

# Soils of Croatia in the strategy of soil protection of European Union

## Regarding of International year of soils - 2015

Ferdo BAŠIĆ<sup>1</sup>, Arwin JONES<sup>2</sup>

2015  
International  
Year of Soils



<sup>1</sup>Croatian Academy of Science and Arts, Zrinski trg 11, 10000 Zagreb, Croatia,  
(e-mail: ferdo.basic1@gmail.com)

<sup>2</sup>Joint Research centre, European Soil Bureau, Land Resource Management Unit/SOIL action

*Croatian people in the true sense of the word “live of the land”, on their own part of pedosphere they built heir life in the past, and they will continue to build it in the future. Soils of Croatia are the greatest treasures of he Croatian people, an inexhaustible source of their power and the foundation of the Croatian homeland...*

*(Academician M. Gračanin, 1942)*

### Abstract

Honouring the proposal of International Union of Societies of Soil Science (IUSSS) and other “soil-oriented” scientific and professional societies around the world at its 68<sup>th</sup> session on December 2013<sup>th</sup>, the General Assembly of the United Nations nominated the 5<sup>th</sup> of December as World Soil Day, and the 2015 the International Year of Soils (IYS). The Food and Agriculture Organization of the United Nations (FAO) has been nominated to implement the IYS 2015, under the slogan ‘Healthy soil for healthy living!’, within the framework of the Global Soil Partnership and in collaboration with governments and the secretariat of the United Nations Convention to Combat Desertification. The IYS 2015 aims to increase awareness and understanding of the importance of soil for food security and essential ecosystem functions. According of some people, the functions of soil in the life of Homo sapiens start with Creation (Creators breathing the soul into a soil-made man! Soil - we are it!) through food security and safety (soil feeds us!), storage of drinking water (soil waters us!) building landscape (soil is source of the beauty of landscape!). Non-food functions of soil include ecological regulation, among which the most important is as universal filter of water and the role of soil in the context of global warming, as sources and sinks of greenhouse gases (climate regulating) and support of global biodiversity. In this light; the sustainable management of soil is the foundation of all farming systems in agriculture and source of food, bio-fuels and fibre supply, stability of terrestrial ecosystems and adaptation to climate change present and future generations. In the light of actual chaotic climate changes the question of soil protection for Homo sapiens is practically the question of survival. Climate change we witness, seeking investment in soil amelioration so that the soil can hold large amounts of water in rainy years, and ensure the supply of water of good quality for irrigation in dry years. This fact has motivated the European Commission to design a thematic strategy for soil protection, which provides a framework for an effective protection of soils of European Union (EU). Unfortunately, they have failed efforts, to be at the level of the EU accept general, for all EU Member States binding framework for protection of the soil, so it is the responsibility of each member state.

Activities in Croatia in IYS aim to raise public awareness about the key roles of soil as a national riches, limited natural resource analysis of the activities undertaken to give impetus to organized soil protection - monitoring of soil, the concept that is designed by EU project, thoroughly presented to the public and decision-makers. Without answer! The text of the concept is in handbook available in website: <http://www.azo.hr/ZadatakID7Program> and/or <http://www.azo.hr/TheSoilMonitoring>.

It is unacceptable, anachronistic and disturbing, that chaotic ownership relations of agricultural land remain insurmountable barrier due to the pending investment cycle from the EU funds make soil amelioration and protection, as national treasures and foundations Croatian viability and (economically, socially and environmentally) sustainable progress.

Additionally, to create the appropriate public interest, the intention is to introduce to the education system for preschool, school (elementary and secondary) and higher (university and vocational) education to provide a minimum level of knowledge on soil.

Key words: soil functions, sustainable land management, raising soil awareness, soil protection

## Tla Hrvatske u strategiji zaštite tala Europske Unije Povodom Međunarodne godine tla - 2015.

### Sažetak

Na prijedlog Međunarodne unije tloznanstvenih društava (IUSS) i drugih znanstvenih i stručnih udruga "bliskih tlu" na 68. zasjedanju Glavna skupština OUN odredila je 5. prosinca za Svjetski dan tla, a 2015. godinu Međunarodnom godinom tla, koju FAO provodi pod krilaticom; *Zdravo tlo za zdrav život!* Namjera je ovih odluka podizanje opće svijesti o važnosti tla od postanka (udaha Duše u lik oblikovan od tla! Tlo...to smo mi!), preko opskrbe hranom i njene zdravstvene ispravnosti (tlo nas hrani!), skladištenja pitke vode (tlo nas poji!), izgradnje krajobraza (tlo prinosi estetskom ugođaju!) i ekološko regulacijskih uloga. U tom svijetlu, bjelodano je jasno; *održivo gospodarenje tлом temelj je svih sustava gospodarenja u poljoprivredi i izvor opskrbe hranom, vodom, biogorivima i predivom, stabilnosti terestričkih ekosustava i usporavanje klimatskih promjena.*

Procesi degradacije tla počeli su nezaustavljivo s počecima poljoprivrede. Zabrinjavajući podaci o razmjerima oštećenja tla motivirala su nadležna tijela EU na osmišljavanje organizirane zaštite tla putem Okvirne direktive za tlo. Unatoč potpori većine, Europska komisija odlučila je povući prijedlog toga dokumenta u koji je uložena ogromna količina: vremena, dobre volje, energije, znanja, novca i iskustva stručnjaka iz cijele Europe, (članica EU, zemalja kandidata i potencijalnih kandidata) i oba autora ovoga rada.

