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THE PROBLEM OF THE DESERT AREAS: AGROFORESTRY RECOVERY OF THE SAME AND INFLUENCE OF THIS ON CLIMATE

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Preface

In the overall framework of the causes and problems of climate change, which proceeds in part to natural causes (eg. increase of solar activity), and partly by human action (eg. increase of environmental pollution and greenhouse gases), an important factor, as already shown in the past, is connected to the change of state of soils and to land use in a great part of the planet.

The presence/absence of plant cover, radically changes the reflectivity of the soil and the temperature of the air layers, as well as the hygrometric equilibrium of the area.

The electric charges produced by the trees facilitate the condensation of the rain

Furthermore, we also have the phenomenon of diffusion of electric charges from the areas with vegetation cover to the atmosphere, existing between the soil and the atmosphere itself a difference of electrical potential also relevant, which favors the atmospheric moisture condensing into rain. It is in fact frequently observed, during the night, in desert areas, the formation above them of moisture supersaturated air masses, which, however, does not condense because the coalescence between the water microdroplets is prevented by the mutual electrostatic repulsion, as they are, generally, provided with a positive electric charge.

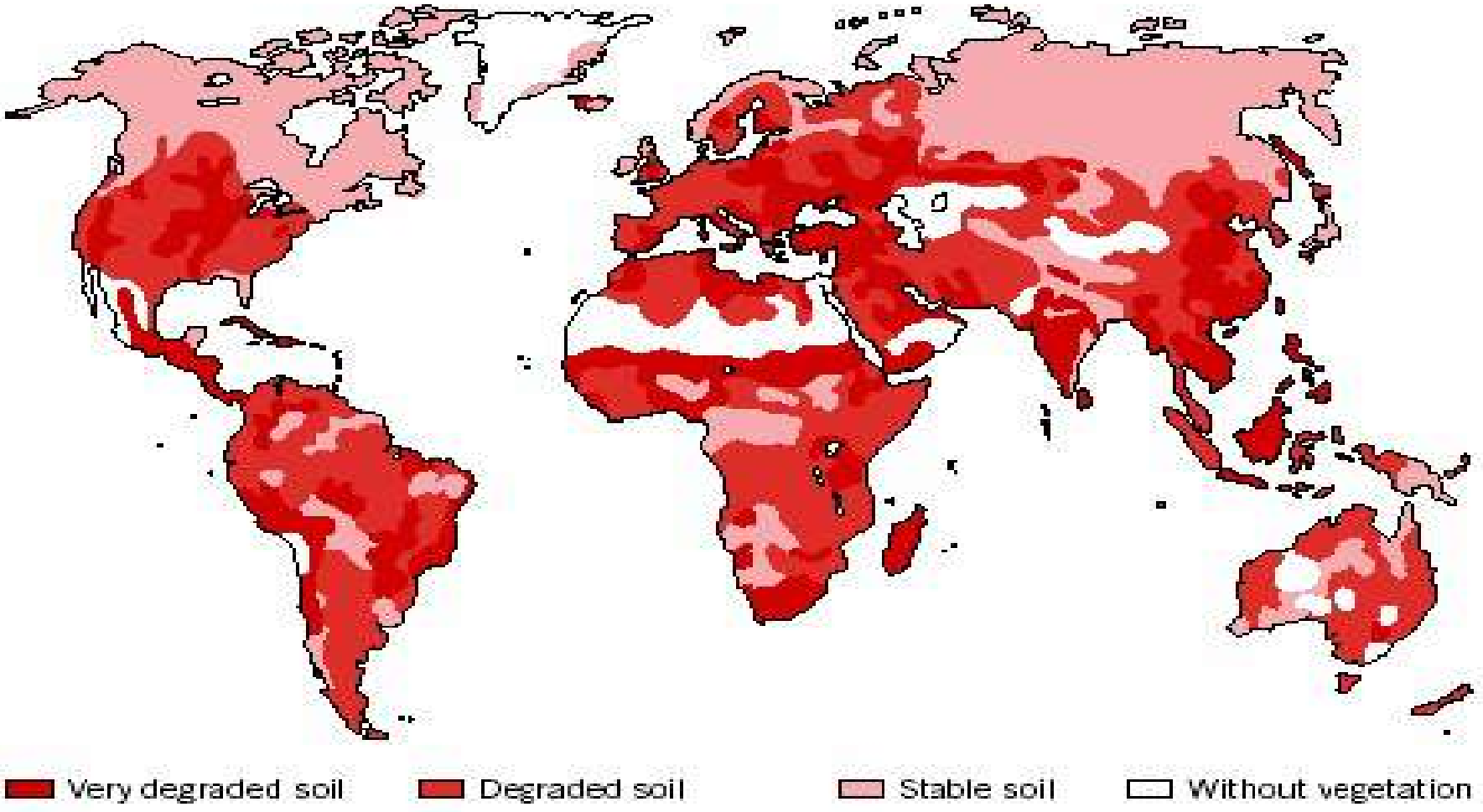
On the contrary, it is easy to observe the presence of frequent and sudden rainfall, for example, above the alpine coniferous forests, where, for adiabatic expansion and consequent cooling of the air, also are formed of moisture supersaturated air masses. That to, however, to this effect, condenses very easily in rain.

