Ringisei"*, in Robert E. Ward (ed), Political Development in Modern Japan, 1968). In other words, the Japanese CEO or Minister, literally rubber stamps it. I do not think that that system would work in Trinidad and Tobago or anywhere else in the world.

Raul Prebisch, the distinguished Argentinian economist, concluded from his study of Maynard Keynes' General Theory, that *"One of the conspicuous deficiencies of general economic theory, from the point of view of the periphery (of countries in the South) is its false sense of universality."*(Edgar Dosman, The Life and Times of Raul Prebisch 1901-1986, 2008). Unfortunately, that false belief in the universal applicability of Northern concepts is widespread in the South. Many concepts that we have come to accept as universal were formulated in a way that predetermines the choices and solutions available.

One such example is the concept of sustainable development. In the international discourse, that concept tends to be discussed only in terms of ecological sustainability. However, for the vast majority of countries in the South, development should be sustainable in both economic and ecological terms. It is one of many examples where concepts, which have been formulated in the industrialized North, need to be adapted to the necessarily different conditions of countries in the South.

Because those concepts were formulated in response to particular sets or combinations of circumstances they are both limited and limiting, in the sense that they can neither accommodate or envisage possibilities, problems, or

solutions which fall outside of their own paradigms. The various concepts of development that have been formulated in the North do not envisage, and cannot accommodate, forms of development that are not environmentally destructive or which do not deplete the earth's natural resources at an excessive rate. They are all based on exploitative, ever-increasing growth. A concept of sustainable development which neither destroys, or depletes the earth's natural resource base fell outside of Northern paradigms. Thus, the only solution for the problem posed by the over-rapid depletion of the Earth's natural resource base, available within Northern paradigms, was a reversal of the process of development, itself. Hence the propagation of such theories as Zero growth and Degrowth, which are rapidly gaining currency in the international debate on the subject.

Few today could possibly imagine how productive were the ancient agricultural systems created by the indigenous peoples of tropical South America. A considerable area of South America's tropical savannas are subject to seasonal flooding for periods of up to several months a year. Because of their low soil fertility, those waterlogged savannas are now considered marginal farm lands. However, for many centuries those same lands had produced a wide variety of crops under highly productive, eco-indigenous, raised-field agricultural systems. Nonetheless, a large part of the Lake Titicaca plain, where extensive raised-field remnants testify to intensive agricultural production in the pre-Columbian past, is deemed unsuitable for cultivation by modern resource surveys, because it cannot be cultivated economically with modern methods. The eco-indigenous agricultural system which had made those flood plains so highly productive fall outside the paradigms of modern agricultural science.

The indigenous cultures of the South possess the world's greatest reservoir of environmentally-friendly development techniques, methods, and practices. With a paradigm change taking place in Northern discourses concerning the need to shift from a philosophy of economic growth to one of environmental sustainability, it is to the countries of the South that the North would need to look for lessons on how that could be achieved.

The central role of Agriculture in achieving sustainable development.

Agriculture is central to sustainable development. If considered together with deforestation, which often accompanies agricultural expansion, conventional agriculture is the single most important source of toxic gases that help generate climate change. That is the downside. The upside is that eco-indigenous or organic agriculture not only does not deplete the Earth's natural resources but it also reduces greenhouse emissions instead of contributing to them. It appears, therefore, that the most effective policy for promoting sustainable development is a global shift to ecological or eco-indigenousl agriculture.

The Rodale Institute in Pennsylvania, USA, has conducted the longest-running U.S. comparative field trials on organic and conventional agriculture. Two of the Institute's researchers published a paper in 2008 describing the benefits of an integrated approach to farming that uses regenerative, organic practices, including cover crops, composting, and crop rotation. Those techniques, which are all standard features of eco-indigenous agricultural systems, reduce atmospheric carbon by removing it from the atmosphere and storing it in the soil as carbon. Rodale's agricultural field trials demonstrated that while the chemical fertilizers and pesticides, utilized in

conventional agriculture, release carbon into the air, organic agriculture sequesters carbon, removes it from the atmosphere, and returns it to the soil. The authors of the paper made the following observation:

