

# Understanding the Root Causes of Soil Degradation as a Basic Precondition for Efficient Soil

**Jozef Vilček**

Faculty of Humanities and Natural  
Sciences University of Prešov in Prešov,  
Soil Science and Conservation Research  
Institute Bratislava, Slovakia  
Email: j.vilcek@vupop.sk

**Zuzana Krušková**

Faculty of Humanities and Natural  
Sciences University of Prešov in Prešov

**Radoslav Bujnovský**

Water Research Institute Bratislava,  
Slovakia

**Abstract - Persistent problems of soil degradation indicate that the current use of this natural resource is not sustainable. The reasons are as follows:**

- **Insufficient attention paid to the principles of good soil management and the relevant supporting legislation**
- **The negative impact of economic activities on soil quality, not only in industrial and urban areas, but also on soil quality in the agricultural and forest sector**
- **giving preference in the long-term to the importance of soil production function over remaining ecological functions**
- **lack of utilisable information on soil protection in individual economic sectors**
- **lack of broad public awareness to protect soil as a natural resource**
- **building of infrastructure and industrial enterprises for provision of permanent economic growth**
- **misunderstanding the essence of ownership relations to the soil.**

Besides these issues, there are also deeper causes of soil degradation, closely related to human thinking and activities. Favouring economic views in contrast to environmental benefits, private and group interests to cross societal ones, short-term benefits to long-term ones, promotion of excessive consumption as well as permanent need to increase the economic growth of individuals or purpose-built groups – they are; all of these mask the driving forces of soil degradation that must be taken into account for the provision of sustainable soil use. Understanding these activities and the societal forces that cause them is essential for the creation of necessary measures for efficient soil protection. With regard to the complex nature of the causes, soil protection must be of interest of all society.

**Keywords – Soil, Degradation, Causes, Soil Conservation, Productive Soils.**

## I. INTRODUCTION

Soil, as with other natural resources, is used by human for safeguarding the quality of life. This natural resource should, as a minimum, be maintained in the same condition for future generations. However, soil quality is still far from this desired vision. Many documents and papers [1, 2] refer to soil degradation as a prominent environmental problem, and the necessity to sustain this

resource in the long-term. Processes of soil degradation decrease its capacity to provide ecological functions essential for human life [3, 4, 5]. Moreover, soil degradation has a close relationship with other environmental and societal problems, such as occurrence of floods/drought, food and water availability/quality and human health.

Recently, a significant part of soil science activity has focused on understanding the evolution of soil parameters and properties under given soil use and management, as well as on the evaluation of soil state through monitoring. This provides information to support the development of legislation and the realisation of necessary soil protection measures. Although this area of activity is still under development, the analysis of the driving forces that directly or indirectly initiate/promote soil degradation is perceived as essential [6, 2]. Moreover, as Meyer and Turner II [7] introduce, human activities are the main issue for present changes of the biosphere state and its development. Understanding of these activities and societal forces that cause them is essential for the development of the necessary measures.

## II. MATERIAL AND METHODS

The examination of the driving forces that cause soil degradation represent part of *DPSIR analysis* [8]. According to Loveland and Thompson [9], the drivers of environmental change are socio-economic factors, while physical, environmental and natural factors are considered rather as pressures.

In the paper, basic/accustomed and more complex views of the reasons that directly or indirectly cause the soil degradation are presented. In line with Lambin [10], the second approach is based on an *in depth analysis* of factors that cause environmental degradation or that may impede the adoption of more sustainable management practices, also including behaviour with respect to natural resource use and management. In the broader context, the environment deterioration mentioned below includes soil degradation.

## III. RESULTS AND DISCUSSION

### *Basic analysis of soil degradation*

The type and degree of soil degradation is affected by soil use. Generally, the intensity of soil degradation decreases in the order: industrial area > urban area >

agricultural sector > forestry sector. The immediate reasons for soil degradation are often remarkable and attract the attention of soil scientists and policy makers. First of all, it is necessary to mention the insufficient attention to the principles of good soil management practice and relevant legislation (erosion, compaction, loss of SOM, and partially acidification as well pollution in agriculture; erosion and landslides in forestry).

Giving long-term preference to the importance of soil production function over ecological functions represents a significant cause of soil degradation. Until now, soil has been considered as the basic production tool through which the farmer can gain economic benefit. It is necessary to stress that, principally, soil preservation is not consistent with permanent increases of benefit from its production use. Even today there is still, around the world, pressure on the need to sustain the soil production function to feed the growing world population. However, the real problem is somewhere else: a regional surplus of agricultural commodities does not always meet the threatened group of the global population. Economic activities affect soil quality not only in industrial and urban areas (compaction, pollution), but also soil in agricultural and forest sectors (acidification, pollution). Building of infrastructure and industrial enterprises for the provision of permanent economic growth has often been realised at the expense of soil/environmental degradation, including a preference for the use of new agricultural/forest soil instead of restoration of brown fields. It seems that meeting social needs in the future is not practicable without continuing (agricultural) soil sealing, and the intensity of sealing and quality of sealed soil will have substantial significance.