Bad cultural practices cause rapid loss of arable land, but its regeneration process requires centuries

About the present state of fertile soils, remembers that the average natural rate of soil formation is about **1 mm every 200÷400 years (equivalent to 40 kg/ha/y)**, but, following the anthropic action, the agricultural soils are losing 10 to 40 times faster than they can form, **when a soil profile is established in a time of 2,000÷10,000 years**.

In total, **we has a fertile soil loss amounting to 6,000,000 ha/y, on a total of about 1'200'000'000 hectares of fertile soil available in the planet (that is 0.5% per year)**.

Degraded Soils in the World



Deserts occupy 30% of the planet's surface. And they have a strong influence on climate warming: we must recover the desertified land!

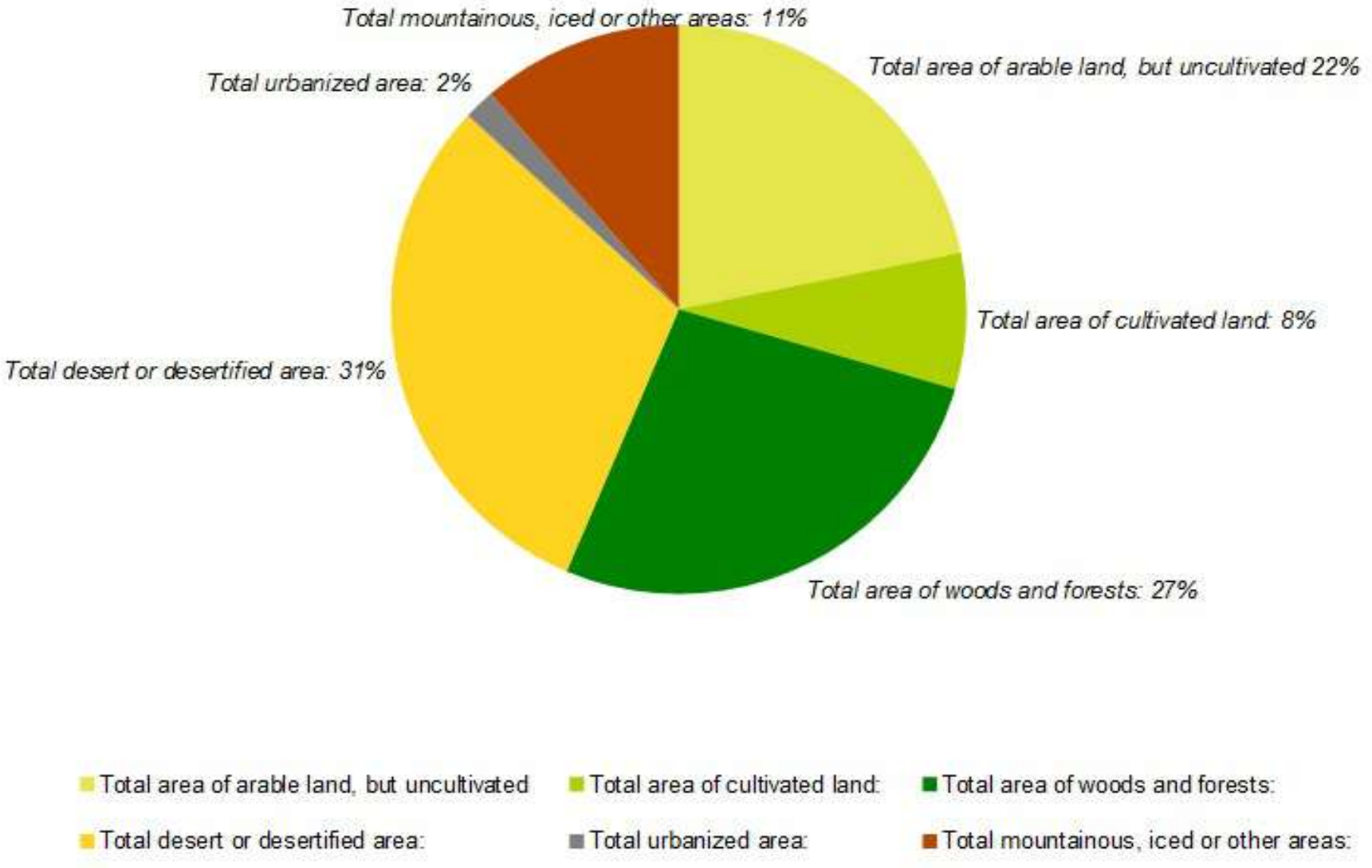
An important contribution to climate modulation, canceling, at least partly, the natural or anthropogenic factors that determine its alteration, would be to recover an adequate vegetation cover, forestry and agricultural, in the soils today have become sterile, while recovering and conserving the biodiversity.

