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«Soil fertility and water availability, the main ingredients for conflicts of all kind throughout the world»

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Soil fertility and water availability, the main ingredients for conflicts of all kind throughout the world

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Since the early 50s, both national and international institutions have put forward data known for millennium on food production but very little, dealing with recent knowledge with regard to the basic functioning of ecosystems. Paramount sums of money were allowed describing the components taken for granted that ecosystems static for long term and dynamic for a short one may provide for food security and production.

All of this was based on the assumption that agriculture is the only universal way to be taken into account. The result are clear: Third World countries have developed most agricultural practices best fitted for temperate climate countries but not so well fitted for many tropical soils. There is also the demand for water which is sky rocketing in modern agriculture when the reserves are shrinking year after year while the total world population is constantly increasing

All problems related to food production and security are tied to soil depletion and water scarcity. So far, no applied technology was able to produce new stable soils nor more water. Consequently there are more and more regional conflicts in the Middle East countries and no real solution is expected rapidly. The same situation can be applied to sub-Saharan countries in Africa for almost the same reasons but with different actors for as poor crop production. Over grazing and slash and burn seems to be the main reasons. A primitive agriculture coupled with a high mortality rate among populations are the main factors that could favor soil and water improvement.

A great number of diverse technology have taken its toll on both water and soil utilization with an increasing population, moving faster and faster to urban areas

leaving a country often depleted and, as in the Great Lakes area in Africa a density of population far exceeding the capacity of feeding themselves.

The ingredients for an ever lasting universal conflict

Without some new basic knowledge, some already available, it is clear that we are heading for an eternal combat between man and technology as well as a social structure alike millennia ago; because wealth and power are into the hands of small number of people in power while poverty seems to be a way of life for the multitude. Such a prevalence of wealth and power stemming from technology has some, similar effects of the dominance of man over man or communities over others. If we don't react we leave an old paradigm at work: Things much change because an incredible amount of new knowledge was accumulated day after day for the last two centuries. An old world may still exist, but a new one has been improved over the two deadly wars during the 20th century.

One of the most rooted paradigm is without any doubt the **agriculture** born with the need for man in search for food. By the same token outside the scientific world, but with a major industrial agriculture has been put in place only for its economic value

Jackson (1985)[1]. suggests that modern agriculture practices are used in a ***"paradigm of ignorance"*** where technology and money are enhanced by old believes most of the time, and then closing the door to new knowledge where consensus cannot be reached between and among communities responsible for food production. Therefore speculations for prices stay at the international level. Moreover, international trades and the outstanding influence of few majors are involved by controlling both currency flow and usual information instead of new knowledge for competition purposes over the world market. In addition, industrial secrets with deep scientific implications are swept under the rug to prevent further competition.

The old agricultural paradigm and the need for a new one

This endless competition between men, mankind and environment will always be. and is translated into behavior ruling our societies. As we all know our physical

[1] Jackson, W. (1985) «New roots for agriculture» University of Nebraska Press , 150 pp.

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world is encompassed into a single planet: the Earth. As long as technology was almost unknown we were ruled by the interaction of all actors of this world giving some small niche where our "maturation" developed at all levels. However we have found scientific data acquired and dealing with the rules involved in evolution unfortunately cannot find new ones such namely in space, water, air, in SOIL, which was too long forgotten by science, but taking care by the economy as a cost, while seen by producers as a physical support to provide food for all living species.

As a matter of fact the soil is the result of the evolution of biology as well as the fundamental link, the mineral world. The Ukrainians scientisis were the first to describe the physical differences in soils and gave them Russian names such as podzol, tchernozem, rendzine, solonetz, etc. which are universally known and used since the end of the 19^{tn} century,

Unfortunately rapid increase of technology coupled with new knowledge during the 20th century did not allow the recognition of the fundamental characteristics of soils but only the maintain the of the old paradigm partly renewed in the middle of the 19th century by the German scientist von Liebig. He has recognized the basic role of chemical nutrients such as nitrogen for the growth of plants in the protein structure of tissues.