"Agriculture is an undervalued and underestimated climate change tool that could be one of the most powerful strategies in the fight against global warming. Nearly 30 years of Rodale Institute soil carbon data show conclusively that improved global terrestrial stewardship--that specifically includes 21st Century regenerative agricultural practices--can be the most effective currently available strategy for mitigating CO2 emissions. Agricultural carbon sequestration has the potential to substantially mitigate global warming impacts. When using biologically based regenerative practices, this dramatic benefit can be accomplished with no decrease in yields or farmer profits. Even though climate and soil type affect sequestration capacities, these multiple research efforts verify that regenerative agriculture, if practiced on the planet's 3.5 billion tillable acres, could sequester up to 40 percent of current CO2 emissions." Timothy LaSalle & Paul Hepperly, Regenerative 21st Century Farming: A Solution to Global Warming, 2008 arming practices that can reduce agriculture's contribution to climate change, which are easy and inexpensive to implement.
http://www.greenpeace.org/raw/content/canada/en/documents-and-links/publications/cool-farming-summary-version.pdf

A team of China's leading climatologists and agronomists independently reached similar conclusions about the carbon sequestration capcity of ecological agriculture. Those conclusions were published in October, 2008, in a report entitled Climate Change and Food Security in China. In the light of the Rodale Institute's findings, four European countries - the U K, the Netherlands, Germany, and Denmark changed their emission-reduction targets, under the Kyoto Protocol, to take into account their organic agriculture's carbon sequestration. Moreover research on carbon forestry has shown that low latitude tropical forests sequester far more carbon than a northern latitude temperate

forest. Thus, taken together, agricultural sequestration in tropical zone countries possess a far greater capacity to mitigate the effects of climate change than those situated in temperate

Neither the LiILIENDAAL DECLARATION ON CLIMATE CHANGE AND DEVELOPMENT, adopted by Caricom Heads of Government in July 2009, or the Declaration on Climate Change issued in September 2009 by the Alliance of Small Island States(AOSIS), of which all but one Caricom state are members, made any mention at all of the agricultural carbon sequestration potential of ecological agriculture. For countries with a significant agricultural sector, agricultural carbon sequestration would appear to be a cheaper and more appropriate method of promoting sustainable development by reducing atmospheric carbon than the Carbon Capture and Storage method (CCS) proposed by the International Panel on Climate Changeand adopted at tthe latter in its Declaration, Article 6 of whicg stated: *"We further recognize that the inclusion of Carbon Capture and Storage (CCS) is potentially an important mitigation option for achieving the ambitious emission reduction targets being supported by AOSIS and urge the development of a program of work on Carbon Capture and Storage in order to resolve related issues."*

http://www.rodaleinstitute.org/files/Rodale_Research_Paper.pdf

A number of American universities and research centers have corroborated the findings of the Rodale Institute. According to a Greenpeace report which contains similar findings, *"The most important finding is the fact that agriculture has the potential to change from being one of the largest greenhouse gas emitters to a net carbon sink."* (Pete Smith, Cool Farming: Climate impacts of agriculture and mitigation potential, School of Biological Sciences, University of Aberdeen, January 2008). The paper details a variety

of farming practices that can reduce agriculture's contribution to climate change, which are easy and inexpensive to implement. http://www.greenpeace.org/raw/content/canada/en/documents-and-links/publications/cool-farming-summary-version.pdf

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agricultural carbon sequestration is minimal and there is a bonus in that the sequestered carbon also fertilizes the soil.

