JOURNAL OF ENVIRONMENTAL ENGINEERING
AND LANDSCAPE MANAGEMENT
2010
18(3): 179–187

INVESTIGATION AND ASSESSMENT OF DEPENDENCES OF THE TOTAL CARBON ON pH IN NERIS REGIONAL PARK SOIL

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Submitted 19 Mar. 2009; accepted 20 Feb. 2010

Abstract. Soil is one of the most important natural subsystems of the Earth's landscapes, which is exceptionally vital for a human being as the main source of food resources. In order to take care of the future one of the most relevant problems of the mankind is to preserve soils of the Earth, their fertility and normal state under conditions of the increasing technogenic effect and degradation of natural landscapes. As the global warming has already started, its after-effects, which will be invertable faced by the Lithuanian agriculture, must be overcome as an additional negative factor. The paper aims at revealing the dependence of the total carbon on pH. It also focuses on the impact of climate change on the total carbon and soil degradation.

Keywords: soil, total carbon, pH, soil studies.

1. Introduction

Soil pH, commonly referred to as a soil reaction (Motuzas 2005), has been recognised as one of the essential properties of soil determining chemical-geochemical processes which are responsible for the buffering capacity of soil and, finally, for sensitivity of the entire geo-system to the chemical and mechanical impact. Practically, soil pH determines soil fertility. At the end of the 20th century the essential results of the multiyear studies on the spatial distribution of soil pH carried out at state level were generalised in Europe. The regularities of the spatial differrentiation (both vertical and horizontal) of soil pH were justified by the concept of natural sciences by pointing out the most important factors in the broad sense: geological substrate – parent rock and bedrock, and geological time – the geological age of rocks, the duration of landscape evolution and the age of soil (Kern 1987). As the methodological analysis performed in the North, West, Central and East Europe shows, a spatial distribution of soil pH is directly and indirectly related, in the narrow sense, with a depth of the specific geological substrate, the so-called carbonaceous horizon, a granulometric composition and a carbonate content of parent rocks through the correlation of geological substrate and time. Similar regularities are discovered in the continental glaciation area of Europe – Denmark, Poland, Lithuania, Belarus, and Russia, i.e. dependence of the depth of carbonate content and carbonaceous horizon of moraine parent rocks and on the genesis and age of the rocks themselves and therefore pH of the soils that formed in moraine sediments is the age function of moraine substrates (Eidukevičienė 1993). A statistically reliable linear negative correlation between the depth of carbonaceous horizon and pHKCl indicator in a soil layer 30–120 cm thick was identified in the territory of Lithuania. The correlation of carbonate content with the content of dust (0.05–0.001 mm) and clay (<0.001 mm) particles is linear positive and the correlation with sand particle (1–0.05 mm) content – linear negative. Granulometric composition (as well as carbonate content) of parent rocks also changes according to a certain regularity typical of all relief types from elementary surfaces to elevations and is distinguished by a regular difference in carbonate content. Consequently, the elevated relief surfaces of parent rocks with coarser granulometric composition have a lesser carbonate content than the hollow ones, showing a CaCO3 difference of 4–9% (Eidukevičienė 1996, 1993).

To identify the spatial regularities of soil pH, evaluate soil pH regularities in the whole territory of Lithuania and adapt the obtained results for a spatial analysis of statistics, a soil pH map was compiled according to the map of agricultural land areas (Грибаускас 1978) (Fig. 1).

Relevance of this aspect is related with the previously started studies on a carbon balance in Lithuania's soils, which may also have some impact on their acidity. Moreover that the factor of technogenic pollution is still active – during the cold season of the year Lithuania is dominated by acid and slightly acid precipitations with their pH < 5.6. Due to acid rains, the acidification of soil increases and its intensity depends not only on the amount of acid precipitation in soil but also on the buffering capacity of soil, i.e. the content of chemicals that can neutralise acids in it. Technogenic pollution of soils. Despite the fact that in the past years hydrogen ion con-

