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HIGH HETEROGENEITY OF SOILS IN THE RESIDENTIAL AREA OF IAȘI

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Abstract

The area of the residential spaces from Romania still has a tendency to expand. Residential spaces are part of the national economy and also plays a vital role in urban environment. One of the permanent concerns of the owners of the residential spaces is the creation of pleasant, comfortable and relaxing landscapes because he quality of environment directly influences physical, mental and spiritual life of people. For communities that pay special attention for relaxing landscapes on a site, it is usefully to focus on the characteristic of the soil at the site. Frequently, the urban soils from residential area are characterized by a strong spatial heterogeneity resulting from various input of exogenous materials and mixing of material from different soil horizons or even with lithological material on which the soil was formed. After carrying out field investigations we found different and varied soil limitations for plants even on small areas. The results obtained during the investigations made it possible to present some representative case studies of high heterogeneity of urban soils for the residential area in Iași.

Key words*: heterogeneity, urban soil, residential area.*

INTRODUCTION

According to Wikipedia, residential area is a land used in which housing predominates, as opposed to industrial and commercial areas. These include single-family housing, multi-family residential, or mobile homes.

The infrastructure required to support a residential development can be split into more categories such as transportation infrastructure (local road network, footpath, public transport, parking), waste management (waste collection and waste recycling), utilities (water supply, wastewater management, electricity network, gas network, telecommunications) renewable energy (solar energy, wind energy) community infrastructure, social infrastructure, digital infrastructure, green infrastructure (Bracknell Forest Council, 2012).

According to Stroganova et al. (1998), the soil surface can be covered (isolated from the impact of the atmosphere) by buildings, permeable road surfaces (pavement, gravel), impermeable road surfaces (asphalt, concrete).

The abundance of chemical elements in urban soils is a result of geogenic abundance and anthropogenic ones. Many times, anthropogenic influence is decisive for urban soils chemical, physical morphological and biological properties (Lăcătușu et al., 2008).

Dust pollution affects the atmosphere, vegetation and soils. The dust is generally toxic and hazardous and can pose a serious health threat to humans. The natural environment is also affected by dust emissions: soils in the surroundings of the plant are characterised by alkaline reaction and contain elevated levels of lead and zinc (Charzyński et al., 2013; Dabkowska et al., 1997).

The area's most heavily polluted with dust containing 7 to 9 heavy metals have been identified in Podu Roșu intersection, industrial area in Baza 3 (the Felicia Carrefour supermarket) and in the heavily trafficked Tudor Vladimirescu intersection. All the measures taken to limit the road dust (washing the streets; mechanized, sweeping of the streets; modernization of the roads etc.) are not enough to reduce the dust content below allowable limits (Oiste, 2013).

Soil from urban area are frequent contaminated with high highly chlorinated PCB. Studies conducted by Lăcătușu (2008) showed that most polluted areas in Bucharest are located in areas with intense automobile traffic like Rosetti Square, Sudului Square and Kisseleff Square, where the concentration of PCB exceed even the intervention threshold for sensitive use.

Housing constructions and another categories of infrastructures in residential area strong modifies soil characteristics and usually results in high soil compaction, low rainfall infiltration, and restricted aeration and low drainage porosity (Craul, 1985; Pouyat et al., 2007).
Soil modification can be intentional to strengthen soil for engineered loads, such as house foundations and roadways, or unintentional as a result of heavy equipment usage and site traffic.
It is obvious that following the construction of the infrastructure in the residential area, the floor covering also changes considerably.
One of the permanent concerns of the owners of the residential spaces is the creation of pleasant, comfortable and relaxing landscapes because he quality of environment directly influences physical, mental and spiritual life of people.
Achieving sustainable landscapes in individual gardens could be done only if the soil is kept loose, without high alkalinity or acidity, well supplied with nutrients and without pathogens contaminants.
Soil in individual gardens must also ensure organic matter recycling, rain or irrigation water retention for continuously supply of plants, vigorous root system development, water infiltration and, last but not least, plant protection against pathogens.
Our paper highlight the high heterogeneity of soils in urban areas in Iasi and to some negative influences on plants and human health.

MATERIALS AND METHODS

Most of the studies were conducted in urban area of Iasi, located in the central eastern part of Romania.
Iasi, the city of the seven hills, is situated in the North-East of Romania, at 47˚10’ northern latitude and 27˚35’ eastern longitude
The studied sites are located in the residential area of Iasi city (North-East of Romania).
We studied several locations in the urban area of Iasi. In each location we studied topography and realized several soil profiles.
The representative soil profile of the agricultural land o Iasi is Haplic Chernozems (Figure 1).