U svijetlu aktualnih, kaotičnih klimatskih promjena, zahvati uređenja tala namijenjenih uzgoju bilja trebaju tlu omogućiti prijem velike količine vode za jakih kiša, a osigurati im opskrbu kvalitetnom vodom za navodnjavanje u sušnoj godini ili razdoblju.

Međunarodnu godinu tla - 2015. kanimo koristiti za podizanje svijesti svakog Hrvata o ulogama tla kao nacionalnog bogatstva, a raščlambom poduzetih aktivnosti podstaknuti održivo gospodarenje i organiziranu zaštitu - monitoring tla, na konceptu koji je, zahvaljujući EU sredstvima osmišljen i prezentiran donositeljima odluka. Do danas bez odgovora! U cijelosti je dostupan javnosti na web stranici: <http://www.azo.hr/ZadatakID7Program> i <http://www.azo.hr/TheSoilMonitoring>.

Nedopustivo je, anakrono i zabrinjavajuće, da kaotični vlasnički odnosi nad poljoprivrednim zemljištem u nas (p)ostanu nepremostiva zapreka zbog koje bi predstojeći investicijski ciklus iz sredstava EU zaobišao uređenje i zaštitu tla, kao nacionalnog blaga i temelja hrvatske opstojnosti i održivog napretka.

Ključne riječi: uloge tla, održivo gospodarenje tлом, podizanje svijesti o tlu, zaštita tla

## 1. Introduction - soil as source and regulator of life (food, drink, clothing..., beauty)

Soil is an extremely complex living medium composed of mineral particles with a range of sizes - from colloidal dimension to gravel, organic matter (humus), water (stored and moving through capillary pores system), air (in macro pores), and living organisms (moving through endless system of micro- and macro-pores). Similarity of soil in comparison with living organisms is in genesis (mineral component originated from parent material, but organic matter from biota) and evolution. Evolution of the soil starts with its genesis continues through a juvenile to a developed stage as progression (related to soil fertility) and after that regression. Heterogeneity of soil cover is illustrated by data on three hundred twenty major soil types that have been identified in Europe. Soil is a limited natural resource, and, unlike the other two members of the “ecological trio” (Varallyay 2005) - water and air, soil is largely in private ownership - landowners with absolutely protected rights originated from ownership. *So; soil has a specific position – the private good of a landowner in function of public interests!* Taking in account human life scales, soil is practically non-renewable. The area of fertile soils on the globe is only 11% of terrestrial land surface, most of which is in the antroposphere – the settled part of the ecosphere under increasingly pressure and degradation, caused mostly by inappropriate management and loss to infrastructure and urbanization. At the same time, it is necessary to increase food production to meet the increased demands of an ever-growing population.

As a natural body placed within the lithosphere and atmosphere, soil is the media of a harmonious flow of matter and energy and the maintenance of harmony and equilibrium of processes in terrestrial and semi-terrestrial ecosystems, including agricultural (agro-) as well as forest (silvi-) ecosystems. As “on renewable resources-based” branches of economy using more than 90% of area of EU and Croatia, agriculture and forestry, with related environment-friendly food processing practices and tourism, are the base of sustainable development as economically, environmentally and socially acceptable concept of development in the third millennium (Bašić, 2009).

Functioning as a “medium of interaction“ of all (atmo-, hydro-, litho-, bio-) spheres, soil is a multifunctional natural resource with numerous functions: *productive* (primary production of organic matter) *regulatory* (receptor, reactor, accumulator, media of biotransformation - decomposition of plant and other organic wastes, universal filter for water, climate regulator - source of gashouse gases), *biological-regulatory system* (media of beginning and ending of numerous bio-cycles, gene-reservoir and base of biodiversity), *storing* (plant nutrients, water, heat energy - wastes), *spatial* (base of landscape and anthroscape, space for all human activities: agriculture, forestry, housing, recreation, transport, industry, waste disposal), *a media of historical memory for human* (archaeological) and natural -pedological, geological and paleontological heritage.

Summing briefly, we can say that is understandable to respect sustainable management and protection of soil as an important natural resource embedded in global economic policy and legislation.

Complex processes of soil degradation began with the initiation of agriculture, which illustrate the words of the famous American expert for soil conservation W.C. Lowdermilk, who, after studying the state of soils in the area of ancient civilizations, wrote in 1939 ‘*if Moses who bring Israelites in Canaan knew what would happen to the fertile soil of the Holy Land safely obtained 11<sup>th</sup> command of the Creator that man committed to keeping the soil for future generations*’.

Comparing with the (dirty) thirties, the position of soil is not better. Just the opposite; data on the current state of global and the EU soil resources show an alarming increase of all processes of soil degradation. To illustrate this statement, data for the period 1990 - 2006 show that at least 275 hectares of soil per day were permanently lost through soil sealing; soil erosion by water is estimated to affect 130 million hectares in Europe, which means an area equivalent to 2.5 times the size of France. The European Commission estimates the current costs of soil degradation to be at least € 7-38 billion.

In spite of the recognised importance of soil functions, only a few EU Member States have specific legislation on soil protection. Actual EU policies in areas such as prevention of industrial pollution or protection of other two members of “Ecological trio”, do generally contribute to the soil protection. But, because these policies have other aims, and noting the trans-boundary effects of pollutants on soil, they are not sufficient to ensure an adequate level of protection for soils in Europe.

## 2. Review of activities in soil protection

The review of soil protection initiatives and activities presented in this paper is based on analysis attached references and more than forty years of experiences in research activities in the field of soil management and monitoring for different purposes, within which as member of ESNB from 1996 to 2010 and as a member of its Steering Committee from 2008-2010.