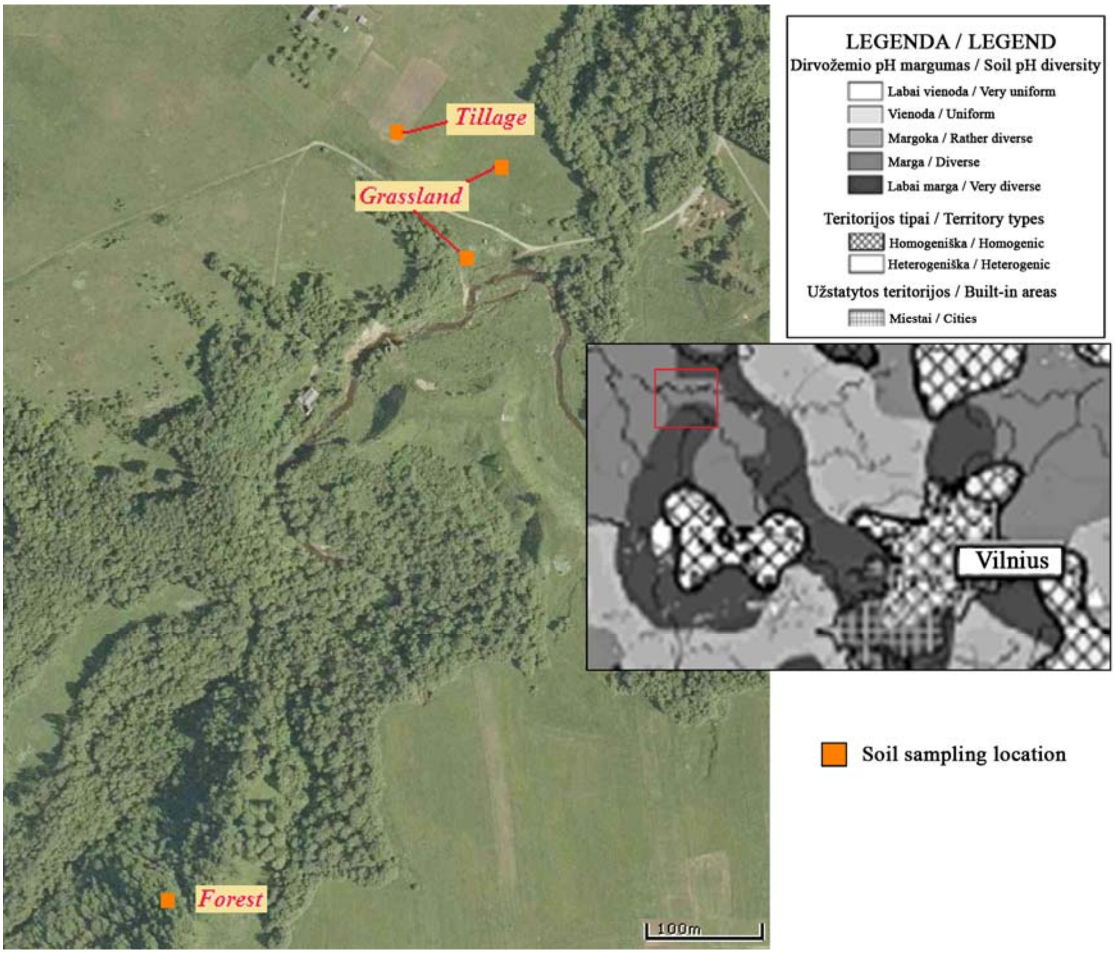
ISSN 1648–6897 print / ISSN 1822-4199 online
doi:10.3846/jeelm.2010.21

centration in wet precipitation was decreasing, on average, by 15%, and that of sulphate sulphur and ammonia nitrogen by around 9% per year, the average monthly flows of pollutants still are quite big – those of sulphate sulphur – … 19.0–26.0 mg/m^2, nitratic nitrogen … 17.0–24.0 mg/m^2, ammonia nitrogen … 15,0–27,0 mg/m^2 (Eidukevičienė *et al.* 2001). According to the data of the most recent agrochemical study, there are 618 870 ha or 18.7% of acid soils, with 1.5% of strongly acid, 7.0% of moderately acid and 10.2% of slightly acid soils among them, in the Republic of Lithuania % (Mažvila *et al.* 2004).

A fertile soil is of a neutral or close to neutral reaction, contains many nutrients suitable for plants to assimilate, and has a sufficient content of humus and microorganisms. Soil fertility mainly depends on its type. Soil is classified into the following types: sand, sandy loam, loam and clay. Plants grow best in loam as it is rich in nutrients and microorganisms. Sandy soil is distinguished by high water permeability and therefore nutrients are leached out of it best. As clayey soil compresses fast its compression needs to be avoided (Iveta *et al.* 2007).

Different microorganisms live in the topsoil (humus) and underneath. Upon digging soil, these layers of soil are often overturned, i.e. they are switched. Humus bacteria that like oxygen enter the lower layer where they can't survive and quite often die. The others migrate to the surface but slowly and, therefore, much more than a week is needed for the damaged vitality of soil microorganisms to get restored. In addition, digging of a sandy soil results in the acceleration of organic matter degradation, which reduces soil fertility.

Soil acidity is determined by a depth of a carbonaceous layer. Where it is not deep, 40–50 cm, the acidity of top soil layers will be close to neutral, and deeper – more acid. Soil acidity is described by its pH (a scale from 1 to 14): pH 1–6 marks acid medium, pH 8–14 alkaline mediium, and pH 7 is considered as neutral medium. Many cultivated plants can normally grow and fruit only in non-acid soils; therefore, soils with their pH below 5 need to be calcified (Knašys 1985). After calcification nutrients become better accessible to plant roots and microorganism activity improves (their ferments are activated). Soil acidity also has a major influence on the abundance of microorganisms. Soils with their pH below 5 nearly do not contain atmospheric nitrogen fixing bacteria (except for lupine nodular bacteria). Acid soils have lesser contents of other bacteria, plant residues are slower degraded in them and, consequently, plant nutrition worsens (Dirvožemis… 2008).



