



Soil, Earth and People - Our Care and Responsibility

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Abstract

The article discusses the relationship between soils, land modern man and his concern and responsibility for sustainable land management. The main problems, which limit the rational use and protection of land are analyzed and also on the first place among them the improper and unfair distribution of fertile soils and lands, and the resulting problems on a different nature – geographic, demographic, ecological, food consumption and social onece. The significance of the triadic paradigms "soil-land-people", "capital-labor-science" and "wisdom-harmony-prosperity" is noted as well as the maxims that oblige us to work on them. It is also emphasized that soils in Bulgaria are subject to natural, anthropogenic and technogenic pressures. Problems are outlined which are related to arable land, recommendations, guidelines and critical assessments of the soil scientists and the European institutions (European Parliament and European Commission on Agriculture and Development of Rural Areas) concerning the organization and management of soil and land resources.

Key words: sustainable land management, soil, land, people, problems, overconcentration of land and finances, recommendations, guidelines, land use, conservation

Sustainable Land and Human Resource Management - Cardinal and Global Problem.

Sustainable management of soil, land and human resources is a cardinal and global problem for harmonizing the attitude of our society, people and nature. On the first place it is the issue of the unequal and unfair distribution of soils and lands since their origin and the planet formation as well as the last 150 years of intensive use of earth resources (Teoharov, 2006). This problem also raises the following issues - physiographic, demographic, food and environmental ones

Why Physical, Geographic and Demographic Problem?

1. It is a well-known fact that of the total land area of the planet, which is 30%, only 10-11% is arable land and soil. The other part are deserts, rocks, swamps, tundra, waterways, coastal streams, ravines, gullies, quarries, ballasts, disturbed and polluted territories, deserted and abandoned lands.

2. Every person living on the planet now has about 0.27 ha of land, while it is necessary to have 0.6 to 0.8 ha. For comparison, every Bulgarian citizen owns about 0.5 ha of land, significantly less than the "conventional" levels of a Canadian – 3.8 ha, of a Russian - 2.7 ha and of an American – 2.4 ha (The Soil Resources of Bulgaria, 1989; Teoharov, 2006).

3. Half of the fertile soils and lands are in Europe and North America. The other part is in Africa, Asia and Latin America, where almost 6 times more people live and there is almost the same share of fertile soils. At the same time, the fertile capacity in Africa is 7 times lower and in Asia it is twice lower. The conclusion is that countries with six times lower population are six times richer at birth. At the same time, in countries with a population 6 times more, the land potential is used from 2 to 7 times less.

Why food security problem ?

1. Because of shortage of food and consumption of less food and other products that are produced and manufactured.

2. This shortage leads to the use of natural resources and first of all of plant produced food, without solving the food shortage problem. It is known that for a year and a half soil, lands and plant resources are destroyed as big as the territory of the state of Bulgaria.

Why environmental problem?

1. Because of overloading and use of land resources and destruction of natural plant cover, irreversible soil degradation processes occur alongside threatening increases of carbon dioxide, reduction of organic carbon and disruption the exchange of soil carbon between soil and air, due to the climate change and increase of greenhouse gas emissions into the atmosphere.

2. Climate change and permanent disruption of mechanisms and systems in pedoclimatic, bio-productive and hydrodynamic processes.

3. Uncontrollable and unreasonable use of underground resources. (Just one example of our reality in Bulgaria: the demand for shale gas in the Dobrudzha Chernozem soil - a place, where there is no slate (shale), is contrary to all natural, geological, public and social laws).

These three problems are at the heart of the next two economic and social issues, which lead to a public crisis. Is there a solution? Yes, there is !

1. A real look at science, as the EC says, and the use of its innovations.

2. By preparing specialists and transferring ideas, think talks, funds and capital to the periphery of individual countries and from one point of the planet to another, by strictly observing international rights and agreements. Otherwise the issues will not be solved with aggression and wars, redistribution of land and human resources of the world.

3. Strict implementation of the Paris climate agreement and penalty procedures accompanied by international pressure in case that someone does not fulfill them.

The Modern Paradigm and the Three Maxims

In recent times, soil science has continued to be a major challenge for researchers and societies. Moreover, today, the triadic paradigms "soil-land-people" and "capital-labor-science" are complemented by another one - the new perfected paradigm: "reason-harmony-prosperity"), outlined in the study of the noosphere by Vernadski (2009), where the modern "geological" person is responsible for the future of the planet. If today's societies do not realize the need for cleanliness and health of soils, land and people, they will cease to exist. Three major maxims oblige us to work in this direction:

1. Soils, land and people need to think globally and solve problems locally because the potential of soil, land and human resources and the problems that exist in each country are different.