Figure 1. Haplic Chernozems

The studied soils have been diagnosed according to the Romanian System of Soil Taxonomy (Florea et al., 2012) and World Reference Base for Soil Resource (WRB, 2014).
Characterization of soil profiles was done following the instructions from guidelines for soil and land descriptions (Munteanu et al., 2009; Guidelines for soil description, FAO, 2006).
Soil samples were taken from each pedogenetic horizon in order to conduct laboratory analyses: according to the current methodology (Dumitru et al., 2009; Lăcătușu et al., 2017).

RESULTS AND DISCUSSIONS

In residential spaces undergoes irreversible changes is the soil cover.
The extent and type of changes in the soil are influenced by many factors such as time and intensity of initial land use before the start of the residential area infrastructure, the physical, chemical and biological properties of the soils on which the new houses will be built and the related infrastructure, reclamation techniques etc.
Frequently, the largest share of urban soil constituents is owned by those of anthropogenic origin.
The natural constituents of the soils that are associated with those of anthropogenic origin

(artefacts), usually come from several pedogenetical horizons and from lithological layers which were excavated and stored on the surface of the land near the newly built houses.
Our studies carried out in urban areas of Iasi have shown a great heterogeneity of soils even in residential areas established on agricultural soils.
Part of the soils of the residential areas in Iași were removed by excavation during the construction of the designed buildings (Figure 2), another part is covered with permeable or impermeable roads surfaces.

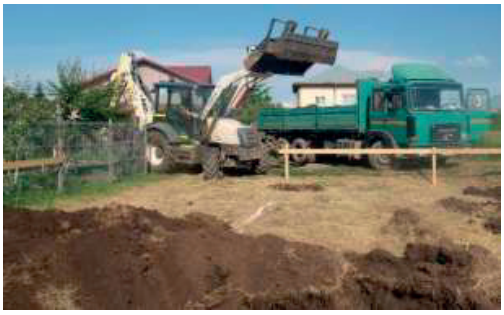

Figure 2. The excavated soil is transported from the place prepared for the construction of the building in the residential area

During the execution of the construction, the upper part of the soil is compacted strongly and is often covered with different artefacts made of materials used in the construction of the building.
In order to preserve the initial state of loosening of the soil and after the construction of the building, we recommend that in the first phase only a part of the excavated soil be removed, and one part be used to cover the soil to prevent compaction (Figure 3).

Figure 3. Covering the soil surface with the soil resulting from excavation

After ending of the building, the ground cover can be removed and the soil can be used for creation of pleasant, comfortable and relaxing landscapes.
The removal of the soil used to cover the ground must be done separately from various resulting artefacts.
The soil covered by permeable roads (pavement, gravel), can be partially supplied locally with water both from lateral infiltrations and through the joints between concrete or brick pavers in the pavement.
The free spaces between the pavers can be infested with annual or perennial weeds such as little hogweed or couch grass (Figure 4).

Figure 4. Couch grass (*Cynodon dactylon*) and little hogweed (*Portulaca oleracea*) developed in the joints between the pavers

In some cases, paved alleys are infested with invasive and quarantine weeds (Figure 5) such as common ragweed, annual ragweed, and low ragweed (*Ambrosia artemisiifolia*).

Figure 5. Pavers pathway infested with quarantine weed *Ambrosia artemisiifolia*

This species harms the health of the population; many people are allergic to pollen. In

Switzerland borders several heavily ragweed colonised areas and up to 12% of the population suffers from allergies to ragweed pollen in these areas (Taramarcaz et al., 2005).
The soils covered with pavers in the studied areas are urbic ekranic Technosols or calcaric ekranic Technosols.
It is necessary to control the weeds in the paved alleys both to prevent their degradation and maintain a pleasant landscape and to prevent the disease of the population allergic to pollen of different species.
The soils of the residential areas covered with impermeable roads surfaces can be moistened with water from lateral infiltrations from adjacent lands.
In these cases, the ekranic Technosols allow the development of the roots of the plants that grow on adjacent lands (Filipov & Robu, 2013). Even if it seems impossible, the asphalt path can be traversed by perennial herbaceous plants such as *Convolvulus arvensis, Equisetum arvensis, Cynodon dactylon* (Figure 6).