The "chemical" approach to soil productivity was soon understood by bursting the chemical industry, which became a real gold mine. The **"chemical nutrient approach for plant productivity"** gave birth to many insect and plant disease problems, another gold mine for the biochemical industry, producing new toxic molecules for controlling some severe parasites, namely insects, bacteria or virus. This was the beginning of a large scale biologic as economic operation with the introduction of DDT in the '40s.

It is worth stressing that most of the molecules found by chemical industries are banned from the market place by laws because they interfere long term on the quality of human health if not simply causing mortality.

A slot to introduce new knowledge and building a new paradigm

Recent scientific knowledge is showing how close agriculture and forestry are intertwined contrary to the perception that they are irreducible enemies as seen in the old paradigm. However, agriculture has been always seen as the most needed

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activity for mankind to survive and prosper. Therefore, forests had to be removed in order to provide arable land, and keeping away all the dangerous predators such as wolves, bears lions, tigers, or snakes… Getting rid of the dangerous dark forests and their predators for good arable land, as seen, all over the world was the way retained to survive from famine and wars. The constant quest for chemical resources required by some new technologies is on the way to sterilize agricultural soils, to favor droughts and natural forests to melt like ice under the tropical sun. The new more productive varieties of cereals such as rice, maize, must be grown on good quality soils need to be provided with water for irrigation if needed.

From the old paradigm the common answer to water scarcity, food shortage and soil erosion and depletion was strictly a traditional one. Obviously the industrial technology approach is firstly the economic with no reference to the real situations throughout the world, except the economic one.

The new paradigm is primarily based on the evolutionary mechanisms we encounter into historic and biological features of the world. **All attempts to define sustainability outside of a forest scope** ***cannot be taken seriously, because it is the only biological living productive system being able to produce and reproduce in a predictable way over centuries.***

Our main resources based are on their industrial and economic values and more and more this fragile short sighted system, often called agro-ecosystem, is being fed with nutrients from the chemical industry, without any reference to biology except in terms of pests and diseases control. By the same way forests are destroyed at a rate never recorded before, reducing forestland to vast brush countryside in a process well known as **desertification.** According to their utilization paradox, agriculture and forestry are still in deep competition, more than ever before, instead of supporting one another for **"sustainability"** reasons and a minimum harmonious way.

The soil an immense recycling machine

These two biological systems, agriculture and forestry, have a basic and very important point in common, the soil, which seem to be unknown to farmers and all industrial taking into account what we published in both scientific and technologic literature all over the 20th century. The soil is only seen as a physical support for the crops and not relevant at all. In fact at the end of the 19th century the soil was

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described as a seedbed to be activated by chemical "fertilizers" recommended to farmers from a multi million chemical industry operating with large subsidies from the State.

Our research on different soil types has proven that many factors must be taken into account. In the late 1970s scientific soil research began to prove how complex were the soils from the biological standpoint and how poor are the agricultural ones in term of biodiversity while forested soils are being so rich. It appears obvious that stable fertile agricultural soils are derived from the forests, destroyed to gain agricultural land. It has been seen very often that soils depleted by some wrong agricultural practices are slowly invaded by early stage of natural reforestation, or left as deserts. Therefore, one must recognize that ultimate soil stable stage is forest's where it has evolved towards a greater biological diversity and stability, and where water scarcity was much less a problem.

When that situation was known by some scientists, they began to pay attention on what was the differences between an agricultural and a forest soil and why the first one is biologically poor and need to be improved with "chemical fertilizers" while the other was rich in biodiversity and productivity by itself on a long run. A clear answer was given in 1987[2] with regard to some aspects of the soil biology, and in 1989[3] the role of fungi on lignins opening the door over polyphenolic chemistry was a big step for soil science in 1990[4]. The access to basic dynamics of ecosystems was finally described and published.

So the door over a total different approach to the role of soil and dynamic mechanisms, was recognized and has given the base for the **new paradigm** where the basic equilibrium rely on the biological world, not on the fertilizers as the **old paradigm** was relying upon. On this regard, forested systems should be seen and assessed as living long term sustainable equilibrium instead of short term unbalanced.