Also of importance is the clarification of ownership issues relating to the soil. Soil in the private sector is usually considered as property that serves *exclusively* for the owner's purposes. It is necessary to mention that property rights to the soil are often connected with its economic use (production function, resource of raw materials, space for economic human activities including housing construction – soil sealing). The types of ownership alone cannot satisfactorily solve the problem of soil/land degradation. As Cairns [11] introduces, there is a conflict between environmental protection and property rights. Human “rights” cannot be met if the ecological life-support system is endangered by doing so. So, property rights, even private, should encompass also duties and responsibility, especially in the case of natural resources, because the consequences of deterioration of ecological soil functions have impact on other people. It is necessary to stress that a person can no more consider the soil/land as a commodity exclusively belonging to him - in fact, he is a steward that should maintain the soil in the same condition for future generations.

It is possible to state that the importance of the soil for the human society is still not adequately appreciated [12, 4, 5]. Although the results of soil science research are usually used for the development of soil protection legislation and relevant educational/methodology publications, much of the expert and scientific knowledge

does not have satisfactory application in practical life. Even though regular environmentally focused training of farmers or forest users brings some progress, the remaining broad population remains uninformed about the problems with soil degradation. Progress still has to be made in the area of periodical environmental education of soil users as well as in the area of increasing environmental awareness of the broader population. In line with this, the proposal for an EU Directive for soil protection [1] stresses the problem of awareness and the need to address it. Moreover, the acceleration of natural disasters and human tragedies (poverty, epidemics, local war conflicts, criminality increase, etc.) masks and shifts the problems of soil degradation and its societal effects into the background of human attention.

In harmony with Gordon et al. [13], efficient use and protection of natural resources, including soil, assumes three basic factors: *i)* adequate information, *ii)* motivation for sustainable use of soil/environmental resources, and *iii)* required capacity to adopt the necessary measures in daily life. While the creation of knowledge and information is in the process of permanent development, the motivation to adopt sustainable use of the soil and other environment resources is weak. Often scarce capacities are used insufficiently when individual, rather than cross-cutting, solutions are preferred [14]. There is tendency to perceive soil protection as a ‘competitive issue’ or a less significant problem within environmental protection.

Standard methods and tools widely used at present to address soil degradation causes include:

- creation of information support for strategic and operative decision making
- ensuring the education of students and soil users in the area of causes and consequences of soil degradation
- creation of new knowledge in the area of causal-consequent relationships, soil degradation and impairment of other natural resources within national and international research projects
- Development of new measures for the elimination or mitigation of existing damage of soil and other natural resources.

Traditionally, policy regulations in hand with the market are considered as major tools to solve current environmental problems [15, 16, 17]. In fact, the market has only limited capacity to solve these problems that cannot be solved by internalisation of external costs, as they have deeper social roots.

#### *Broader view on causes of soil degradation*

Despite the broad lack of peoples willingness to search for and solve the primary causes of other capacities, the problem of gradual soil degradation still persists and is even worsening at the global level. As follows from many sources [11, 18, 19, 7, 20, 21 ], no matter what reasons of land degradation, they are closely related to the human activities. According to Meyer and Turner II [7], the consumption is considered as a key variable of driving trends and patterns in the human impact on atmospheric deposition, land use, biogeochemical cycles - and so the soil and its quality. Permanent growth of material and

energy consumption connected with incomes increase is one of the basic features of a consuming society and reflects unconcern of individuals about the state of the environment and its improvement. The predominance of growth in human activity is broadly perceived as a positive process.

While nature is usually in balance, human always *must* have a benefit. The main interest of people is concerned with growth of material/economic sufficiency. As discussed by many authors [18, 22, 23, 24, 7], the satisfaction of humans is usually compensated by material consumption, but the level when people are satisfied still increases. However, as follows from many papers [23, 25], economic growth is not a panacea for environmental quality – indeed, it is not even the main issue. Moreover, the meaning of human life is more than daily satisfaction of a great number of human desires.

In fact, reasons (driving forces, pressures) as well as necessary measures are vertically and horizontally structured phenomena (Fig. 1).