1 pav. Dirvožemio pH erdvinės struktūros margumas ir ėminių paėmimo vieta šalia Buividų gyvenvietės

Fig. 1. The diversity of the spatial structure of soil pH and sampling place next to Buividai residential settlement

Soil leachability and related loss of calcium can increase through drainage improvement or field irrigation. For instance, it has been determined that the acidification of calcified, medium-heavy loamy soil is more stimulated by shallow soil cultivation than deep autumn ploughing. Organic fertilisers, on the contrary, reduce soil acidification in the case of both deep ploughing and shallow cultivation (Žemės ūkio … 2006). As it has been announced, in England up to 200–1000 kg/ha of calcium recalculated into $CaCO_3$ are leached by soil filtrating waters per year and in Russia's non-humus area – up to 400–450 kg/ha (Орлов 1992). In acidic soils the mobility of Fe, Mn, Al, B, Cu, Zn compounds increases and big concentrations of them suppress plant vegetation and decrease harvest. Furthermore, in such soils the availability of molybdenum, an important plant micro nutrient, decreases as decreases the assimilation of phosphorus.

Further analysis will cover only the actual acidity of the soils researched, which depends on their composition and the quantity ratio of water-soluble components.

It's common knowledge that the acidity of soil solutions depends on the content of free organic acids and other organic compounds having the acid terminal functional groups (carboxyl –COOH, phenolhydroxyl –OH, metoxyl $–OCH_3$, carbonyl –C–O, hynoid –C = O, also $–NH_2$; = NH; –SH; = $P(OH)_3$), free mineral acids (carbon, sulphur, nitrogen and others), and other soil ingredients with some properties of acidity (Al^{3+}, Fe^{3+}). In the majority of cases the ratio of these components in typical soils is such that their pH values are equal to the interval 4.2–6.8. However, in connection with the relevant technogenic environmental pollution and related acidic precipitation, the pH of soil solutions steadily and significantly shifts towards acidic values (Pagrindinių … 2000).

With soil pH decreasing aluminium solubility is increasing. In moderately acid soils Al^{3+} ions perform the role of acid as they react with water and form aluminium hydroxyl. The content of mobile aluminium in soil for the most part depends on soil reaction. In acid soils with their pH below 5.5, aluminium solubility sharply increases; it starts actively competing with other cations in ion exchange. The content of aluminium in a neural soil solution is up to 400 µg/l, in the meantime it increases up to 5700 µg/l in a soil solution with its pH 4.4. The coefficient of correlation between the mobile aluminium and pH in Lithuania's soils is 0.82–0.85 (Mažvila *et al.* 2004).

The most essential components of soil which predetermine the pH of its solutions include a chemically quite strong carbon acid which forms at the time carbon dioxide dissolves in water. The latter steadily regenerates in soil during chemical oxidation or microbiological degradation of organic matter. These processes unbind such a plant-specific macro component as calcium, which, upon reacting with carbon acid, forms carbonates (as a rule, calcite) (Pranskevičius *et al.* 2008):

$$Ca^{2+} + H_2CO_3 + ½O_2 \leftrightarrow CaCO_3 + H_2O \leftrightarrow Ca^{2+} + [HCO_3]^- + [OH]^-$$

Thus, actually we can talk about the mineral system $CO_2 – H_2O – CaCO_3$, acting as a natural buffer system,which steadily exists in many types of soil:

$$\underset{pH=5,2}{\underline{\mathbf{CO_2}}}\ \underset{pH=8,35}{\underline{\mathbf{H_2O}}}\ \mathbf{CaCO_3} \qquad \textit{Equilibrium with atmospheric } CO_2\ (0,03\,\%\ CO_2)$$

$$\underset{pH=4,4}{\underline{\mathbf{CO_2}}}\ \underset{pH=6,7}{\underline{\mathbf{H_2O}}}\ \mathbf{CaCO_3} \qquad \textit{Equilibrium with soil air}\ (10\,\%\ CO_2)$$

The system's left shoulder ($CO_2 – H_2O$) shows pH = 5.2 of the water which under standard conditions interacts with atmospheric CO_2 (in the absence of other components' impact). Water, having a long contact with $CaCO_3$ under the same conditions (for instance in limestone pores), will be alkaline with its pH = 8.35. In soil with partial CO_2 pressure much lower, the mentioned values of pH will be lower. It has been proved that only the carbon dioxide contained in soil can actually maintain nearly the full range of pH that is typical of soils, particularly due to low organic acid concentrations in soil solutions (Орлов 1990).

Thus, the pH of soils in humid areas is greatly dependent on its cation reserve, in the first instance calcium. The generalised data of the 2005 agrochemical study on soils in Lithuania's 44 cadastral areas shows that since 1990 the number of conditionally acid soils ($pH \leq 5.5$) has been increasing (on average, 3.2%) even in the previously calcified areas and their pH-reaction has been gradually returning to their pre-calcification condition. The biggest acidification was noticed in the soils of West Lithuanian cadastral areas where acid soils increased 8.1%. Soils in some districts acidified 25.2% (Šilalė), over 12% (Kretinga and Skuodas), 10.4% (Šilutė) (Žemės ūkio … 2006).

Soil fertility can also be enhanced through peat insertion. The main indicators of peat are acidity and calcium content. Acid peat with its pH in water extract below 4.5 negatively affects plant development and its acidity has to be neutralised before use. The most acid (pH 2.8–3.0) is peat from raised bogs. Even a small amount of calcium significantly improves its properties as calcium with humane acids form calcium humates which have an influence on soil fertility.