To do this is, therefore, necessary to recover the soils to adequate fertility, which are the areas for the reforestation or for the agriculture.

We **estimate a 30% of the land surface is now occupied by deserts**. A part of them are definitely related to situations for which these areas have maintained for millennia a desert character. Also worth considering is that - perhaps opposed to what usually think - the deserts are home to an important biodivesity, which must also be protected. However, a portion of these deserts has formed in recent times (past 50÷100 years) to the anthropogenic and environmental degradation factors, especially for improper agricultural practices, and in particular of industrial agriculture. Others are formed and extended in historical times, as an important part of North Africa. In addition, we have desert surfaces that should be retrieved, in terms of vegetation cover, to restore livability to human settlements adjacent to them.

Use of the soil in the World, and desert area

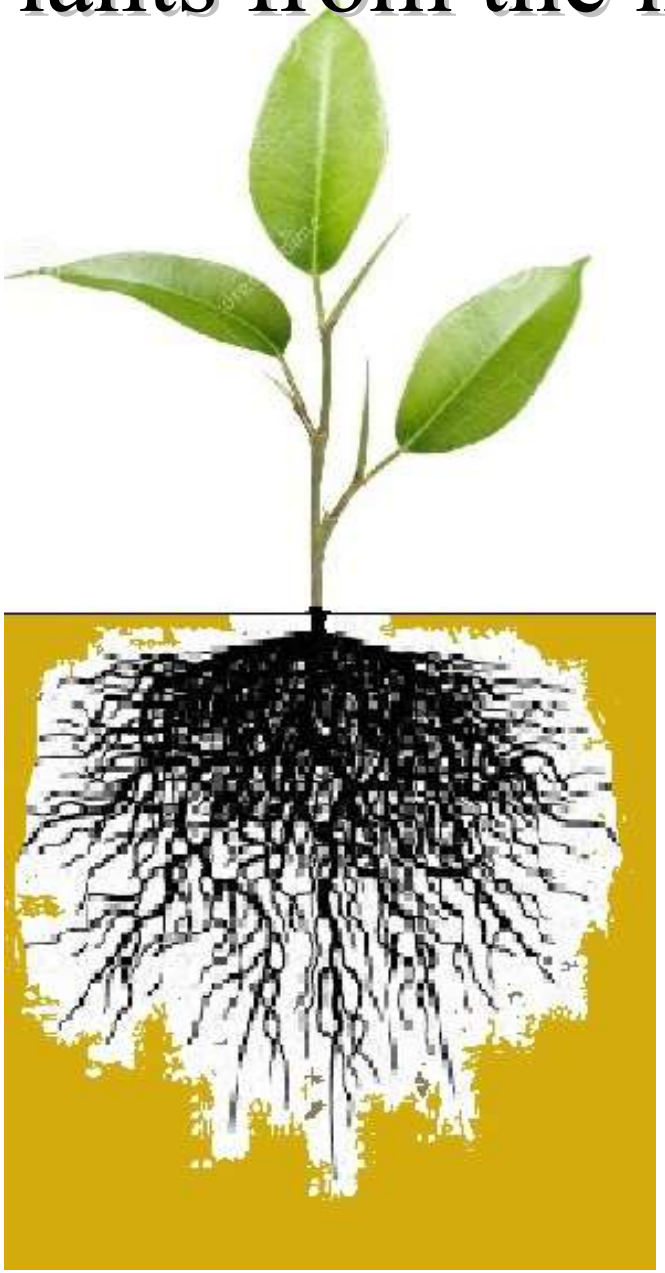
(Approximate)