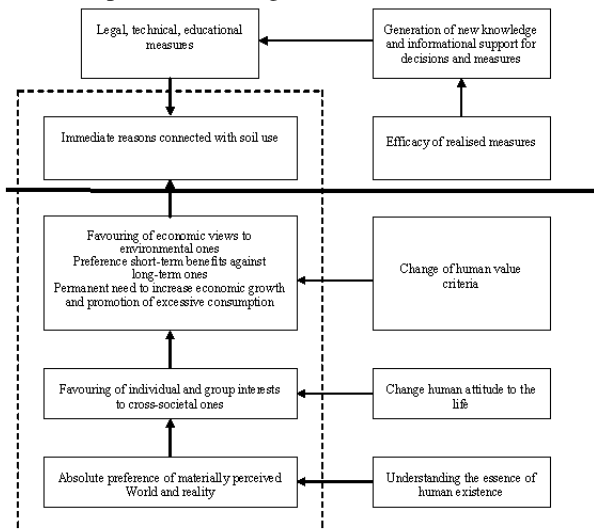


Fig.1. Hierarchy of causes and measures

The deeper level of insight, the more difficult it is to accept mentioned problems and related solutions. There exist more societal forces and phenomena, which directly or indirectly affect state and evolution of the environment, and so they become politically significant. Besides economic, political, social and cultural factors, market, advertising, demographic factors and technical developments, it is necessary to mention human convictions, beliefs, values, attitudes and behaviours at the level of individuals, household, communities and whole public [26, 27, 6, 24, 20, 21, 28, 25]. It is important to point out that the individual groups of driving factors have a different hierarchical position and the common denominator of all these drivers is the satisfaction of human needs.

To the ideas, beliefs and convictions that influence existing life quality and degradation of Earth environment belong:

- there is lack of resources to meet the demands of all people and for that reason it is necessary to compete or battle for these resources

- the people are separated from each other
- some people are considered better or more valuable than others
- people cannot satisfy their own needs themselves
- it is not possible to change basic beliefs and convictions
- it is human nature to behave as he does
- it is necessary to maintain and respect age-long traditions that create the identity of the society (alternative ways of life are unrealistic or hardly imaginable)
- the future is to be discounted (it mirrors the preference of short term benefits from natural resource use before the long term ones), etc.

Topicality of thinking and human behaviour, as illustrated above, is confirmed by many authors [29, 28]. According to these, for most people more than a simple change in ecological awareness is required. Rather a more fundamental reassessment of basic beliefs and thinking algorithms is needed, because environmentally relevant behaviour is at the end of long causal chain involving a spectrum of personal and relevant factors. As follows from the next simplified scheme (Fig. 2), human beliefs and convictions influence behaviour.

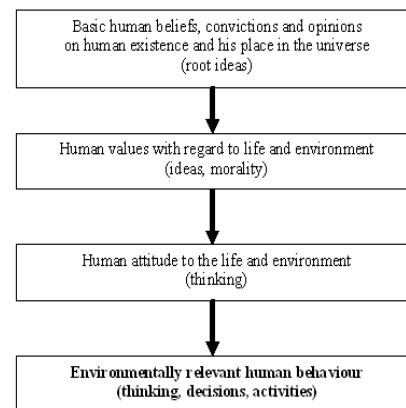


Fig.2. Hierarchy of causal factors at environmentally oriented human behaviour

#### IV. CONCLUSIONS

People permanently try to change their living and environmental conditions, instead of changing the convictions/opinions responsible for the existing inappropriate state. Soil/land preservation should start with the change of attitude of mind, preferences, motivation, behaviour, desires and attitudes of humans to the environment that support sustainable life. Soil preservation against degradation should be a matter for the whole society, not only the soil scientists, farmers and policy makers. Hence, measures that aim to moderate soil/land degradation should have a cross-cutting character to provide a more complex and deeper insight into the system (human thinking and activities embracing the whole ecosystem). Soil/environmental research should also have a sociological dimension, as several writers suggest.

As follows from many papers [19, 28, 25], external conditions and human behaviour are not possible to

change only by political and economic means. It is inevitable to perceive activities on a system level, as the initial positive changes occur on an individual level. Besides, continuing the recent state role at environmental protection can promote undesirable command and control structures. This process is based on the belt-tight principle. Higher prices in the name of environmental protection i.e. water, air, refuse prepare good business platforms for other economic activities, which will increase in line with consumption.

The intention is not to stop a certain way of human behaviour (with possibility of recurrence) but rather to change it.

People place value on things they want as individuals and as a part of society. One of the root questions is what the people want and what they will really do to achieve it. Recent decisions of people lead to soil and environmental degradation.

While recent progress in science and technology are remarkable, positive changes in areas of human mind & thinking, human attitudes, way of acting and systems of beliefs develop very slowly and with difficulties. Every system is maintained until the people decide to change it. Until now, people have intensively changed the environment state reflected in the degradation of soil and other natural resources. For the reasons mentioned, now is an important time to start positive changes of human beings from both a system and individual level.

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