Carbonaceous sapropel can also be applied. As the studies on the long-term efficiency of carbonaceous sapropel performed at the Vokė branch of the Lithuanian Institute of Agriculture show, 50–200 t ha^{-1} of calcareous sapropel from dry substances can be applied for fertilisation. It reduces soil acidity and this effect can last more than 18 years. Organic and food materials inserted together with sapropel increase the amounts of humus, total nitrogen and sorbed bases in soil. Comparative studies on sapropel of different types showed that carbonaceous sapropel acted more as a calcifying agent. Its application for fertilisation reduces soil acidity; however, organic or silicon sapropel has no effect on this indicator.

Humus matter has an effect not only on soil structure and water properties but also regulates ion exchange reactions between the solid and liquid phases of soil. Change in solubility of mineral components has an effect on the nutritional conditions of plant organisms (Ján and Bernard 2006).

The aim of the work is to analyse the dependence of total carbon in soil on soil pH.

2. Methods of the work

Soil samples for the identification of the total carbon content were taken next to the Neris Regional Park (Fig. 1). Sampling methods were designed on the basis of the soil sampling protocol which was prepared for the identification of changes in the European Union organic carbon content.

A metal ring, 5 cm high and 15 cm in diameter, was used for taking samples of non-destroyed structure soil. The ring was used with the aim of avoiding physical destruction of soil as much as possible. The taken samples of soil were placed into numbered polyethylene bags

Methods for determining the total carbon (TC) in soil with the analyser SSM-5000A

As a water content has an effect on solid sample's form, matrix, and, consequently, results, the sample was dried prior to measuring. The sample was dried at a temperature of 100 °C up to the constant weight. The efficiency of a carbon burning oxidation reaction varies depending on the type and structure of samples and, therefore, all samples (up to 100 mg of soil) were crushed with a mortar before measurement.

Adherent alkaline substances absorb CO_2 from the environment, which results in the formation of carbonates (e.g. sodium carbonate or calcium carbonate) and, therefore, sample's results may show a higher carbon content than the actual one.

Sample crushing:

1. Materials that are not necessary for the research are removed from the sample.
2. The sample is thoroughly crushed with a mortar.3. A crushed sample is sifted through a sieve with appropriate meshes.
4. Non-sifted particles are crushed once more. To reduce the sample a conical separator or a groove collector are used.
5. Steps 3 and 4 are repeated to obtain the final sample which is sifted through a 200-mesh sieve.

In the TOC (total organic carbon) furnace a working temperature of 900 °C is set.

Prior to measurements, sample analysis vessels were heated in an electric laboratory stove for the carbon contained therein to oxidise. The sample vessel was heated in the furnace at a temperature of around 500 °C for 20 minutes. Use of a new vessel for each sample is recommended. However, if the investigated sample has not polluted, changed or damaged the vessel, it can be used again.

With the aim of obtaining the precise data, sample material has to be uniformly spread within the vessel. The quantity of sample is selected by the optimum weight taking account of burning temperature and oxygen deficiency during burning.

Carbon concentration is presented in percent of the dry mass of soil sample.

3. Results of the work

The performed research on the total carbon and pH in soil shows that with the content of carbon decreasing the value of pH is increasing. According to this trend, in the first meadow plot pH values in a composite soil sample distributed at a depth from 0 to 20 cm (Fig. 2). A decrease in the total carbon content from 4.264 to 2.49 and an increase in pH value to 0.11 were observed in these samples. Analysis of soil samples at a depth of up to a metre did not show any dependence of pH values on the total carbon content. Starting from a depth of 40 cm the content of the total carbon sharply rises, 26%, but later slumps 86%. In the meantime pH value was rising up to a depth of 40 cm, but upon reaching a depth of 60–80 cm it fell 1.5%.

In the second meadow plot under review the content of the total carbon decreased from 1.2316 to 0.1064 of its percentage value in the samples at a depth of up to a metre (Fig. 3). In the meantime pH value increased from 5 to 5.73.

Comparison of carbon contents in meadow soils shows that the total carbon content is higher in the lower point of relief of the plot concerned. The content of the total carbon in composite soil samples was by 1.45 times larger in the first meadow plot.

In the samples taken from deeper soil a difference in carbon content was smaller by 1.35 times, i.e. it was bigger in the first meadow plot, which is in relief's lower point. Distribution of the total carbon is also dependent on relief.

A similar coincidence was noticed in forest soil. With the content of carbon decreasing, soil pH is increasing towards acid properties. With the content of the total carbon increasing soil starts acquiring more alkaline properties. When the total carbon content fell from 3.074 to 1.3578 of its percentage value, pH rose from 5.21 to 6.12 (Fig. 4). Comparison of the total carbon content in deep samples and the first meadow plot's soil shows by 1.34 times lower content in forest soil, and that in the second meadow plot – by 1.17 times larger content. The difference in composite samples was by 1.31 times less and 1.03 times more, respectively, compared with forest soil. Such distribution of the carbon content was predetermined not only by relief but also by different structure of soils.

The total carbon content in arable soil was very low, but the relationship between the total carbon and pH was the most significant in composite samples. The total carbon in these soil samples varied from 1.1908 to 0.136 of its percentage value. In these soil samples pH dependence on the total carbon content is inversely proportional. pH changed from 5.87 to 6.29 (Fig. 5). By the total carbon content arable soil was close to forest soil and the second meadow plot soil. The carbon content in deep soil samples was by 1.26 times bigger in arable soil and by 1.09 times bigger in composite soil. When compared to forest soil, the total carbon content in deep samples was by 1.08 times bigger in arable soil and by 1.09 times bigger in composite samples.