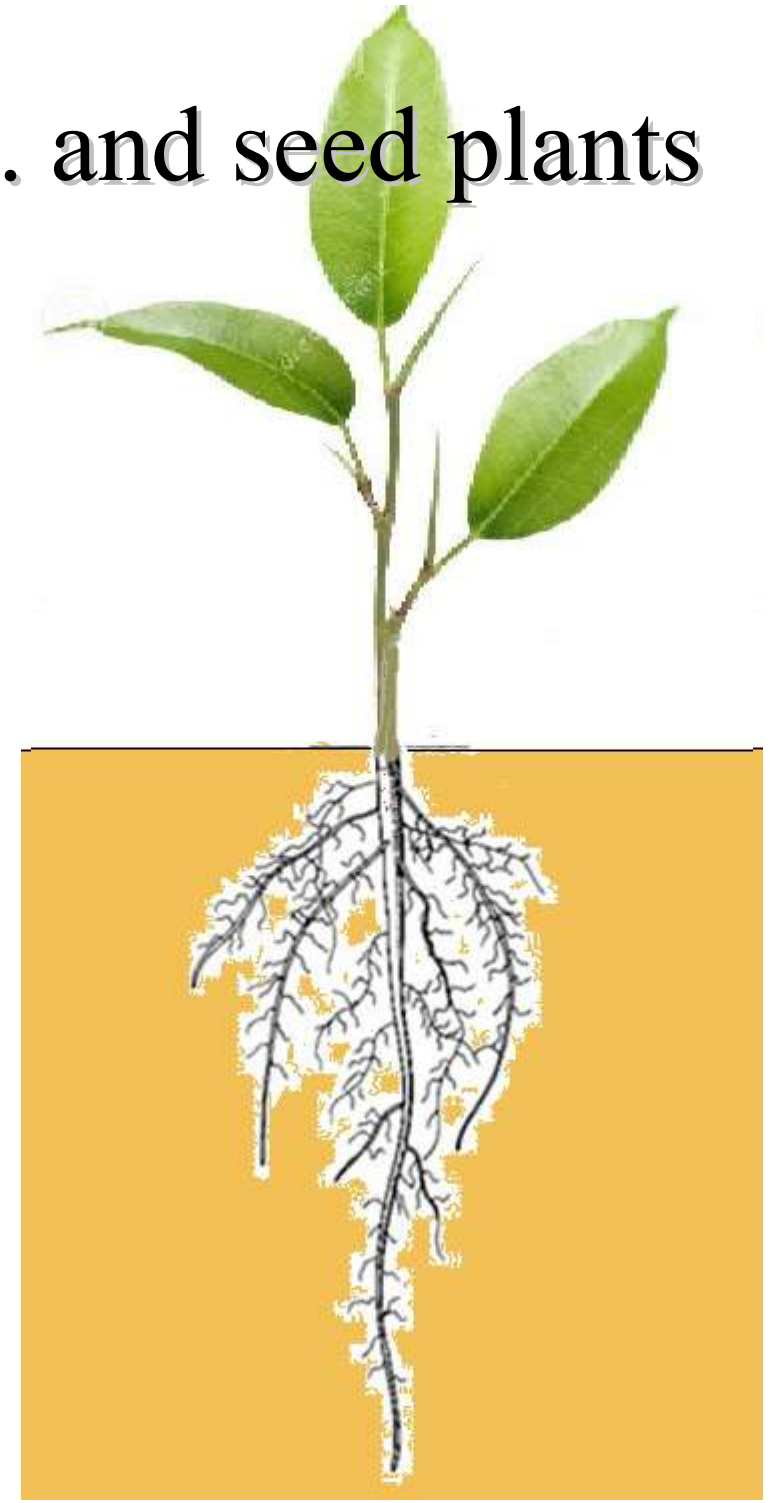


Venanzio Vallerani (1924 - 2012)

A first successful experiment, which extends over large areas in Africa and China, has been done in the last 20 years, from prof. Venanzio Vallerani (1924†2012) and co-workers, introducing a particular technique of modeling of soil, and planting of seedlings not previously developed in plant nurseries, but proceeding to be planted directly the seeds in the soil.