Nonetheless, AOSIS gave its full support to CCS in its Declaration. Article 6 states: *"We further recognize that the inclusion of Carbon Capture and Storage (CCS) is potentially an important mitigation option for achieving the ambitious emission reduction targets being supported by AOSIS and urge the development of a program of work on Carbon Capture and Storage in order to resolve related issues."*

Agricultural carbon sequestration would seem to be more relevant than CCS to underindustrialized Caricom countries. http://www.sidsnet.org/aosis/documents/AOSIS%20Summit%20Declaration%20Sept%2021%20FINAL.pdf

Carbon capture and geological storage (CCS) is a technique for trapping carbon dioxide as it is emitted from large industrial polluting sources. The gas is captured, compressed, and then transported to suitable underground geological formations where it is injected and stored until a method for dealing with it pemanently is discovered. CCS has great potential potential as a technique for mitigating climate change, but the technology for carbon capture is not yet perfected and transporting it by ship or pipeline would be expensive. Furthermore, suitable geological rock formations, in which it could be safely stored, would need to be found at reasonably deep levels underground. Most importantly, CCS would be cost-effective only where there are large single-source Carbon emissions. Among Caricom countries, only Trinidad and Tobago, might meet that condition.

Organic or eco-indigenous agriculture would produce several other benefits of considerable value to Caricom countries. The Rodale Institute's field trials

demonstrated that organically managed soils can convert carbon dioxide from a greenhouse gas into a food-producing asset, which would be no small benefit, considering that a substantial drop in food production, high food prices, and food scarcity are widely predicted as a consequence of climate change. Organic agriculture would also reduce soil erosion and prevent loss of fertility, while discontinuing the use of chemical fertilizers and pesticides will lead to cleaner waterways. For Caricom countries, it will also mean cleaner coastal waters, cleaner beaches, and healthier coral reefs - an asset of inestimable value for countries with an significant tourism sector. Another important factor underlined in the Rodale Institute's research paper, is the rapidity and low cost of switching to organic agriculture, which puts it well in within the reach of almost all farmers.

FAO has also come out very strongly in favour of eco-indigenous agriculture, which it calls Conservation Agriculture (CA). FAO asserts that conservation agriculture is a way to combine profitable agricultural production with environmental concerns and sustainability, and that it has been proven to work in a variety of agroecological zones and farming systems. According to FAO, conservation agriculture would also improve the livelihoods of farmers.

Haiti and Cuba present starkly constrasting examples of agricultural development policy decisions, taken in a context of fairly rapid climate change. Early this year Haiti faced the task of rebuilding its rural economy from scratch after it was largely destroyed by the combination of January's earthquake and last year's four devastating hurricanes. When the government formulated its Emergency Food Production programme to meet the needs of its rural population and those who had fled the towns for the countryside after the earthquake, it had the opportunity to abandon its unsustainable

conventional agricultural model in favour of an ecological one. Haiti chose instead to continue relying on conventional agriculture, despite the considerable environmental degradation that method of agriculture had produced in the past. Instead of increasing food security, stimulating agricultural development, and reversing the process of environmental degradation – all stated objectives of the Emergency Programme, it appears quite likely that the programme would produce exactly the opposite.

Cuba's conventional agricultural system, with its high-cost, energy-intensive inputs, was converted into smaller-scale, organic and semi-organic farming systems which utilized low-cost, environmentally-friendly inputs. Agroecological techniques and processes were substituted for chemical fertilizers and pesticides, sufficient quantities of which the country could no longer afford to import. Almost overnight, fertilizer and pesticide imports fell dramatically**.**

According to the Society for Conservation Biology, an international NGO concerned with the conservation and study of biological diversity, Cuba's coral reefs are the healthiest in the Caribbean, which a direct result of the sharp reduction in chemical fertilizer use, following the country's adoption of agroecologial practices. The World Wildelife Fund (WWF) has concluded that Cuba is the only country in the world to have met internationally established criteria in respect of both the ecological footprint and high human development. (Living Planet Report, 2006). The WWF has established the following two criteria for assessing a country's progress towards achieving sustainable development - the UNDP Human Development Index (HDI), as an indicator of well-being; and the ecological

footprint The Ecological Footprint (EF) is a measure of the consumption of renewable natural resources by a country's population.

Eco-Indigenous Agreocological Knowledge in the Latin American and Caribbean Region

One of the most effective systems of raised-field agriculture is the *chinampas*, which were first developed by the Ancient Maya and subsequently adopted by other Amerindian peoples in Mexico and Central America. *Chinampas* have been under continuous cultivation in Mexico for at least two and, perhaps, three thousand years. (G. C. Wilken, Good Farmers: Traditional Agricultural Resource Management in Mexico and Central America, 1987). The *Chinampa* system of agriculture has been described as one of the most productive in the Western Hemisphere, past or present, in terms of output per unit of land. *Chinampas* have been under continuous cultivation in Mexico for at least two and, perhaps, three thousand years. (G. C. Wilken, Good Farmers: Traditional Agricultural Resource Management in Mexico and Central America, 1987).