### 2.1. JRC - ESNB as Centre of excellence in Soil Science of Europe

Damage, threats and degradation of soil is any defined as any process or set of processes, or effect/effects (of natural or anthropogenic origin) that impact or modify the physical, chemical and/or biological properties of soil, on the way of negative influence on the most important functions (roles) of soil, affecting the biosphere in natural biocenosis - wildlife, or cause changes in natural and/or anthropogenized ecosystem. The main task of activities in soil protection on local, state, regional and EU level is to recognize the degradation processes, to monitor it and to define measures/practices of stopping degradation.

Leading activities of soil protection in Europe, within members of EU and candidate countries, has been *The European Soil Bureau Network (ESBN)*, established 1996 as a network of national soil science institutions coordinated by the *Joint Research Centre (JRC) of the European Commission in Ispra - Italy*. The main tasks of the ESNB was to collect, harmonise, organise and distribute soil information for Europe. The *European Soil Portal* is an integral part of the *European Soil Data Centre*, which is one of the ten environmental data centres in Europe and is the focal point for soil data at European level. This European Soil Portal contributes to a thematic data infrastructure for soils in Europe.

*The ESNB was a network of Centres of Excellence in Soil Science of Europe*. The scientific quality of the work is guaranteed by a *Steering Committee* formed of outstanding European soil scientists. In general terms, therefore, the role the ESNB Project at the JRC is twofold - to perform a co-ordination activity by hosting the ESNB to provide a central source for information relevant to the work and decision making in the field in soil policy and land management of the EU Commission.

All activities of ESNB in soil policy, land management and soil protection to be efficient have to be in harmony with numerous rules, protocols, agreements and directives of EU, because of according of described soil functions/rules reflect to more branches of economy and directives of EU; *The Common Agricultural Policy, Agri-Environmental Policy, World Trade Organisation - WTO*, observe soil in its productive function; the *Kyoto Protocol* in soil find one of the major sinks of greenhouse gases; the *Water Policy and Water Framework Directive* is interested for soil particularly in the light of the correct implementation of *Nitrates Directive*; similar is the *Waste Management Policy* needing the data on soil properties relevant for the revision of the *Sewage Sludge Directive* taking in account *Environmental Impact Assessment (EIA)* procedure as described in *Council Directive*. Other binding International agreements necessary to respect: *The Convention on the Protection of World Cultural and National Heritage (1972)*, *The European Soil Charter (1972)* and recommendation of the Council of Europe, *The World Soil Charter (1981)*, *The World Charter for Nature (1982)*, *The Convention on Biological Diversity (1992)*, *UN Conference on Environment and Development in 1992 in the famous Agenda 21* with Chapter 10 focusing on Soils. The recent work on *Public Policies for the Protection of Soil Resources* by the OECD (1994), *The Alpine Convention* and its protocol on Soil Protection (1998), *The Convention to Combat Desertification (1994)*, etc.

The constant link of ESNB with policy makers is ensured by an *Advisory Committee* with delegates from the Member States. Actual, specific operational activities are performed through ad-hoc working groups. The results of these converge into the *European Soil Information System (EUSIS)*, designed to be the main source of georeferenced information on European Soils. EUSIS collects harmonised soil data and integrates in appropriate interpretation models, but outputs can be not only in cartographic (mapping), but in tabular form. The practiced multi-scale system answers to problems which can be optimal solved using maps of the scale of very wide range; from global assessments (1:5 000 000 scale) to spatial planning and precision farming for which are appropriate maps of 1:5 000 scale. The average, most used scale is 1:1 000 000, appropriate to respond to EU soil policy issues. The most important thematic cartographic outputs of the EUSIS are; soil erosion risk maps, organic carbon content, background (in parent material of soil) concentration of heavy metals, soil suitability for the major crops, desertification, groundwater vulnerability to agrochemicals, soil degradation, etc.



### 2.1.1. Thematic Strategy for Soil Protection

The Thematic Strategy for Soil Protection (TSSP) of the EU was conceived as a legal basis for connecting and unifying - standardization of national systems of soil monitoring in the form of the *Framework Directive on soil (Soil Framework Directive COM (2006) 232)*. Costs of soil degradation are very high and are mainly borne by society and not by the land users. Because of there is no specific EU legislation on soil protection, hence a need for a comprehensive protective approach. The complexity of procedure illustrates the history of resulted in the creation of the *European Soil Forum*. This was followed by a second meeting in Berlin in 1999 and a 3<sup>rd</sup> in Naples in 2001. This was followed by a Communication of the Commission “Towards a Soil Thematic Strategy” in 2002, with positive Council conclusions and very comprehensive stakeholder consultation: more than 400 organisations and experts involved in consultation during 2003 and 2004. Stakeholders prepared six volumes of recommendations (from 2004), continued internet consultation in 2005 with 2 000 replies. Commission adoption of the proposal of text for Thematic Strategy in 2006. Let us to review the Thematic Strategy of soil protection, starting with pyramid “built” from pillars of EU soil policy.