Plants from the nursery... and seed plants





Desert areas recovered by Venanzio Vallerani...

...in Burkina-Faso desertic area

……. This technique, however, does not apply to areas where the sands are very mobile (eg. certain areas of the Sahara or the Arabic desert) or excessively dry.

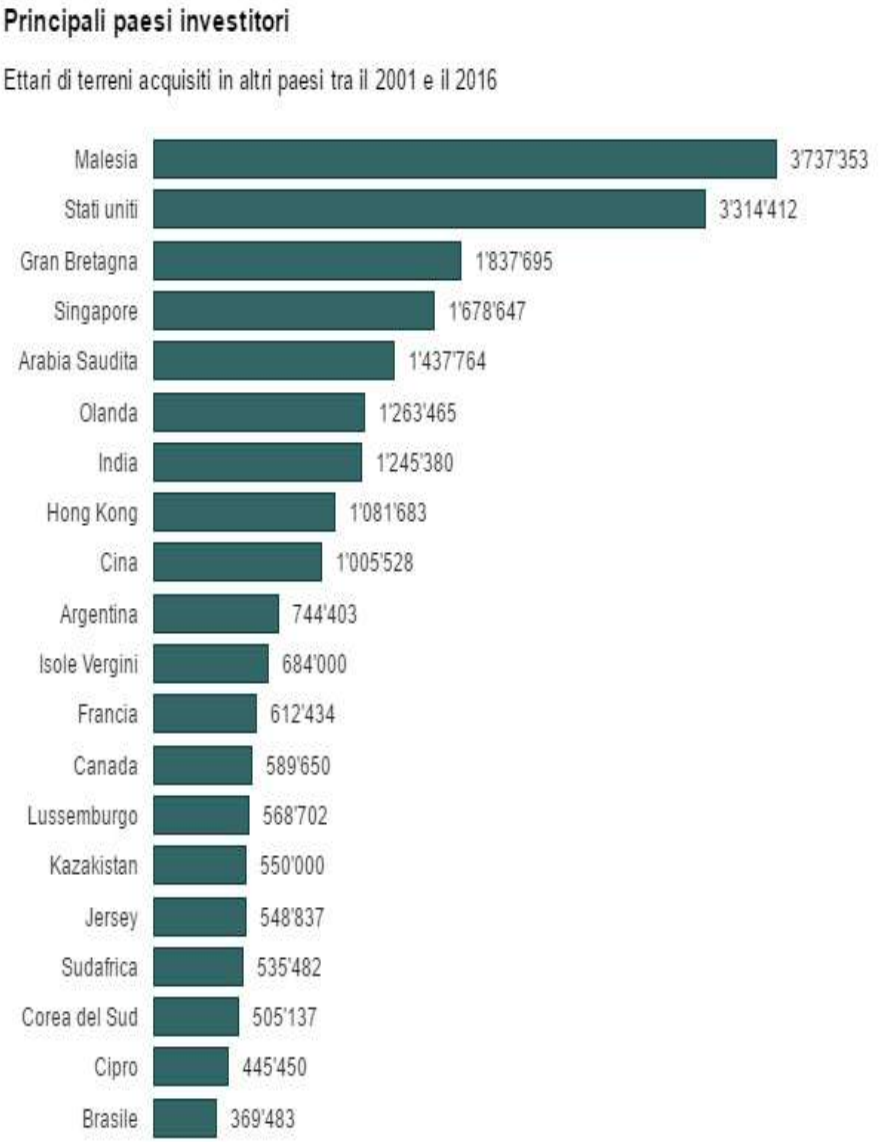
The human and climate catastrophe in North Africa today