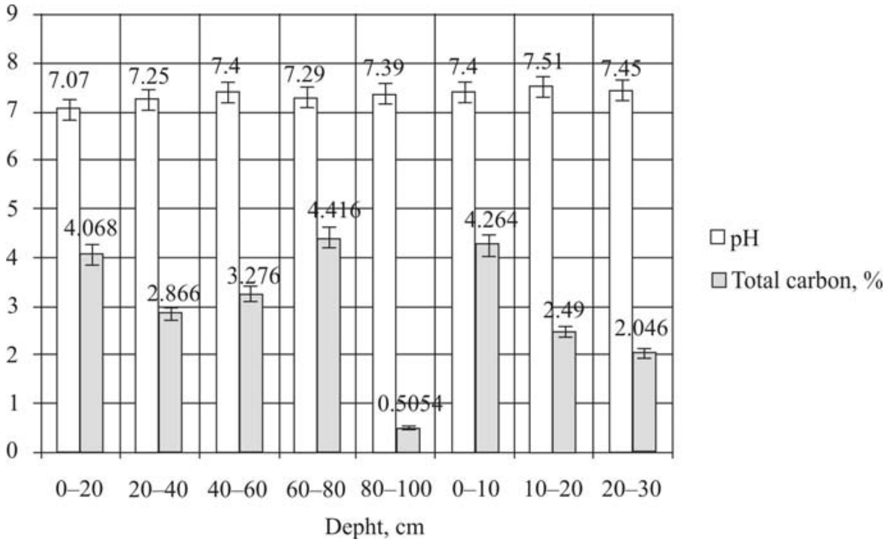


Fig. 2. Soil pH and total carbon content in the first meadow plot

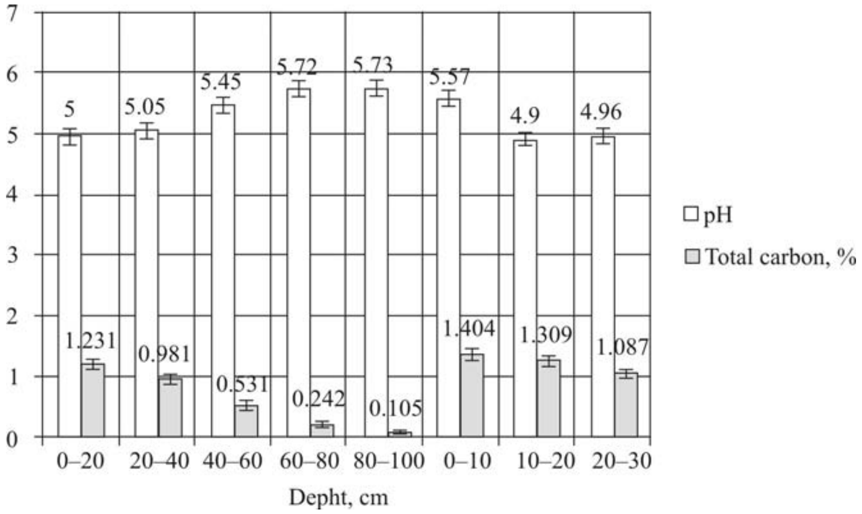


Fig. 3. Soil pH and total carbon content in the second meadow plot

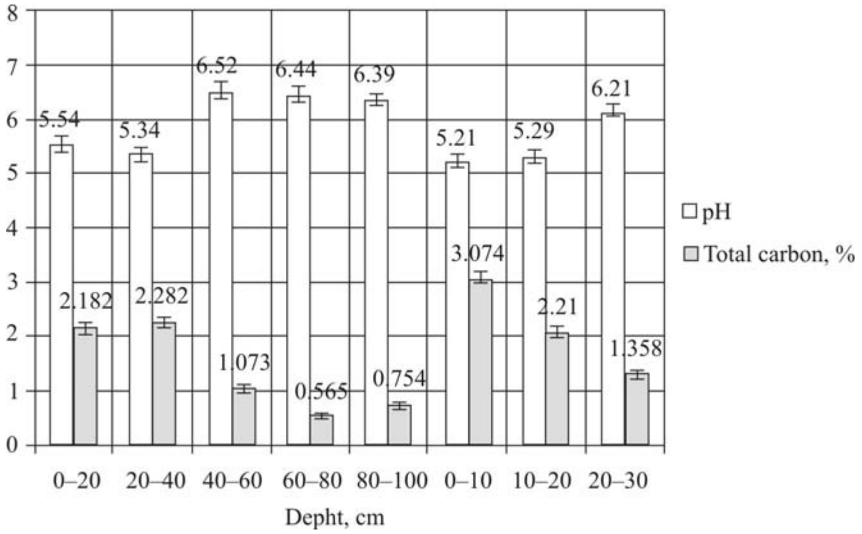


Fig. 4. Soil pH and total carbon content in forest soil

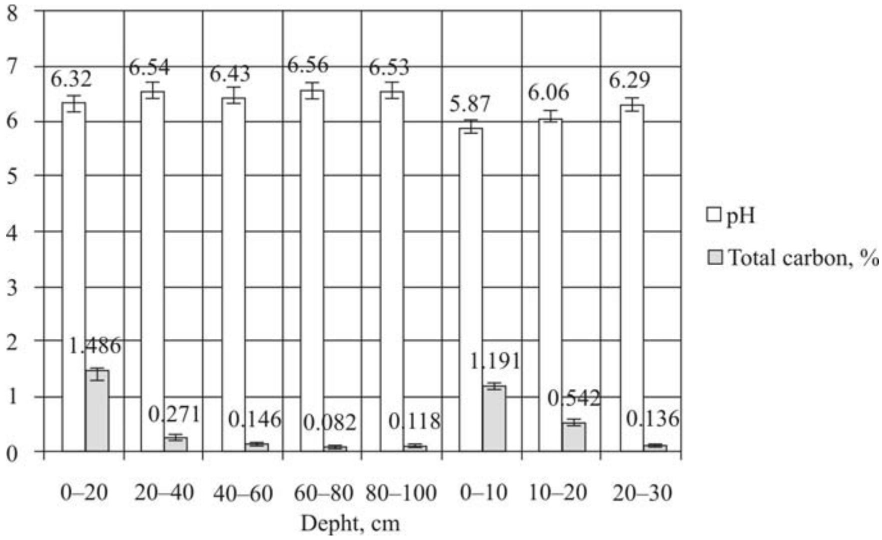


Fig. 5. Soil pH and total carbon content in arable soil

Considering the fact that the concentration of the heavy metals in question in all samples was far below the limit values set in HN-60:2004, it's not worth speaking about their pollution with metals. Therefore, further analysis will cover only the distribution of metals in the various soils by the type of land use, depth and belonging to different types of the elementary geochemical landscapes (Fig. 6).

Concentrations of all metals more or less depend on the purpose of the respective land plot (Fig. 6). Thus, the maximum concentrations of zinc and copper in the surface humus soil horizon (0–20 cm deep) are characteristic of the superaqual landscape meadow, and those of lead – forest soil. In the lower soil horizon (60–80 cm deep) the maximum concentration of zinc is characteristic of forest, that of copper – forest and farmland, lead – grassland in the superaqual landscape position.

Differentiation of the heavy metals concerned in the landscape catena of grassland is quite clearly displayed when analysing the coefficients of their lateral differentiation which are calculated according to the formula:

$$K^i_{ld} = C^i_{sa} / C^i_{te}, \qquad (1)$$

where K^i_{ld} – coefficient of the lateral differential element ***i***; C^i_{sa} – concentration of the chemical element ***i*** in the soil of superaqual landscape (at the appropriate depth), mg/kg; C^i_{te} – concentration of the chemical element ***i*** in the soil of transelluvial landscape (at the same depth), mg/kg. The view of this in the examined areas of grassland is shown in Fig. 7. In many cases $K^i_{ld} > 1$, i.e. all the three metals show a trend of accumulation in the soil of superaqual meadow landscape. This is most consistent as regard zinc whose K_{ld} decreases from 2.56 at a depth of 0–20 cm to 1.21 at a depth of 60–80 cm. The coefficients of the lateral differential of lead and copper show the same tendency with several exceptions that are difficult to explain. Due to insufficient analytical material so far it has been impossible to explain the coefficient's values below 1.0.