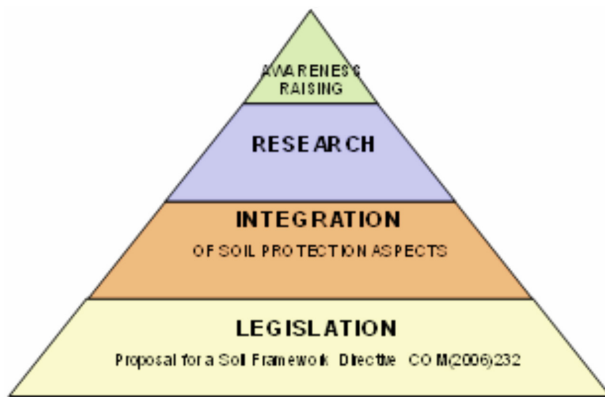


Fig. 1. Hierarchy of pillars of EU soil policy

As shown in fig. 1., the base of TSSP is a *Soil Framework Directive COM(2006)232* which regulates the protection and sustainable, use of soil as basis of system, in order to integrate soil protection into national and EU policies. This is supported by research as source of data to improve public and stakeholders/soil users knowledge on soil functions and importance of soil as public good; and measures to increase public awareness. The last one, positioned on the top of pyramid is generally regarded the in EU (and globally) as a weakness.

The approach of the TSSP is specific and flexible but at the same time legally binding at EU level, based on the principle that soil as a common media is practically a non-renewable resource and good, protection of such good is *par excellence* of common interest across the EU. Soils do not recognise state borders and because of transboundary impacts, soil degradation can jeopardize other media covered by the EU *acquis*. Additionally, EU legislation is obligate to enhance food safety, to diminish human health impacts, to minimise the distortion of competition in the internal market and to play a leading role in the international arena.

The TSSP is structured so that as a prime objectives are the protection of soil functions, integration in sectoral policies, precautionary measures, prevention of contamination and define measures to limit or mitigate soil sealing. As obligation. The proposed directive anticipated the *identification of risk areas* for main soil degradation processes: erosion, organic matter decline, compaction, salinisation, landslides *in a time-limit of 5 years*. For the obligation of identification of contaminated sites *anticipated time-limit was 25 years*. The TSSP also defined the preparation of a *programmes of measures* as well as *National remediation strategies*, with the protection of soil as a clear objective - the preservation of soil functions: biomass production (agriculture and forestry); storing, filtering, transforming nutrients, substances, water; biodiversity pool, habitats, species and genes; physical and cultural environment for humans and human activities; source of raw materials; acting as carbon pool; archive of geological and archaeological heritage.

Let us to focus on problem of soil contamination, on which TSSP losses the fight “in labyrinths of different EU interests/lobbies”.

At first, the definition of a “contaminated site”: a site where there is a confirmed presence, caused by man, of dangerous substances of such a level that Member States consider they pose a significant risk to human health or the environment. That risk shall be evaluated taking into account current and approved future use of the land with polluted soils.

The TSSP proposed preventive obligations concerning diffuse and local contamination with intention to limit the (un)intentional introduction of dangerous substances, with significant risks to human health.

High costs of remediation of contaminated soils cause the proposed obligation for Member States to establish an inventory of contaminated sites in 25 years and made it public, based at least on the following, really impressive list of potentially soil-polluting activities; airports, IPPC installations, ports, petrol and filling stations, mining installations, waste water treatment plants, former military sites, dry cleaners, landfills of waste, pipelines for dangerous substances.

There was a special proposal for selling and buying of polluted land. Namely, when selling a site where there is or there has been a soil polluting activity buyer or seller provides it to the competent authority and the other party in the transaction a report on the state of the soil; the background history of the site, a chemical analysis, concentration levels posing a risk. Objective of this order is to inform the competent authorities and to stimulate the setting up of the inventory of contaminated soils.

The European Parliament adopted the guidelines in November 2007. But the decision of the Council of Europe on their entry into force was not accepted.

Some five years after the adoption of the *Soil Thematic Strategy*, on 13 February 2012 the European Commission published a policy report on the implementation of the *Strategy and ongoing activities (COM(2012) 46)*. The report provides an overview of the actions undertaken by the European Commission to implement the four pillars of the Strategy, namely awareness raising, research, integration, and legislation. It underlines that at the March 2010 *a minority of Member States in the Environment Council* continued to block further progress on the proposed *Soil Framework Directive*.

While the Commission in May 2014 decided to *withdraw the proposal for a Soil Framework Directive*, the *Seventh Environment Action Programme*, which entered into force on 17 January 2014 still commits the EU and its Member States to increasing efforts to reduce soil erosion, increase soil organic matter and to remediate contaminated sites.

*In spite of a majority in support, the EU Commission decided to withdraw the proposal for a Soil Framework Directive in May 2014, which means the end of a document in which was “invested” a tremendous amount of time, goodwill, energy, knowledge, money and experiences of experts from all over the Europe (Member States of EU, Candidate Countries, Potential Candidate Countries, EEA). Many ideas, and some measures and actions launched under that programme continue to be implemented in Member States. For us, direct involved in this long-term project was an experience which showed that the value of soil is still not recognised by all aspects of society and where short-term political aspirations do not consider the rates of soil formation.*

## 2.2. Croatian initiatives

The first activity of Croatian soil scientists in soil protection on regional level was the ongress of *soil protection of working association of Alps - Adria* (Prpić et al 1987). This association nominated the *Working group for soil monitoring* based on Bodedauernbeobachtungsprogramm, proposed and established in Bavaria. This group of experienced soil scientists was very active, successfully finishing the work by preparing the *Handbook for soil monitoring of Alps-Adria region* (Muller et al. 1994).