The ecological interactions that are set in motion by the *chinampa* system, produce very high maize yields and a marked reduction in soil-borne diseases. Moreover, the *chinampa* system not only produces high agricultural yields all-year round but it requires no fossil-energy inputs, no fertilizer, no pesticides, and no herbicides. (H. David Thurston & Joanne M. Parker, «Raised Beds and Plant Disease Management», in D. Michael Warren *et al*, (eds), The Cultural Dimension of Development, 1995).

Mexican scientists at the Institute for the Study of Biological Resources

(INIREB) in Jalapa, consider that a low-input agricultural system, like *chinampa,* possesses the capacity to satisfy local food needs. (Malcolm Hadley & Kathrin Schreckenberg, Traditional Ecological Knowledge and Unesco's Man and the Biosphere (MAB) Programme, **Agriculture and Human Values**, Summer 1989). With the real prospect of serious food shortages, due to rapid climate change, Caricom countries might well consider the feasibility of introducing, into the region, that highly productive, low-input, eco-indigenous agricultural system, because of its proven capacity to satisfy local food needs.

The *waru waru,* a similar traditional system of agriculture, which evolved in the Andean *altiplano* about 3,000 years ago, is based on the combination of raised beds and canals which, according to Michael Altieri, *"have proven to have remarkably sophisticated environmental effects."* (Where the Rhetoric of Sustainability Ends, Agro-Ecology Begins, **CERES**, March/April 1992). So highly productive and environmentally protective is the *waru waru* system that Peruvian NGOs and state agencies have created an interinstitutional project, in order to assist farmers in reconstructing the ancient system.

Agricultural scientists found that the *waru waru* system reduces the impact of temperature extremes (which is a very important advantage in a period of rapid climate change) while at the same time maintaining, and even improving, soil fertility. It was the environmental effects induced by the *waru waru* which determined its high productivity, as compared with that of chemically fertilised Pampas soils: «*This ancient Inca technology is proving so productive and inexpensive that it is being actively promoted throughout the Altiplano in preference to modern agriculture. It requires no modern*

tools or fertiliser. The main expense is labour.....to dig canals and build platforms » (Altieri, 1992).

In 2008, Jesús León Santos, a Mexican farmer, won an international environmental prize for his work on land renewal and agricultural development in the Mixteca region of Oaxaca, one of Mexico's poorest states, by employing the ancient eco-indigenous *milpa* system to successfully restore the region's ecosystem to its pristine state. The barren, highly eroded area was transformed into rich arable land and the region's acquifers refilled. Conventional agricultural methods and intensive use of chemical fertilizer and pesticides had caused serious soil erosion in Mixteca, decreased soil fertility, and reduced crop yields to such an extent that many small farmers abandoned their lands because they could no longer make a living from cultivating them.

The *milpa* system, which fixes nutrients in the soil and creates natural barriers to pests and disease, produces large food crops yields without the use of artificial pesticides or fertilizers. An agronomist at the University of Massachusetts, who has studied the *milpa* system, declared that *"The milpa is one of the most successful human inventions ever created."* (Charles C. Mann, 1491: New Revelations of the Americas Before Columbus, pp.197-198, 2005.

The Milpa system might be ideal for small farmers in the Caribbean, particularly those who farm marginal or less fertile lands. It is easily accessible, requires no external imputs, and can be used for continuous cropping. Agricultural departments, both university and government, in Caricom countries might wish to investigate the possibility of introducing

the system on a trial basis. By providing small farmers with the means to earn a decent livelihood from the land, the *milpa* system would foster rural development, combat rural poverty, promote greater equity between the rural and urban sectors, and contribute to food security.