2. Care for the soil and the earth is care for the health of the people and future generations. Professor Justus von Liebig, the founder of organic chemistry, plant nutrition and soil fertility, says: "*Civilization develops and dies together with its soil.*"

3. Soil is a natural body and a major ecological resource that is usually associated with fertility quality and the functions it performs in nature. The most important role of soil is that of a living, biological system with enviable geological and historical memory, which creates material goods and preserves the archeological values of man. It is enough to make an archaeological (soil) profile in the center of Sofia to convince this new definition.

Something More and Unknown of Soils and the Earth.

In our country, care for the soils, land and people has not begun today. The first Bulgarian soil scientist, Nikola Pushkarov, wrote in 1909 the capital work "Soil Formation" and clarified the genesis and the laws of its formation, and in 1911 and 1931 respectively created the first Agro-geological Department for Soil Studies and the first National Soil Map. On December 14, 1930, scientists from the Faculty of Agronomy and Forestry and the Agricultural Bank of Bulgaria organized the first holiday of Bulgarian land, and one year later the best scientists and specialists developed a program for its management, which they devoted to the "*peasants – men, women, and children, who, from sunrise to sunset, infuse Bulgarian lands with their noble sweat.*" The same scientists and specialists turned with a proposal to the International Institute of Agriculture in Rome (now the FAO) to make this land celebration as much as possible a global and an international one. By its letter of March 3, 1931, the International Institute of Agriculture proposed the date of March 21, when the spring begins (Vassilev, 1932). All this was done at a time when the developed countries in Europe did not have a national soil map and a holiday of the land. **It is time to recreate this holiday again and to turn it into a week of Bulgarian land to be celebrated in conjunction with the World Soil Day.** Nowadays soil and earth must be seen in unity, and they need the utmost protection of society. The soils and the earth are national and ancient wealth, which guarantees the national security of a nation for ever and ever.

Geographical distribution of soils shows that Bulgaria is a unique soil museum. From 32 soil groups and 320 soil differences across Europe and the world, there are 24 soil types (groups) and 276 soil differences in our country. Our country has been a wide field for research work at national and international level. In the N. Pushkarov Institute three international meetings were held in 1980, 1981, 1982, at which the foundations, principles, rules and guidelines for the development of the World Reference Base for Soil Resources were outlined and Bulgarian Soil Science made a significant contribution to its creation (WRB, 2006). People in our state have highly appreciated the role of scientists, the importance of soils and soil fertility, even the name of some soils are connected with their lifestyle, culture, traditions, history and folklore. Several examples: The *Chernozems* - with the granary and the bread of Bulgaria; the *Gray-brown forest soils* - with the "wild" forests in Ludogorie and the lush meadows and pastures of the Fore-Balkan; *Cinnamonic soils* - with the preservation of the historical memory of several civilizations, the breeze of the south and

the southern fruits, the *Smolnitza* - with the snow-white cotton and the "black cotton soils", the *Brown forest soils* - with the sound of the beech trees and the song of the voivodes, the *Dark-colored soils*- with the evergreen coniferous forests and the clear spring waters, the *Mountain-meadow soils* with the Chiprovtsi carpets and Karakachan flocks, the *Alluvial and the Deluvial* soils of the bows and the colts - with the unsurpassed in color and sweetness fruits and vegetables, the amber grapes and the Red Bulgarian Rose, artistically depicted by a number of artists. Even the soils with a primitive and shallow profile are in areas with unique and whimsical shapes - red, yellow and colorful pyramids and rocky spaces, resembling a variety of images and shapes taken from the earthly world - from the beautiful Bulgarian to the fearless angry lion. The Bulgarian, historically, took special care to preserve and enhance soil fertility, and in this connection he always built his settlements on hilly terrains and at the foot of the mountains but not in the plains over fertile soils and lands.

However, the resistance and buffer properties of the Bulgarian soils have been decreased over time. The area of the so-called low-productive, degraded, primitive, shallow, eroded, disturbed, polluted, sealed, anthropogenic, technogenic, generally defined as "defective" or problematic soils, have increased every year (Koinov 1980; Ninov et al.1982,Teoharov, 2003; Boyadzhiev and Teoharov, 2006; Rousseva et al., 2010). They are subjected to natural anthropogenic and technogenic pressure and irreversible processes - degradation, vegetation, erosion, acidification, salinisation, over-wetting, swamping, pseudo-subsoiling, demolition, geochemical loading, pollution, sealing, disturbance, plowing, seizure and total destruction of soils in construction works etc. These processes are responsible for the formation of different new soils and introducing some of them into the national and world classifications (Garbucheve et al., 1975; Donov et al., 1975; Penkov et al., 1992; Teoharov, 2006; FAO, 2006, Jeleva, 2010). It is our duty and responsibility to manage these processes, arising from their genesis and post-genesis, which generally affect soil and earth changes. Depending on these processes and changes and the constraints they create on soil fertility, certain groups and subgroups are formed.