This was followed by the *International Workshop on Harmonization of Soil Monitoring Systems* in Budapest (Vidaček et al. 1993) with very ambitious pretensions on the level of Europe, where already started more by concept and content very heterogeneous national and/or regional programmes of soil monitoring. Problem of such development is that any comparison of results getting using different methods is practically questionable. That is the main reason way a harmonization - standardization of methods of soil monitoring on the way to be comparable stay as opened question or never-ending story.

The first document on soil protection in Croatia was driven by the Ministry of Agriculture and Forestry, responsible for agricultural and forest soils, under the title *Programme of protection of soils of Croatia*, which includes; *inventarization of state of soils, soil monitoring methods* and *Soil information system*, prepared as

a study of working group of experts experienced in different fields of soil science (Bašić et al. 1993). This programme was never realized, but proposals are partly actual and today, in spite of progress in this field.

We observe soil as a multifunctional environmental entity with functions necessary to protect from all kind of damage/degradation: eco-system regulation (retention, filtering, transformation), functions important for social and economic activities (agriculture, forestry, housing, infrastructure), archival function containing records of natural and human history.

Our long term investigations of land management cover very wide topics of soil degradation; organic pollutants and heavy metals in cultivated soils, pollution by petroleum exploitation, soil erosion (Bašić et al 1991,1994,1997, Husnjak et al 2011, 2014, Kisić et al 2010, 2012), classification of soil damages (Bašić 1992, 2009, 2010, 2013), soil losses and soil degradation processes caused by harvest of sugar beet (Jurišić et al 2011), assessment of soil degradation, crop growing on soils contaminated by crude oil, petrochemicals (Kisić et al 2002, 2008, 2009), influence of mineral nitrogen rates on the nitrate leaching from drained Stagnogley (Mesić et al 1997), nitrate leaching under variable nitrogen fertilization (Šestak et al 2014), sulphur cycling between terrestrial agro ecosystem and atmosphere (Zgorelec et al 2012).

Table 1 presents a classification of soil degradation of Croatia from 1992 adapted to DPSIR concept (state - driving forces - pressures - impact) in 2009.

Table 1. Classification of soil degradation in Croatia (Bašić, 1992. adapted to the DPSIR concept 2009.)

LEVEL OF SOIL DEGRADATION (STATE)	CAUSES OF DEGRADATION (DRIVING FORCES)	PROCESSES OF DEGRADATION (PRESSURES)	EFFECTS OF SOIL DEGRADATION (IMPACT)
I. WEAK SIMPLY RESTORABLE, (REVERSIBLE)	IMPROPER LAND MANAGEMENT	Agricultural practices; soil tillage, fertilization, etc., cause degradation of physical, chemical and biological properties of soil as components of soil fertility,	Decline of soil fertility do to; compaction, destruction of soil aggregates, soil crusting, decline of humus content, acidification, decline of soil biodiversity of soil micro flora, soil infection, Enhancement of costs of soil tillage and land management.
II. MODERATE HARDLY RESTORABLE, (CONDITIONALLY REVERSIBLE)	EMISSION OF POLLUTANTS	Contamination by heavy metals and toxic elements, PAH, residues of pesticides, petrochemicals, Radionuclide, Dry air-deposits and acid rains.	Plant products non-usable for food or fodder do to mutagenic, carcinogenic and teratogenic effects on consumers, Depression of plant growth, phytotoxic effects, Jeopardize of other ecosystems do to emission of pollutants.
III. STRONG NON-RESTORABLE (IRREVERSIBLE)	SOIL TRANSLOCATION	Erosion by water and wind, Exploitation of stone, gravel, sand, peat, brickyards, Soil removal by root and tuber, Soil borrowing, covering by waste, or other soil, Damages by forest fire.	Loss of part, or whole soil profile, change of natural soil stratigraphy, Decline of productive land area, Increase of heterogeneity of soil cover, Increasing of costs of farming, Loss of productive land, Damage of water and other ecosystems.
IV. DURABLE SOIL SEALING	PERMANENT CHANGE OF PRIMARY USE	Building of infrastructure and housing, Hydro accumulations,	Permanent loss of soil function in biomass production

Experiences in use this classification are positive. Activities of JRC and ESNB create very favourable conditions for projects financed by EU funds on this topic. So, under leading role of *Croatian Environment Agency* and *Faculty of Agriculture University of Zagreb* with practically all qualified experts realized LIFE 05 programme under the title; *Development of the Croatian soil monitoring programme with a pilot project* (Mesić et al 2006, 2008). Project finished very successfully and resulted in extremely valuable printed handbooks available on the internet - web site: <http://www.azo.hr/ZadatakID7Program> and/or <http://www.azo.hr/TheSoilMonitoring> and usable for neighbouring countries understanding Croatian language (Bosnia and Herzegovina, Montenegro, FYR Macedonia, Serbia, Slovenia).

The sampling and analysis of 90 forest soil profiles in the three-year cycle that will enable the collection of data on the state of the forest soils it is necessary to provide a total of € 500 000 in three years. Optimal number of the soil profiles of agricultural soils provided the Program is 90, of which provided for the establishment of nine stations for permanent soil monitoring (one in each agricultural sub-region) and 81 becomes the second level (distributed in relation to the share of agricultural areas of certain sub-regions). The cost of the establishment of stations for monitoring of agricultural soils in the three-year cycle to a total is € 1 000 000. To establish a system for monitoring and observation of changes in agricultural soil sampling and analysis should be repeated every three years.