Behaviour of chemical elements in the vertical profile of soils can be described by the coefficients of their radial differential which are calculated according to the formula:

$$K^i_{rd} = C^i_j / C^i_c, \qquad (2)$$

where K^i_{rd} – coefficient of the radial differentiation element ***i*** in the respective elementary landscape; C^i_j – concentration of the chemical element ***i*** in the soil horizon ***j***, mg/kg; C^i_c – concentration of the chemical element ***i*** in parent rocks, mg/kg. The vertical differential of elements in forest soil in presented in Fig. 3. As the Fig. shows, it is quite diverse: zinc and copper that are distinguished by better solubility and mobility in acid (pH = 5.3–6.5) forest soils are mainly de-alkalified and eliminated from parent rocks ($K^i_{rd} < 1$) by parent rock processes. Dealkalisation is especially active in the topsoil horizon as deep as possible with podzolic processes occurring. Lead, as a chemically less mobile element, differently from zinc and copper, is accumulated in all horizons of soil, compared with parent rocks, especially in mould horizon A1, which is enriched with the total carbon and humus.

The vertical differential of Zn, Pb and Cu displays itself in a somewhat different way in the position of transelluvial landscape, close to elluvial one (Fig. 8). First, differentiation here is contrast (K^{Zn}_{rd} is hardly above 1.6). Second, unlike in the case of forest soil, lead is also among de-alkalised chemical elements and its minimum concentration coincides with the minimum concentration of the total carbon in podzolic soil horizon A2. The illuvial soil horizon B is marked by increased concentrations of lead and copper. So far the minimum of Pb and Cu concentrations under the illuvial horizon B has not been quite clear. Taking account of the structure typical of the concrete soil profile, it can be preliminary assumed that in this case the process of suffosia, which quite often occurs in transelluvial landscapes, takes place and is activated by a low water permeability of clayey parent rocks.