I. Soil Influenced by Natural Hazards and Overloaded.

1. Acidic (medium, strong and very strong) soils. Their total area in Bulgaria is about 2 million ha, of which: 0.5 million ha with a very strong and highly acidic reaction and 1,5 million ha with a medium acidic soil reaction. 4,3 million ha are potentially susceptible to acidification. Solution: Melioration with gypsum and growing and acidophilic plants.

2. Salt affected (halomorphic) soils. Their total area is 55 000ha, of which 35500 ha have been salted by natural processes and 25 000 ha - by industrial and drainage activities. Solution: Melioration with chalk and growing of halomorphic plants.

3. Eroded soils - with a slope of over 3%. Their total area in the state is about 5,08 million ha, of which: 3.73 million ha of water erosion and 1.35 million ha of wind erosion. About 9.6 million ha have a potential risk of water erosion and about 0.5 million ha of wind erosion. There is no evidence of irrigation erosion. Solution: Application of organizational-economic, agro-technical management, forestry, hydro-technical methods, anti-erosion and bio-protection systems of agriculture.

4. Seasonal surface-waterlogged soils. Their total area is in the range of 0.45 to 0.55 million ha. Solution: Deep rupture and drainage (surface and indoor).

5. Swamp soils. Of these: 60 000 ha meadow swamps, 6 000 ha of peat bogs, 25000 ha drained and meliorated, which after 2-3 decades restored their original status due to unsupervised drainage channels. Solution: To preserve their environmental status in order to protect their ecological status. Afforestation with hydrophilic plants, drainage only in case of important case.

6. Podzolic soil. They have not been studied. They are spread in the Rila and Pirin mountains on northern exhibitions with coniferous vegetation on acid rock. Solution: Afforestation with acidophilic coniferous and broad-leaved vegetation.

7. Shallow high-carbonated soils. Their total area is 208 000ha of the Rendzinas soil type. They are formed on solid scales with more than 40% calcium carbonate in the rock. Solution: Growing of sweet-loving plants and use of weather-resistant pads in perennials

8. Deep carbonated soils. The total area is 626 000 ha of Calcic Chernozem subtype with more than 10% calcium carbonates. They are formed on soft carbonate rocks. Solution: Growing of plants with high carbonate resistance and use of rooted graftsin permanent crops.

9. Colluvialand prolluvial (rocky) soils with a rock fragment content of over 30-40%. Solution: Stone cleansing and afforestation.

10. Shallow primitive soils with a rock landscape, with a depth of up to 10 cm and humus up to 1%. Solution: Afforestation.

II. Soils Influenced by Anthropogenic Pressure

1. Rigged soils. Their total area is 0.31 million ha. New soil cover is formed with an increased clay content, secondary carbonates and altered pH when it is mixed surface humus A horizon and illuvial subsurface horizon. Solution: Proper diagnosis and land evaluation, and appropriate selection for perennial crops.

2. Rice (sank) soils. Their total area is 11200 ha. Formed over soil with hydromorphic character, secondary gally formation and acidification. Solution: Rotation of crops.

3. Hydromelinated (drained) soils. Newly soil cover is formed, which is mostly salted due to the high content of secondary water-soluble salts and exchangeable sodium. Solution: To preserve the status and ecological areal of swampy soils.

4. Burned soils. Typical of Bulgaria since 1989, after 2001 their area became about 130 000 ha. Annually, between 8,000 and 30,000 ha are burned. Decision: Adopting strong legislative measures.

5. Reclaimed soils. Their total area is 11 228 ha. Modern low productive soil from embankments and soil-geological substrates from industry is formed. Solution: Afforestation and cultivation of agricultural crops on flat terrains.

6. Degraded (artificially eroded, "beheaded") soils. They are formed at excavation of the soil at different depths in order to align the terrain, terraces, construction of motorways, railways. lines and more. The excavated ("buried") soils are formed from the excavated soil mass.

7. Buried soils. They are formed by overlapping (depositing and depositing) with other soil materials with a depth of about 50 cm above natural soils.