### 3. Objectives of the International Year of Soil 2015

The Society of Soil Science of Croatia will celebrate the 2015 International Year of Soils inspired by words written below of title of this paper. Agricultural soils of Croatia were formed by joint action of Croatian man and nature and, subsequently, the soil can be considered “heritage” and time shackle - a link between past and present generations of users of the Croatian part of anthroposphere. As a starting point, and links, agriculture in the Croatian part of Pannonia has continuity from the Neolithic period - more than six thousand years. This link requires us, contemporary users, particularly agronomists, the management of soil as heritage inherited from previous generations deliver the next generation in a better state than we inherited it. The knowledge that we have generated commitment and guarantee of such relations.

Public interest is permanently directed to problem of waste disposal as direct not at all modest consumer of soil. Annual waste production of Croatia is  $13,2 \times 10^9$  kg or  $2,97 \times 10^3$  kg *per capita* and  $0,23$  kg/m<sup>2</sup>. Soil used for disposal of municipal and industrial waste becomes at the first time accumulator but later a source of emission of different pollutants in environment; biosphere, atmosphere and hydrosphere. A special problem of waste disposal is on Adriatic islands with shallow soils, specific situation is in protected areas - on more than 700 000 ha, some of which are also on shallow soils on limestones.

Our message directed to public is short and clear: The data are inexorable; *Croatian soil cannot endure all pressures to which is exposed!*

For this reason, there is an urgent need to increase public awareness to change the way of thinking about soil. One of changes will be education-oriented: *to learn never-ending story about soils on all stages of education system.*

Namely, Croatian pre-school and primary school children learn about plants and animals, including tropical ones, but nothing about the concept of “soil which means life”. Our proposal to decision makers in education will be to stand up to the education system for preschool, school (elementary and secondary) and higher (university and vocational) education to include a minimum level of knowledge and understanding about soil.

For wider - civil public society the Croatian Society of Soil Science would support effective policies and promote investment in sustainable soil management and soil protection.

### 4. Conclusions

Data on current state of global and EU soil resources show a worrying tendency of increasing processes of soil degradation in many areas. In the period 1990 - 2006 at least 275 hectares of soil per day were in EU permanently lost through soil sealing.

Damage/threats/degradation of soil is any process and/or set of processes, or effect/effects - impact, natural or anthropogenic origin modified and changing physical, chemical and biological properties of soil, on the way of negative influence on the most important functions (roles) of soil, affecting the biosphere in natural biocenosis - wildlife, causing changes in natural and/or anthropogenized ecosystems.

High influence on all activities in Europe - within members of EU and Candidate Countries realised the European Soil Bureau Network (ESBN), located at the Joint Research Centre (JRC) of the European Commission in Ispra - Italy. ESBN was created 1996 as a network of national soil science institutions.

The Thematic Strategy for Soil Protection (TSSP) at EU level should to be a legal basis for connecting and unifying national systems of soil monitoring in the form of the Framework Directive on soil (Soil Framework Directive COM (2006) 232). Member States should be encouraged to continue to work for pan-European framework for soil protection.



The soil can be considered “heritage” and time shackle - a link between past and present generations of users of the Croatian part of anthroposphere. As the main user of soils Croatian agriculture in the part of Pannonia has continuity from the Neolithic period - more than six thousand years. This link requires us, contemporary users, particularly agronomists, the management of soil as heritage inherited from previous generations deliver the next generation in a better state than we inherited it.

Soil protection in Croatia started on regional level through a Working Group for soil protection of Working association of Alps - Adria, which preparing a Handbook for soil monitoring of Alps-Adria region.

The first official document for aim of soil protection in Croatia (1993) which ordered Ministry of agriculture and forestry authorized for agricultural and forest soils, under the title: Programme of protection of soils of Croatia, which includes; inventarization of state of soils, soil monitoring methods and Soil information system.

Practically all qualified experts realized LIFE 05 programme under the title; Development of the Croatian soil monitoring programme with a pilot project. Project finished resulted by valuable printed Handbooks available on web site <http://www.azo.hr/ZadatakID7Program> and/or <http://www.azo.hr/TheSoilMonitoring> and usable for neighbouring countries understanding Croatian language (Bosnia and Herzegovina, Montenegro, FYR Macedonia, Serbia, Slovenia). Lack of money is the main reason for stopping all activities.

The Croatian Society of Soil Science will celebrate the 2015 International Year of Soils inspired by words written below of title of this paper. The aim is to raise awareness and promote the sustainability of our limited soil resources. By reason of that, there is an urgent need to increase public awareness and change the way society thinks about soil. One of ways will be through education: to learn the never-ending story about soils on all levels of education system; pre-school, school (elementary and secondary) and higher (university and vocational) to include a minimum level of knowledge and understanding about soil.