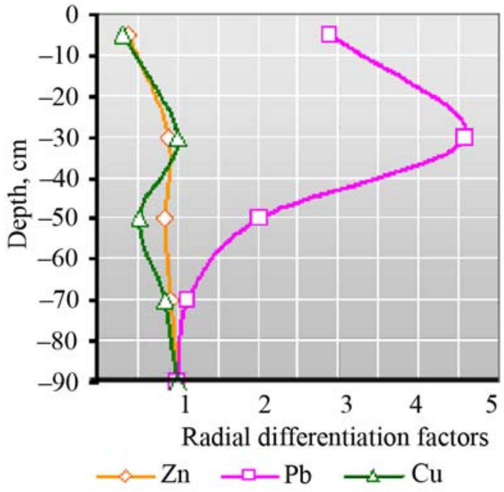


Fig. 6. Heavy metals in forest soil profile diferentiation

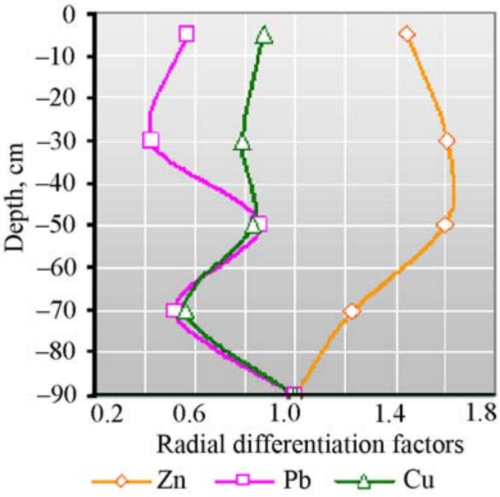


Fig. 7. Heavy metals in first grassland soil profile diferentiation

It is common knowledge that superaqual water migration landscapes of class H^+ are normally described as the place of accumulation of chemical elements which are de-alkalified and leached from elluvial and transelluvial landscape soils. This is favourably influenced by the general geochemical situation in them: the mechanical hydrodynamic and sorptive geochemical barriers related to the accumulation of clay minerals and humus strengthen, the surface and intra-soil entry of water-soluble metal compounds is steady, and the thickness of soil and active filtration geochemical barrier in it is increased. Thus, the total carbon content in topsoil horizons up to a depth of 3–40 cm exceeds its respective concentration by 2.9–3.3 times in the 2nd transelluvial meadow landscape position and by 18.2 times in the illuvial horizon B.

No wander that metals are especially intensely accumulated and sorbed by humus from soil solution under such conditions. As Fig. 5 shows, zinc and lead are more actively accumulated, especially in humous soil horizon. In fact the reason for anomalous low concentration of lead in the upper part of this horizon is not quite clear. Most probably this can be explained by the stability of fulvic complexes of the metals under review in slightly acid (pH ≈ 5.0) medium. According to R. Brooks, the stability of their compounds under such conditions corresponds to the line Cu > Pb >> Zn. This means that under the conditions of transelluvial landscape Cu and Pb would better migrate in organic complexes (and less of them would remain in the composition of this soil). In addition, unlike Zn, they could easier surmount the alkaline geochemical barrier of superaqual landscape soil, particularly lead.

Like in the case of transelluvial landscape, the minimum of geochemically more mobile Zn and Cu of not quite clear origin is seen here above clayey parent rock, which, like previously, is preliminary related to the processes of leaching and increased water metabolism that is close to suffosia.

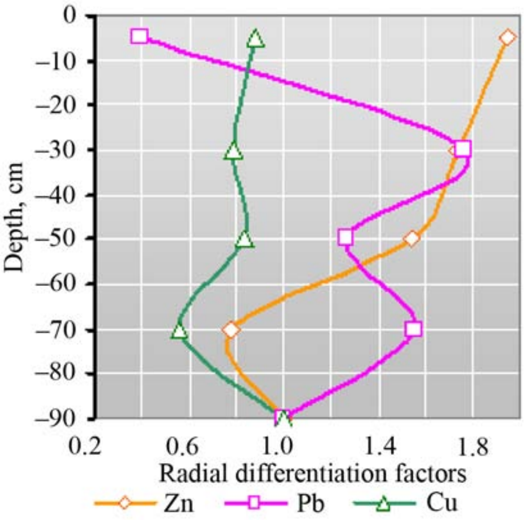


Fig. 8. Heavy metals in second grassland soil profile diferentiation

Acknowledgements

Scientific research was carried out under implementation of the projects funded by the Agency for International Science and Technology Development Programs in Lithuania under COST 639 action "Greenhouse gas budget of soils under changing climate and land use (BurnOut)"

4. Conclusions

1. As determined by the performed experimental research, the content of carbon in forest soil is inversely proportional to the content of pH. The data correlation coefficient was equal to –0.345. The dependence of carbon content was most clearly displayed in composite samples of soil with the correlation coefficient –0.25. Therefore, it can be stated that when regulating metabolism in soil, pH determines the processes of mineralisation and microorganism nutrition of carbon contained in soil. An important role is also played by leaching of heavy metals to deeper soil layers. When identifying

the leaching of heavy metals account can be taken of the granulometric composition of soil which highly determines the content of organic matter in soil. Apart from that, both metals and organic matter of soil closely correlate with clay minerals in soil. These minerals are distinguished by sorbtive properties.