8. Contaminated Soils from manure. These soil are formed over unregulated dumps with manure. Solution: Construction of sustainable concrete bunkers, away from groundwater, wells and garden soil.

9. Contaminated soils from plant protection products (pesticides), growth regulators and other chemicals (insecticides, acaricides, fungicides, herbicides, zoocides, rodenticides, nematocides, limetites, defoliants, desiccants). Every hectare in Bulgaria is attacked with at least 250 g of pesticides. Solution: Creation and use of plant extracts and natural products to combat plant diseases and pests; mechanical, physico-mechanical, biological methods of plant protection; sanitary control of soil, crops and food production.

III. Soils Influenced by Urbanization, Recreational, Technogenic and Industrial Activities and Pressures. Total area of about 404 000 ha.

1. Contaminated soils. The total area is 99 400ha.
 - With heavy metals from the industry in agricultural territories – 44 000 ha, of which 8160 ha with pollution 3 times above the limit value.
 - With heavy metals from industry in non-agricultural territories – 43600 ha
 - With radioactive elements – 1000 ha.
 - With petroleum products – 130 ha.
2. Degraded soils. Their total area is 95543 ha.
 - Mining and landfills for industrial waste – 32 144 ha.
 - From industry and energy production - 65397 ha.
3. Quarry and stone pit. The total area is 3800 ha and 5800ha.
4. Sealed soils. The total area is about 396 000 ha
 - Urbanization and infrastructure – 348 000 ha..
 - In recreational areas - 47871ha.

Solution: Construction of new roads and highways at the foot of hill and mountain terrains, technical and biological reclamation of the lands, remediation and bioremediation of the soil and extension of soil-ecological monitoring. To conduct soil research using *cathena* method and geo-ecological soil profile. To improve all legislation acts connected with soil protection.

Actual Issues Related to Arable Land and Soil

Bulgarian Ministry of Agriculture and Food (MAF) statistics show that arable land and soil in the country is about 5.09 million ha. According to the data of N. Pushkarov Institute, they are 4 827 785 ha. By comparison, according to Academician Stranski, in 1939 they were 3 907736 ha. The increase of the agricultural lands before 1989 is due to the consolidation and melioration of the soils and lands, and after that date due to the inaccuracies and the legal inscription through declarations after the changes in 1990. At present time, 3.49 million ha are actually cultivated. An agricultural-environmental problem is dualism in land use, namely the over-fragmentation of the land of about 19.5 million landed properties and its over-concentration in tens of thousands of acres. Separately, according to former agriculture minister Nihat Kabil, the land of 340,000 owners was on the different levels of the judiciary system. All this makes it difficult: 1. To apply scientifically based systems of land use and production, adapted to the agro-ecological regions of the country; 2. To ensure proper organization and farming in the agricultural territories; 3. To build and establish fair land and lease relations with sustainable socio-economic and environmental benefits (Stoynev, 2004, Teoharov, 2006, 2011, Hristov, 2017). With a

reference to that, some basic and imposed harmful processes in agricultural practice that are directly related to the management and conservation of soil and land resources deserve attention such as:

1. Non-application of the agro-ecological-scientific approach in agriculture and ignorance of the agro-ecological regions in the country.
2. Non-application of minimal treatment to soil diversity and agro-ecological conditions.
3. Incorrect soil treatment and mixing the humus horizon (surface) with the illuvial - clayey (horizon) horizon.
4. Vertical soil cultivation in perennial arrays and acceleration of erosion processes.
5. Deterioration of soil properties due to additional compaction by super-heavy agricultural machinery.
6. Non-maintenance of soil fertility and deterioration of land and social life of landowners due to unsettled land property and difficult access to it.
7. Bad rotation of crops and application of monoculture agriculture.
8. Unbalanced fertilization and nutrition regime of crops with consequent acidification of soils.
9. Exclusion from farming systems of microbial fertilizers, organic fertilization and sideration as the main organic (biological) methods for maintaining and increasing soil fertility.
10. Implementation of construction and industrial activities in areas with high soil fertility and lands up to the 3rd land category.
11. Use of high-yielding soils and land for road infrastructure rather than the foothills of the mountains and slopes.
12. Damage and contamination of soils and lands from agricultural areas and appearance of new pollution "hot" points.
13. Non-maintenance of open and closed irrigation systems and channels and appearance of new "cold" swamp points.
14. Impaired natural-biological basis of agricultural production (land, agricultural crop animals), which is why there is an imbalance between plant and livestock.
15. Creation of unproven state and private structures for development and implementation activities related to the management of soil and land resources.