The issue is particularly important today: for example the North Africa is going through, in recent years, an environmental catastrophe, and therefore socio-economic and political, with millions of people who are emigrating mainly to Europe.

Please note that, traditionally, **in North Africa more than 80% of the population lives on agriculture, and in recent years, referring only to the cultivated areas, 40% of the soil has become sterile**. For which the people living there were left without livelihood, and then forced to migrate. This is also one of the causes of conflicts under way in this part of the world.

The desperate search for arable soils

In an area such as the Arabian Peninsula, where economic development in recent decades has led to a rapid increase in urban population, the food resources are largely insufficient, which led to **the Arab States, over the past 15 years, have acquired well 1,500,000 hectares of agricultural land in other countries**, thus putting them in 5th place worldwide among the countries that have begun to colonize cultivable land abroad, even in an amount equal to 1.5 times China.



Desert in Dubai

The terms of the problem

In addition to this, there is the problem of influence it has on the climate, also of Europe, of these huge desert areas.

To solve this problem, for desert areas where even the Vallerani technique is unenforceable, we want here to propose a modification of it, related to a series of measures to support plant growth, prevent the silting up of these, and to develop a land use planning that promote its natural, climatic and socio-economic recovery.

The deserts we took as an example have very rough climates, **with very high temperatures (for the Arabian desert, they can reach during the day even 54°C, while the annual average temperature is slightly below 30°C),** dry , and sometimes even very saline, little or no organic substance.

About the problem of temperature, **please note that the temperature range in which a plant is metabolically active is about 10÷30°C**. However, as they should be to form a green cover, itself lead to the much more moderate temperatures.

The plant cover, as mentioned, would also change the rainfall, making those areas much less arid. In this regard please note that in recent years, some parts of the Arabian Peninsula, to the climatic changes in progress, have been affected by extraordinary rains.

There are also various plant species that have the ability to absorb water, in addition to from the ground, even directly from the atmosphere, such as, for example, *Eucalyptus*. And how, for example, many plant species that live in humid deserts.

About the problem of the chemical nature of the soil, **the desert soils that we talked about consist mainly of silica and silicates, alumina, limestone and dolomite, clay minerals, with low or minimal amount of organic matter; and in some areas the presence of sodium chloride** - as in certain areas of the Sahara - can also reach 8%.

The basis for a solution of the problem

Of these, the most complex problem is that of the very saline areas. But where the salinity not reaches excessive values, we have the ability to identify species that can be made suitable. With the restoration of the vegetation cover and the start of its pedochemical mechanisms, the same salinity will likely decrease.

For the problem of the lack of humus, the creation of a plant cover will produce the mechanisms of formation of the same, given that the underground biomass of a plant more reach and exceed 40% of total.

The soil of most of the Amazon region is characterized by a composition not very different from that of the desert areas we are talking about, with an abundance of silica, alumina and iron oxide and very little organic matter, but this does not prevent the growth of a thick vegetation; although, in the latter case, we have a very high rainfall, tens of times greater that a desert.