2. The performed comparison of carbon contents in different soils showed the highest contents in the first plot of meadow. The average value of the total carbon in deep samples was 7.45%, and that in composite samples – 7.27%. Comparison of the identified contents with other analysed types of soil shows that the carbon content in deep samples from the 2nd plot of meadow was by 1.35 times lesser, and in composite soil samples was by 1.45 times smaller than in the first plot of meadow. In forest soil the total carbon content was 1.45% smaller than in the first plot of meadow and 0.86% smaller than in deep soil samples. Arable soil by its carbon content was similar to the soils of forest and the 2nd plot of meadow. The carbon content in deep soil samples was by 1.26 times bigger in arable soil and by 1.09 times bigger in composite samples. When compared to forest soil, the total carbon content in deep samples was by 1.08 times bigger in arable soil and by 1.09 times bigger in composite samples.
3. The performed analysis of heavy metal migration in forest soil determined a tendentious geochemical barrier. Due to this barrier the accumulation of both heavy metals and carbon takes place at a depth of 40 cm. This barrier is a layer of horizon B, also known as illuvial.
4. The performed research also identified a dependence of carbon content and pH change in arable soil. However, due to soil cultivation geochemical barriers are difficult to evaluate as at a depth of up to 26 cm the natural humous horizon A is replaced with horizon AA. Depending on the type of ploughing, part of elluvial horizon A_2 underneath horizon A_1 (E) was also ploughed. It was determined that the carbon content was more related to the content of lead. As regards other metals in question which are more mobile in soil than lead, a geochemical barrier was identified at a depth of 40-60 cm.
5. Upon analysing the data of meadow soil a phenomenon identical with arable soil was identified. Such a coincidence is possible as the meadow was a plough-land. The current age of the meadow is around 8 years. A change in carbon content was close to an increase in lead concentration in soil. The analysis of pH dependence on carbon content produced the clearest tendency in composite soil samples of the first plot and deep samples of the second plot.
6. The lateral and radial (vertical) differentiation of all the analysed chemical elements (Zn, Pb, Cu) was more or less displayed in the soils of all researched geochemical landscapes and the coefficient of lateral or radial differentiation, respectively, can be used for its quantitative description.
7. The lateral differential of the aforementioned metals in landscape catena transelluvial – superaqual landscapes manifests itself through their accumulation in the soil of superaqual landscape, particularly in its superficial horizons with the most significant differentiation coefficient of zinc (2.56 at a depth of 0-20 cm). In deeper horizons of soil the values of the lateral differentiation coefficient are decreasing, in the majority of cases however showing a tendency of accumulation of metals.
8. The radial differentiation of the aforementioned chalcophiles in the soils of different elementary geochemical landscapes is displayed so that it quite clearly reflects the material composition of genetic horizons of the respective soils, the concentration of total carbon in them and the effect of activities of geochemical barriers related with them.
9. Revealing of quantitative peculiarities of the geochemical differentiation of elements in the particular types of soils and geochemical landscapes requires a much more representative analytical geochemical material, supplemented with the granulometric analysis of soils and parent rocks and specific research on the existence of chemical element forms in soils.

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BENDROSIOS ANGLIES PRIKLAUSOMUMO NUO pH NERIES REGIONINIO PARKO DIRVOŽEMYJE TYRIMAS IR VERTINIMAS

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Santrauka

Dirvožemis yra vienas iš svarbiausių gamtinių Žemės landšaftų posistemių, išimtinai svarbus žmogui kaip pagrindinis maisto išteklių šaltinis. Rūpinantis ateitimi, viena iš aktualiausių žmonijos problemų – išsaugoti Žemės dirvožemius, jų derlingumą ir normalią būklę vis didėjančio technogeninio poveikio ir gamtinių landšaftų degradacijos sąlygomis. Kaip papildomą neigiamą faktorių privalu įveikti prasidėjusio globalaus atšilimo pasekmes, su kuriomis neišvengiamai susidurs ir Lietuvos žemės ūkis. Straipsnyje siekiama atskleisti bendrosios anglies priklausomybę nuo pH, atkreipti dėmesį į klimato kaitos įtaką dirvožemio degradacijai.

Reikšminiai žodžiai: dirvožemis, bendroji anglis, pH, dirvožemio tyrimai.

ИССЛЕДОВАНИЕ И АНАЛИЗ ОБЩЕГО УГЛЕРОДА И ЕГО ЗАВИСИМОСТИ ОТ pH В РЕГИОНАЛЬНОМ ПАРКЕ «НЕРИС»

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Резюме

Почва является одной из важнейших подсистем природных ландшафтов Земли, имеющей особенно важное значение для людей в качестве основного источника пищи. Одной из наиболее неотложных задач, стоящих перед человечеством, обеспокоенным своим будущим, является сохранение почв Земли, их плодородия и здорового состояния в условиях усиливающегося техногенного воздействия и деградации природного ландшафта. При этом придется преодолеть и уже начавшееся глобальное потепление, которое неизбежно коснется литовского сельского хозяйства. В статье предпринята попытка выявить зависимость общего углерода от pH, а также обратить внимание на последствия, наносимые изменением климата общему углероду, а также на деградацию почв.

Ключевые слова: почва, общий углерод, pH, исследование почв.

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