This new approach coupled with numerous new challenges in regard of transferring some forest long-term biological equilibrium to agricultural land for regeneration

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[2] **Amaranthus, M.P. & Perry, D.A. (1987)** «The effect of soil transfers on ectomycorrhizal formation and the survival and growth of conifer seedlingson old non forested clearcuts» Can. Journ. For. Res. 17: 944-950.

[3] **Leisola, M.S.A. & Garcia , S. (1989)** «The mechanism of lignin degradation» in "Enzyme systems for lignocellulose degradation" Elsevier Applied Science London, p. 89-99

[4] **Perry, D.A., Amaranthus M.P., Borchers, J.G., Borchers, S.L. & Brainerd, R.R. (1989)** «Bootstrapping in ecosystems» BioScience 39 (4) 230-237

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and so doing to reconcile two old enemies: forest and agriculture. In fact it was predictable that conflicts of all kind could arose mainly from agronomists whose interest and basic knowledge are devoted to grow plant for food production at almost any cost..

The old paradigm still used almost daily, calls for an assessment of natural resources without any restriction, because biology is seen to prevent wealth to increase. This is unfair namely for two basic resources, oxygen in the air we breath and water, which is essential for the life on this planet. If we agree on the fact that the oxygen we breath is due to the biological activity of ocean life, but hardly available on the land depending upon the way of life of so many nations..

The Nobel prize of chemistry given by the Royal Swedish Academy of Sciences for 2003 went to Agre and Mackinnon[5] for their extraordinary work on the description of intimate mechanisms of water and ions circulation in and out the cells membrane. In fact they have mapped and describe the basic mechanism by which the life not only depend on nutrients and how water is used at the nutrient level. It is clearer than ever at the soil level.

The conflict between Palestinians and Israelis for water access dramatically underlined the real value of water for agriculture and all other needs of the life**. All fertilizers and pesticides can be purchased abroad but not water needed to sustain life and the economy of both communities.**

Elsewhere, recurrent droughts have the same effects so often recognized in the sub-Saharan Africa and emphasized also by economic, tribal, religious or ethnical disparities. **There is an unbreakable link between water availability and soil fertility as sources of major conflicts throughout the world.**

Question should be raised on the perception of forest and agriculture in biotechnology[6] innovation where Canada is shooting enormous amount of money, in term of agriculture and forestry only referring to the old paradigm when so much is needed to validate the new one, the real efficiency for thew future.

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[55] **Agre, P. & MacKinnon, R. (2003)** «Les canaux hydriques et ioniques des membranes cellulaires» Université Laval, Groupe de Coordination sur les Bois Raméaux, publication n° 179

[6] Anonymous (2003) «La biotechnologie transforme la société: une économie novatrice et une meilleure qualité de vie. Rapport sur la biotechnologie (1998-2003)» Government of Canada, 99 pages

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According to the World Watch Institute in June 2000[7] the grain consumption in Egypt and North Africa could necessitate a volume of water equal to another Nile river to meet demand. Otherwise grain exported from northern countries should be assessed in water by million of tons of water to provide million of people completely dependant upon foreign agriculture and market place. In 2004 some Muslim countries are the most unstable with a bleak future in regard to water and food availability.

At Laval University, Québec, Canada, a research team has began in late 1970s to study this basic question of soil fertility taking an unusual path of research, leading to major discoveries upon soil fertility and afterward water biological management in identifying the basic rules of ***pedogenesis*** which is using branches of trees supporting the photosynthesis, but perceived by the forest industry also by the agricultural one as trash, debris, leftovers, so on and so fort. It was soon noticed that neither industry nor science has never paid attention on a commodity produced all over the world by the billion tons yearly.

These young branches once reduced in chips were incorporated into depleted agricultural soil and in the second year gave yield no one had never expect in term high production and good quality quality. Irrigation was reduced and some parasites, diseases and aggressive weeds were reduced in number and even disappeared completely***. In other terms pedogenesis of forest origin was introduced on the soil, using forested trash of small diameter branches to enhance fertility and soils biodiversity on a long term.*** This called the RCW (Ramial Chipped Wood) technology. This detailed biotechnology has been developed and promising data were recorded from all research works and from users.