Soil fertility and microorganisms

It is also noted, that the fertility of a soil is not only determined by its chemical composition and a certain amount of humus (formed from organic polymers with a high power of absorbing water and ion exchange, similar to clay minerals), but also to microbiological biodiversity of the soil itself: **in a good agricultural soil, we have about a 40 kg/m^2 of microorganisms, protozoa, annelids and other organisms, which continuously regenerate chemically the soil**.

Living organisms change the environment according to their needs

Furthermore, **the same metabolic activity of the plants chemically modified the soil; the micro-roots, with a life time around two years, then transformed, at their death, into humus, favoring the growth of micro and macro-organisms**.

Consequently, not the soil and climate to "allow" the development of the plants, but the plants themselves that create, over time, a soil and a climate suitable to their development. It is in fact a characteristic of living beings to change their environment to make it suitable for their needs.

This is one of the fundamental principles of intervention technique proposed here, aimed at recovering the biodiversity of arid and degraded areas, and their usability for agriculture, in years rather than millennia.

Traditional techniques do not solve the problem

The choice of the mode of action is closely linked to careful preliminary geological analysis, pedochemical and archaeobotanical study, aimed at identifying what were the species that lived in the area before you started the process of desertification, but also of how it has evolved the climate and that led to desertification.

The most difficult phase is the initial one, namely the creation of a first plant cover.

As we have seen, the soil and climatic conditions of those deserts today are absolutely hostile.

From here, seeding with the Vallerani technique is not directly applicable.

The planting of seedlings from the plant nursery, as was shown, it leads to very limited results: the seedling, in fact, tends to form a very shallow root system, which does not reach the water often present in deeper layers of the desert, and must also adapt to soil with a totally unfavorable chemical composition and very hot.

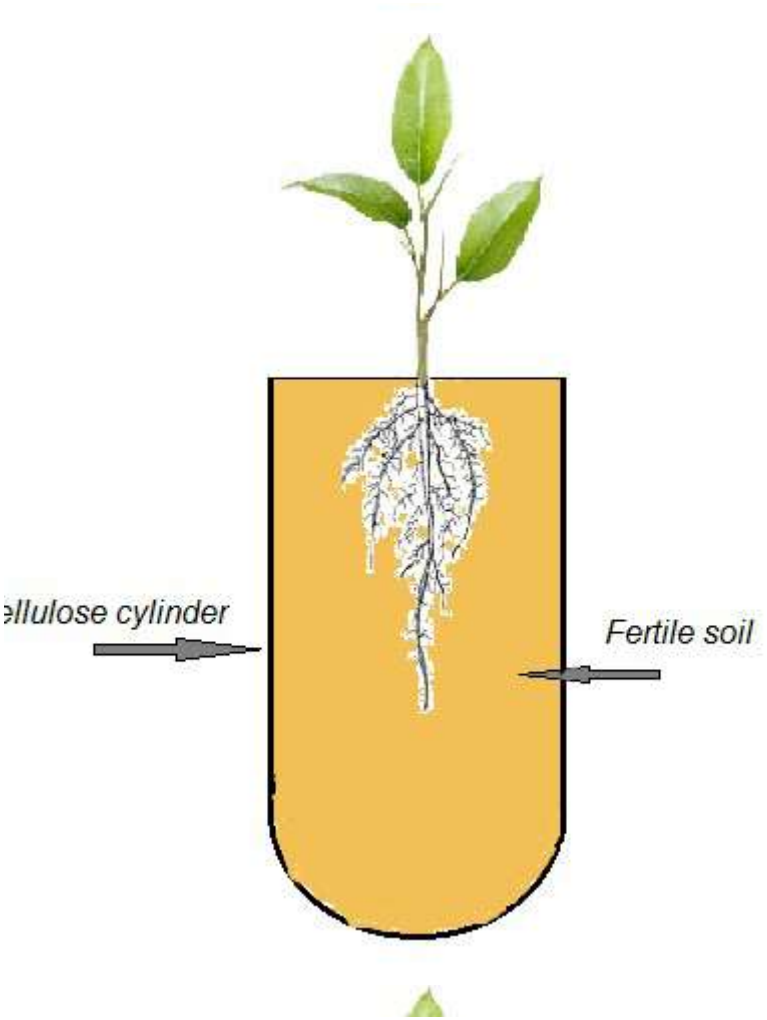
Then we have another problem: the continuous movement of the sand, which tends to bury the young crops.