A significant part of the afore mentioned problems and weaknesses, albeit with a delay, were also noted in the report of the European Parliament and the European Commission of Agriculture and Rural Development on 30.03.2017 with subject "The Current Situation in Relation to the Concentration of Land: How to Facilitate Farmers' Access to the Land ". The report was drawn up on the basis of: 1. Opinion of the European Economic and Social Committee of 21.01.2015; 2. Guidelines on Responsible Management of Land, Fisheries and Forestry Rights of the World Food Security Committee on May 12, 2012; 3. Petition 187/2015 of the European Parliament regarding to: Protecting and managing European agricultural land as a common good: Calling on civil society organizations for a sustainable and fair EU land policy; 4. Survey on the theme "The amount of agricultural land grab in the EU" of the Committee on Agriculture and Rural Development of the European

Parliament; 5. The infringement procedures which the Commission is planning or has already instituted against the Member States, among which Bulgaria is on first place.

Considering that:

1. The agricultural areas used by family, small and medium-sized agricultural holdings are of particular importance for water and climate management, carbon balance and for the production of healthy food, as well as for biodiversity, soil fertility and conservation the landscape; 2. 20% of agricultural land is adversely affected by climate change, soil erosion due to floods, winds and poor management; 3. Loss of agricultural land caused by conflicts of access and use, concentration of land in large farms and non-agricultural investors, deteriorated land and lease relations,

in its report of the European Parliament:

1. Encourages the EU Member States to "step up their efforts to transfer knowledge through research and innovation projects to improve soil quality through the application of agro-ecological practices".

2. Calls on the Commission to "analyze the risks posed by land concentration to the environment, soil quality and rural development".

3. Within the framework of integrated land management, local and regional conditions in the agglomeration programs of the parcels of agricultural land, respectively agro-ecological ones, should be taken into account.

4. Reaffirms the Commission's statement that "land is a scarce resource subject to strong pressures from climate change, soil erosion and over-exploitation or land-use change".

5. Supports environmental and social measures for the protection of the land, while stressing that it is the responsibility of the EU Member States.

6. Proposes that direct payments be received on the basis of environmental, socio-economic and societal benefits, and caps should be set under the Common Agricultural Policy and the direct payments corrected scheme.

7. Recalls the positive measures taken by some EU Member States to regulate their land markets in order to avoid speculative transactions in the land sale and purchase.

8. Calls on the EU Member States to support or create appropriate institutions with state participation and public oversight of land management.

9. Calls on the EU Member States to prioritize small and medium-sized local producers, new entrants and young farmers, special support for small and medium-sized individual farms and cooperatives for young people and women, as they preserve the cultural heritage and support rural and social life in them.

10. Encourages EU Member States to prioritize family farms and sustainable production methods as they play an active role in the economic structure of rural areas by ensuring a wide distribution of land ownership.

11. Encourages EU Member States to use such land-based land-use instruments already successfully used in some countries, namely: "State licensing of land sales and leases, land-use obligations by landlords, restrictions on the right of purchase by legal persons, the upper limit of the hectares that can be redeemed".

12. It is stated that land, its governance and urban development rules are the responsibility of the EU Member States and therefore urges them to take into account, in their public policies, the protection and importance of farmland as well as the transfer of land.

13. Stresses that ownership is the best prerequisite for responsible soil management and sustainable land management. In this respect, it introduces the notion of "active farmer".

14. Points to the large concentration of land and financial resources in large farms and non-agricultural investors, which distorts production and market processes.

Conclusion

Soil and land management for the benefit of people is definitely a European theme. The main reason is that "the concentration of agricultural land and financial resources in the hands of a small number of operators is linked to a significant social, cultural, economic and political impact over EU Member States". The data from 2010 show that in the EU, 3% of farms already control 50% of the utilized agricultural area. On the other hand, in 2012, 80% of the farms had only 12% of the agricultural land in EU states. The European Parliament notes that the scope and rates of concentration of land are alarming. Therefore, in its motives, the EC defends the future development of multifunctional agriculture, small and medium-sized farms, especially family and co-operative farms. The EC concludes that "both the concentration of financial assets and too much concentration of farmland divide society, destabilize rural areas, jeopardize food security, and thus the environmental and social goals of Europe." The conclusion is that the conservation and enhancement of the fertility of continental soil and land in Europe are under threat.

Over the past 28 years, scientists from the "N.Poushkarov" institute have constantly reminded the public and the state institutions about the current problems related to the management of the soil and land resources and the mistakes in the implementation of the land and agrarian reform. Now this question is a European topic, the right solution is found, and the most appropriate thing is to apply the knowledge of soil and agrarian science and to change and apply the legislation.

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