Michael Adas suggests that the demise of indigenous knowledge systems through official neglect or by the rejection of indigenous knowledge and techniques, because of the perceived superiority of modern scientific knowledge, would mean *"….the neglect or loss of values, understandings and methods that might have enriched and modified the course of development dominated by Western science and technology."* (Machines as the Measure of Man: Science, Technology, and Ideologies of Western Dominance, p.15, 1989).

In a paper on sustainable development, two Nigerian agronomists concluded that *"Indigenous knowledge is the single largest knowledge resource not yet mobilized in the development enterprise."* (Adetokun O. Phillips & S. Oguntunji Titiola, Sustainable Development and Indigenous Knowledge Systems in Nigeria, 1995. In his paper, Power Imbalances and Development Knowledge (2007), Norman Girvan implicitly concurred with that statement. He underlined the critical importance of local knowledge (eco-indigenous knowledge under another name), emphasizing the need to turn knowledge hierarchies "on their head" so that local actors, including actors at the community level, become the principal sources of knowledge for development purposes as well as the prime movers of development:

"…we propose that local knowledge (should be) the critical resource in development policy making, and that local actors should be the primary

agents of diagnosis and prescription. Local actors are not only governments but also include the private sector, civil society and people at the community level. Local knowledge includes that which is embedded in cultural traditions, values and social processes. Use of community-based knowledge as a development resource is rooted in the traditions of South peasant-based social movements and rural and community development strategies. In Asia, Africa and Latin America a wide variety of similar initiatives are now being undertaken."

Girvan's paper was prepared for the project, Southern Perspectives on Reform of the International Development Architecture. I would suggest that such reform include the redefinition or reconceptualization of certain universally-accepted development concepts which render that architecture completely askew. I have already discussed that idea in respect of sustainable development. The cultural heritage is another concept of vital importance that urgently needs to be redefined, if the considerable development potential of eco-indigenous knowledge is to be realized

The Cultural Heritage as a Development Resource

Caricom and other countries in the South should urge the international community to redefine the concept of the cultural heritage so as to include eco-indigenous knowledge as a key development resource. The current international strategy to promote development through culture, which focus on the physical heritage, is conceived from a Northern perspective. The industrialized countries have long ago absorbed, and incorporated, their traditional knowledge and techniques into their modernization processes.

There is virtually no residual indigenous knowledge, in those countries, with a development potential.

The notion of the cultural heritage, bereft of its most dynamic component, is now largely confined to the physical cultural heritage, such as monuments, historic buildings and ancient ruins, with the result that the conservation and preservation of that heritage has become the principal concern in those countries. When that concern is applied to the South, physical cultural heritage conservation becomes the focus of development activities rather than the upgrading, modernization, and development activities which a dynamic exploitation of eco-indigenous knowledge systems would require.

Most countries in the South unquestioningly go along with that Northern-conceived policy. By concentrating almost exclusively on the physical cultural heritage while almost totally ignoring their non-physical heritage, countries of the South are selling themselves short. They deprive themselves of the enormous developmental potential of their eco-indigenous knowledge systems**.**

What is required, therefore, is a redefinition of the international community's working definition of culture to include eco-indigenous knowledge. With such a redefinition, the parameters within which international or national action is taken would be adjusted accordingly. Because eco-indigenous knowledge is passed down orally, from generation to generation, it risks being lost forever if it is not transcribed or recorded for posterity. Preserving that extremely important fragile knowledge from extinction deserves, at the very least, the same amount of resources and

energy currently being invested in the protection, restoration and conservation of monuments.

I would suggest that an initiative be taken at the international level, in that respect. Trinidad and Tobago alone or, preferably, together with other Caricom countries, could introduce an appropriate resolution at the next Unesco General Conference and, also, take similar action in the relevant governing bodies of UNDP and the World Bank. Given the crucial importance of eco-indigenous knowledge in biodiversity preservation, such an initiative, if undertaken, could be a very significant contribution, on the part of Trinidad and Tobago or the Caricom community, to the International Year of Biodiversity,. Such an initiative, if successful (and I do not see why it should not be) would do more, in my opinion, to promote the cause of biodiversity than any I have so far seen proposed or undertaken by the international community.