So it is necessary take a different cultivation strategy.

The solution can be offered by the crop above-ground

By growing the seedlings for an appropriate time, in a secure environment, by placing the seeds in cylinders of cellulosic material filled with soil with suitable composition, they would reach an appropriate stage of development before being ordered to stay. The root, in this case, assumes a development mainly in the vertical direction.

Such cylinders of cellulose with inside the seedlings, planted, would provide for a certain time a ground of adequate composition for the initial growth of the plant, which then extend only after the roots to the surrounding soil.



Site preparation

Previously, areas intended to receive the crop, should be adequately protected with more resistant plant species barriers and measures to stop the sand, which has already been tried in the past with success, and possibly with artificial and temporary barriers. The action of the wind on the sand could be countered with controlled spreading of waste vegetable oils, which would prevent the wind to have grip on sandy soil. Although this has already been done in the past in some areas right of the Arabian desert.

The initial intervention area must be chosen adjacent to a zone with a more optimal situation, in a manner to extend this, progressively, in the direction of the desert. The area in which it will create a plant cover will cause the areas immediately adjacent to it are modified, making them, in turn, adapted to accommodate an expansion of the plant cover same.

In the planning of the intervention will take care of creating groups of trees that protect the areas to be allocated to agricultural activities. Practically, creating a sort of oasis succession.

An oasis that expands ...

In summary, the hypothesis of intervention that is proposed, is divided into the following steps...

1) study and preliminary analysis of the intervention area, with identification of the factors that led to desertification and botanical species that previously colonized the area, geological structure and nature of the soil of the same;

2) intervention design (at least on an area of 400 km2), with eventual insertion - if possible - even artificial lakes as water supply and thermal flywheel (a technique used successfully during the ancient Egyptian empires), planning areas intended for reforestation and areas to crops and human settlements (especially rural type);

3) cultivation of the seedlings (species identified by means of previous studies), to then be planted in the desert soil, above-ground, in special cellulose cylinders filled with soil with a suitable composition, up to a certain degree of development;

4) realization of any artificial lakes and rural settlements, that will host the first people involved in launching the project, and then forming farming communities that will ensure over time the management of the area of intervention, as well as a recovery of human activities in the area, premise indispensable to the survival of such a recovery process not entirely natural, but supported by man;

...and then...

5) preparation of the soil in the area of intervention, with measures (eg. spreading of formulations based on vegetable oils) adapted to stop the sand for the time in which vegetation will begin to develop sufficiently;

6) planting of seedlings in areas designated for reforestation, with adequate preliminary preparation of the plantation points for the cylinders containing the seedlings, possibly by adding to the soil appropriate corrective, acts to retain water and nutrients, until the plant is sufficiently developed to become self-sufficient;

7) after that, in a foreseeable time of 5÷10 years, it has started to have sufficient forest cover of planted surfaces, it will proceed to the recovery of other agricultural areas, given that, with the previous interventions, there is expected a positive change of climate (temperature drop, increase in precipitation) and of soil (increase of microbiological activity and therefore improved even its pedochemical characteristics), so to allow an agricultural development;

8) monitoring the start of the project in the years to follow, the weather and pedochemical data in the area of intervention.

From the study of the problem to action

We will want to pass, with this intervention hypothesis, from a passive observation phase of the climate alterations in place, to an active phase of the possible experimentation of solutions to the phenomenon, implemented on a large scale, especially in relation to the needs of life (social, in terms of health and economic) of the world population.

It is certainly a difficult challenge, but not impossible. And is a concrete proposal to begin to solve the serious problems that every year more, affect the climate and biodiversity of our planet, as well as the quality of life, or life itself, of billions of people.

Thanks for the Your kind attention.

...With the hope to introduce to You, the next time, an intervention in progress.

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