This new technology was tested afterward in tropical countries such as Senegal and Côte d'Ivoire in Africa, in the Dominican Republic in the Caribbean and in Madagascar has produced more spectacular results on many tropical crops such as tea, vanilla, essential oil plants…

In order to have results from another northern hemisphere country with the support of the International Development Research Center in Canada gave us support a

[77] **Brown, L,R, (2000)** «Population growth sentencing millions to hydrological poverty» The World Watch Institute Alert Issue, June 21, 4 pages.

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very interesting project in Ukraine[8] has been initiated and the results obtained have shown the great efficiency which as confirmed the importance of the RCW in soil rehabilitation and can now be seen as **"as a universal soil biotechnology".**

Under temperate climate all agricultural soils recognized fertile as arable land is restricted to about 2% of the total. Under tropical conditions the soil is fertile, over the short period of time between cultivation and the long fallow often for a 20 year period. Using ramial chipped wood (RCW) as a soil "organic" amendment bring back fertility, reduces water needs, completely eliminates very harmful nematodes while multiplying yields up to 900% for tomatoes and 300% in maize[9] with much less water needs

These results added to many others have convinced the Laval University research team on ramial wood (RCW) and on **pedogenesis** to submit proposal with a moderate budget for a research and development an experimental project in Africa[10]. Deep and aggressive opposition to this concept of **pedogenesis to restore soil fertility** came from FAO[11] and again from ICRAF [International Research Centre in Agroforestry] Nairobi, Kenya[12]

That strong resistance from international institutions dealing with large sums of money is a way to keep alive the **old agricultural paradigm** so well known and documented for centuries, and more recently supported by multi billion dollar industries of fertilizers and pesticides where their marketing philosophy is based on lack of knowledge of the deep nature fertile soils ruled by biological parameters. Consequently the rich become richer and the poor are left away

There is an urgent need to promote the creation of an **International Institute of Pedogenesis** where the soil will be the main center of interest for gaining new knowledge on polyphenolic chemistry, the base of fertile soil formation, the role of

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[8] **106, Chervonyj, A. (1999)** «Research project on RCW technology on rye (Secale cereale)». Boyarska Forestry Research Station (Kiyv) Ukraine and Université Laval, Québec, Canada. 60 pages, ISBN 2-921728-49-4

[9] **Aman, S.A. (1996)** «Effects of chopped twig wood on maize growth and yields in the forest-savanna transition zone of Côte d'Ivoire» Groupe de Coordination sur les Bois Raméaux, Université Laval, Québec, Canada publication n° 169, 12 pages

[10] **Lemieux, G. (2001)** "RCW TECHNOLOGY AND SOIL FORMATION: A COMPREHENSIVE VISION IN THE AFRICAN CONTEXT: CIDA-IDRC-The World Bank Université Laval, Québec Canada 27 pages ISBN: 2-921728-57-5

[11] **Lemieux, G. (1993)** «A universal pedogenesis upgrading processus: RCWs to enhance biodiversity and productivity» Université Laval, Rome, publication 34b. 6 pages. ISBN 2-921728-05-2

[12] **Lemieux, G.(1996)** « La mission africaine: Sénégal et Kenya, compte rendu et commentaires» in Lemieux G. (1996 " Rapports de mission pour l'année 1996, Sénégal, Kenya, République Dominicaine. Ukraine, France, Belgique" Université Laval publication 68, 261 pages, ISBN 2-921728-22-2

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fungus (Basidiomycetes and Ascomyctes) as the most important agent in the soil formation as the food web.

Poverty and conflict will arise more and more frequently in both Third World and developed countries as long as the soil is not recognized as the main natural resource based on its biological activities needed to keep a soil stable and productive for centuries.

Such an international institution of Pedogenesis must be put into place rapidly and be supported by the United Nations as well as by all industrial countries. So the large amount of money devoted without any clear results for people could be invested in R & D in order to learn all the unknown mechanisms implying biological and mineral ingredients and their relationship with all different crops under all the various climates around the planet Earth

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