Figure 6. Degradation ekranic Technosols covered by asphalt alleys after growth of couch rhizome

The developed cracks on the asphalt or small galleries formed as a result breakdown roots of couch grass allow growth of other plant species such as *Taraxacum officinale* (dandelion), *Polygonum aviculare* (birdweed, pigweed and lowgrass), *Hordeum murinum* (wall barley or false barley), *Lepidium ruderale* (narrow-leaf, pepperwort, roadside, pepperweed or peppergrass), *Poa pratensis* (Kentucky Bluegrass, Smooth Meadow-grass, or Common Meadow-grass), *Cardaria draba* (white top or hoary cress).

Preventing degradation of asphalt alleys by means of *Cynodon dactylon* can only be done by mechanical or chemical removing plant developed on both paths and those in areas in close proximity
Our investigation noticed that some plants species such as *Picea* sp. that grow in the vicinity of asphalted paths lead unevenness, cracking and perforation of asphalt path (Figure 7).

Figure 7. Degradation of asphalt path of ekranic Technosols by deformation cracks and perforation under influence of *Picea* sp. rooting

Soils from ornamental garden frequently contain large amount of artefacts such as bricks, pottery, glass, crushed or dressed stone, wooden boards, bitumen (Figure 8).
Such soils were also found in the residential area where we conducted these studies. Before establishing of the garden, the soil was levelled and then covered with fertile soil from the upper part of the Chernozems (Figure 8).

Figure 8. Mollic hyperatefactic Technosols

Soil has loamy clay texture and slight alkaline reaction.
The high content of artefacts reduces the volume of soil that can be used by plant roots.
The low capacity of the soil to retain useful water amplifies the negative effect of summer droughts on plants.
The resulting soil was diagnosed as Copertic urbic Tehnosol (after Romanian Soil Taxonomy System, 2012) or Urbic mollic Technosols.
Trees on these soils have a shallow root system (Figure 9), and can be knocked down by stronger winds.

Figure 9. Spruce roots developed in the fertile soil layer used to cover deposits with urban artefacts

We recommend avoid planting tall growing trees on these soils which are likely to knock down by strong winds.
In frequent cases, after finishing the buildings, the soil is levelled and covered with humic soil material. Input of good soils does not remove plant restrictions of soil covered with a fertile layer of soil. In the first stage the plants can develop in the imported soil, but later the growing stalling or even dried.
After finishing of construction, soil compaction processes can also occur under influences of some activities in new garden such as walking, sports, and even parking heavy vehicles on grassed areas.
After carrying out field investigations we found that the fertile soil material used to cover the land surface is not sufficient to ensure growth of all plants in individual gardens.
It is necessary to choose the ornamental species according to their requirements for the useful edaphic volume of the soil.

The required input data in order to identify area with where the deficient physical properties of soil for plant growing are uniformity of soil surface colour, soil crusting susceptibility, uniformity of the wetting strip after drip irrigation, the growing stagnation of plants, uniformity of root distribution (Filipov & Chelariu, 2020).
In the studied area we met soils with artefacts represented by crushed or dressed stone which was covered with soil from humic horizon (A mollic) of Chernozems (Figure 10).

Figure 10. Mollic urbic spollic Technosols

The distribution of roots in the soil layer used to cover the ground is uniform.
In lighter soil layers with a higher content of artefacts, the roots are very few and appear only locally.
The reaction of the upper part of the soil is weakly alkaline, the pH values being between 7.4 and 8.1.
The presence in individual gardens of soils with high amplitude of pH values requires the choice of suitable ornamental species.
The presence in individual gardens of soils with high amplitude of pH values requires the choice of suitable ornamental species. Some species prefer the acid reaction and do not tolerate weakly or moderately alkaline soils.
The different colour of *Hydrangea hortensis* flowers is a very good bio indicator of soils with high pH amplitude.

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CONCLUSIONS

In order to preserve the initial state of loosening of the soil and after the construction of the building, we recommend that in the first phase only a part of the excavated soil be removed. After ending of the building, the ground cover can be removed and the soil can be used for creation of pleasant, comfortable and relaxing landscapes.

The soil covered by permeable roads (pavement, gravel), can be partially supplied locally with water both from lateral infiltrations and through the joints between concrete or brick pavers.

In some cases, paved alleys are infested with invasive and quarantine weeds such as *Ambrosia artemisiifolia*.

It is necessary to control the weeds in the paved alleys both to prevent their degradation and maintain a pleasant landscape and to prevent the disease of the population allergic to pollen of different species.

After carrying out field investigations we found that the fertile soil material used to cover the land surface is not sufficient to ensure growth of all plants in individual gardens.

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