## References

- Bašić, F., Hrlec, G., Organische Problemstoffe in den Ackerböden Kroatiens, Experttagung der gemeinsamen Arbeitsgruppe Bodenschutz ArGe Alpen, Alpen-Adria und Donauländer, Szombathely, Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen, s. 32-47, München, 1991.,
- Bašić, F., Butorac, A., Vidaček, Ž., Racz, Z., Ostojić, Z., Bertić, B., Program zaštite tala Hrvatske-Inventarizacija stanja-Trajno motrenje-Informacijski sustav, Zavod za OPB AFZ, str. 122, Zagreb, 1993.,
- Bašić, F., Vidaček, Ž., Petraš, J., Racz, Z., Distribution and regional Peculiarities of Soil Erosion in Croatia, Workshop on Soil Erosion Prevention and Remediation, US-Central and Eastern European Agro Environmental Program, p. 134-157, Budapest, 1992.,
- Bašić, F., Mesić, M., Butorac, A., Teške kovine u tlima općine Glina, poglavlje u knjizi; Spomenica, uz 90. godinu rođenja i 10. obljetnicu smrti Mihovila Gračanina, izdvojeni otisak Agronomskog glasnika br.1-2/94, str. 13-41 od 228, Zagreb, 1994.,
- Bašić, F., Klasifikacija oštećenja tala Hrvatske, Agronomski glasnik, 3-4, 291-310, Zagreb, 1994.,
- Bašić, F., Kisić, I., Butorac, A., Mesić, M., Onečišćenje i sanacija tala oštećenih plinskim bušotinama. Radna zajednica Podunavskih regija, 4. sjednica Radne skupine “Zaštita tla” 1997.,
- Bašić, F., Soil resources of Croatia, country report, Soil resources of Europe, II edition (editors R. Jones, A. Jones, B. Houšková, P. Bullock, L. Montanarella). Edited by European Soil Bureau, Institute for Environment and Sustainability, Joint research centre Ispra, p. 89-96., 2003.,
- Bašić, F., Results of ESNB Workshop in Zagreb, Plenary meeting of ESNB, Hannover, 2006,
- Bašić, F., Soils of Croatia - Status - Problems and anticipated solutions, Conference proceedings Mediterranean Conference. Status of Mediterranean Soil Resources: Actions needed to promote their sustainable use, p. 87-111, Tunis, 2007.,
- Bašić, F., Oštećenja i tehnologije zaštite tala Hrvatske – otvorena pitanja, Zbornik radova znanstvenog skupa Tehnologije zaštite tla i odlaganja otpada, Akademija tehničkih znanosti Hrvatske str. 179–203, Zadar, 2009.,
- Bašić, F., Neka pitanja klasifikacije antropogenih oštećenja tala Hrvatske, XI kongres Hrvatskog tloznanstvenog društva, Knjiga sažetaka, str. 99, Plitvička jezera, 2010.,

- Bašić, F., *The Soils of Croatia*, World Soil Book Series, International Union of Soil Sciences, editor Alfred E. Hartemink, Springer Verlag, p. 179. Dordrecht, Heidelberg, Berlin, New York, London, p. 179, 2013.,
- Bašić, F., Tomić, F., *Poljoprivreda kao razvojni potencijal hrvatskog gospodarstva*, Zbornik radova znanstvenog skupa: Razvojni potencijali hrvatskog gospodarstva, Hrvatska akademija znanosti i umjetnosti i Ekonomski fakultet Sveučilišta u Zagrebu, str. 121-153, Zagreb, 2014.,
- Blum, E.H.W., Busing, J., Montanarella, L., *Research needs in support of the European thematic strategy for soil protection*, Trends in Analyt. Chem., Vol. 23, No. 10-11, 2004
- Husnjak, S., Romić, M., Pernar, N., Poljak, M., *Recommendations for Soil management in Croatia. Agriculturae conceptus scientificus*, Volume 76, No. 1., p 1-8., 2011.,
- Husnjak, S., *Sistematika tala Hrvatske*, udžbenik Sveučilišta u Zagrebu, Hrvatska sveučilišna naklada, str. 373, Zagreb, 2014.,
- Jones, A., Montanarella, L., Jones, R., (Principal Editors), *Soil Atlas of Europe*, European Soil Bureau Network, European Commission, Office for Official Publications of the European Communities, L-2995 Luxembourg, p. 128, 2005.,
- Jones, A., V. Stolbovoy, C. Tarnocai, G. Broll, O. Spaargaren, L. Montanarella, *Soil Atlas of the Northern Circumpolar*, Office for Official Publications of the European Communities, L-2995, p. 144., 2010., Luxembourg,
- Jurišić, A., Kisić, I., Bašić, F., Zgorelec, Ž., Matotek, S., *Soil Losses and Soil Degradation Processes Caused by Harvest of Sugar Beet*, Növénytermelés, 255-258, 2011.,
- Kisić, I., Bašić, F., Mesić, M. *Assesment of the Quality of Contaminated Soils and Sites in Central and Eastern European Countries (CEEC) and New Independent States (NIC)*, Sofija, 2002.,
- Kisić, I., Mesić, S., Bašić, F., Brkić, V., Mesić, H., Sajko, K., Zgorelec, Ž., Jurišić, A., *Growing of Crops on Soils Contaminated by Petrol Hydrocarbons*, EUROSIL, p. 77-78, Vienna, 2008.,
- Kisić, I., M Mesić, S., Bašić, F., Brkić V., Mesić, M., Durn, G., Zgorelec, Ž., Bertović, L., *The effect of drilling fluids and crude oil on some chemical characteristics of soil and crops*, Geoderma - A Global Journal of Soil Science, 149, 3-4; p. 209-216, 2009.,
- Kisić, I., Bašić, F., Nestroy, O., Sabolić, M., *Soil erosion under different tillage and cropping systems in Central Croatia*, p. 141-150, *Global change – Challenges for soil management*, Advances in geocology, managing editor: CATENA VERLAG GMBH, p. 363, Reiskirchen, Germany, 2010.,
- Kisić, I., *Sanacija onečišćenoga tla*. Sveučilišni udžbenik, Agronomski fakultet Sveučilišta u Zagrebu, str. 276., 2012.,
- Kisić, I., Bašić, F., Nestroy, O., *Runoff and Soil-Loss on Different Tillage Treatments in Growing of Arable Crops*, International Conference of Water, Climate and Environment, Ohrid: Faculty of Civil Engineering, 2012.,
- Lowdermilk, W.C., *Conquest of the land through 7 000 years*, U. S. Department of Agriculture, Soil Conservation Service, First published as USDA Bulletin No. 99 1939., Washington, 1994.,
- Mesić, H., Bakšić, D., Bašić, F., Čidić, A., Durn, G., Husnjak, S., Kisić, I., Klaić, D., Komesarović, B., Mesić, M., Miko, S., Mileusnić, M., Nakić, Z., Novak, T., Pernar, N., Pilaš, I., Romić, D., Vrbek, B., Zgorelec, Ž., *Priručnik za trajno motrenje tala Hrvatske*. Life Third Countries, LIFE05 TCY/CRO/ 000105. Agencija za zaštitu okoliša, str. 204, Zagreb, 2006.,
- Mesić, H., Bakšić, D., Bašić, F., Čidić, A., Durn, G., Husnjak, S., Kisić, I., Klaić, D., Komesarović, B., Mesić, M., Miko, S., Mileusnić, M., Nakić, Z., Pernar, N., Pilaš, I., Romić, D., Vrbek, B.,
- Montanarella, L., *Moving ahead from assessments to actions: could we win the struggle with soil degradation in Europe?* Book of abstracts of 5<sup>th</sup> International Conference on Land Degradation, Vol II, 5-11, Tunis, 2008.,
- Zgorelec, Ž., *Croatian Soil Monitoring Programme*, Handbook printed within the project; Soil monitoring programme of Croatia, with pilot project. Life Third Countries, LIFE05 TCY/ CRO/000105. Croatian Environment Agency, p. 131. Zagreb, 2008.

- Mesić, H., Bakšić, D., Bašić, F., Čidić, A., Durn, G., Husnjak, S., Kisić, I., Klaić, D., Komesarović, B., Mesić, M., Miko, S., Mileusnić, M., Nakić, Z., Pernar, N., Pilaš, I., Romić, D., Vrbek, B., Zgorelec, Ž., Program trajnog motrenja tala Hrvatske. Priručnik tiskan u okviru projekta; Program trajnog motrenja tala Hrvatske s pilot projektom, Life Third Countries, LIFE05TCY/ CRO /0 00105. Agencija za zaštitu okoliša, str. 131, Zagreb, 2008.
- Mesić, M., Butorac, A., Bašić, F., Gašpar, I., Kisić, I., Influence of mineral nitrogen rates on the nitrate leaching from drained pseudogley, 7<sup>th</sup> Gumpensteiner Lysimeter tagung "Lysimeter und nachhaltige Landnutzung", p.169-170., Bad Gumpenstein, 1997.,
- Müller, Ch., Holenstein, J., Herzog, U., Bašić, F., Aichberger, K., Gruber, A., Juritsch, G., Goller, H., Bendova, H., Hudnik, V., Hodnik, A., Huber, W., Nemeth, T., Scherer, J., Bodendauerbeobachtungs-flächen, Empfehlung einer abgestimmten Vorgehensweise der Unterarbeitsgruppe "Boden-Dauerbeobachtungsflächen" der gemeinsame Arbeitsgruppe "Bodenschutz", ArGe Alp, Alpen-Adria und Donauländer, Staatsministerium für Landesentwickl. und Umweltfragen, s. 27, München, 1994.,
- Prpić, B., Martinović, J., Bašić, F., Waldschäden und Belastung der Waldböden in der Kroatien, Kongress Bodenschutz ArGe Alpen und Alpen-Adria, s. 73-80., München, 1987.,
- Sestak, I., Mesić, M., Zgorelec, Z., Kisić, I., Basic, F. 2014. Winter wheat agronomic traits and nitrate leaching under variable nitrogen fertilization. *Plant, Soil and Environment*, 60: 394-400.
- Tomić, F., Bašić, F., Zemljišna politika u službi razvoja Hrvatske, Uređenje zemljišta – preduvjet napretka i konkurentnosti hrvatske poljoprivrede na europskom gospodarskom prostoru, Hrvatska–društvo i država blagostanja, izdanje HGK; str. 165-194, Zagreb, 2011
- Varallyay, G., Role of Soil Multifunctionality in Future Sustainable Agricultural Development, Environmental Management; Contribution to Solution, Univ. of Zagreb, Faculty of Chemical Engineering and Technology, Editor Natalija Koprivanac, p. 29-39, Zagreb, 2005.
- Vidaček, Ž., Racz, Z., Bašić, F., The state, current Activities and future Plans for Soil Monitoring Systems in Croatia, FAO/ECE Working Party on Relations between Agriculture and Environment, International Workshop on Harmonization of Soil Monitoring Systems, p. 65-77, Budapest, 1993.,
- Zgorelec, Ž., Pehnec, G., Bašić, F., Kisić, I., Mesić, M., Žužul, S., Jurišić, A., Šestak, I., Vađić, V., Čačković, M., Sulphur Cycling Between Terrestrial Agroecosystem and Atmosphere, *Arhiv za higijenu rada i toksikologiju*. 63, 3; 301-310, 2012.,
- DG Environment: Communication "Thematic Strategy for Soil Protection", COM(2006)231 final (22 Sept. 2006)
- Thematic Strategy for Soil Protection" (COM(2002)179),
- 2006 EU Soil Strategy press release
- 2009 EU press release on soils and climate change
- 1991 EU Sewage Sludge Directive
- EU Common Agricultural Policy
- Summary of EU legislation related to soils
- EU European Soil Portal

sa2015\_p0003