Original paper

PEDOCLIMATIC CONDITIONS OF SWEET CHESTNUT (*CASTANEA SATIVA* MILL.) USED FOR AGROFORESTRY SYSTEMS IN SLOVAKIA

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Abstract

Pedological and climate (agro-ecological) conditions of sweet chestnut (*Castanea sativa* Mill.) trees were tested on the pilot research-demonstration plot of Suchá and Parnou (soil survey and laboratory analyses). Potential of sweet chestnut for agroforestry can generate very interesting and promising commodity for farmers in terms of fruit and wood production. Methodology is based on identification of agro-ecological conditions of the sweet chestnut (*Castanea sativa* Mill.) growing and proposal of areas suitable for these trees planting (ranked as very suitable, suitable, and unsuitable). The land evaluation units (BPEJs (© VÚPOP Bratislava) and their components were separately evaluated based on agro-climate region, soil type, soil texture, sloppiness, exposure, soil depth, and skeleton content. The ArcGIS mapping software system was applied for mapping of the suitability of agricultural land for the sweet chestnut cultivation. Own soil survey was supported by soil sampling and analyses of soil properties. By results only 610,011 ha from agricultural land acreage are very suitable for sweet chestnut cultivation in Slovak Republic, and 765,558 ha is moderately suitable. This identification of areas can support creating methodologies modifying national legislation that allow the creation of the new agroforestry systems in Slovakia in accordance with the European Union legal order. It can be state that his woody plant is very promising for agroforestry systems in Slovakia.

Keywords: sweet chestnut (*Castanea sativa* Mill.), agroforestry, suitability of agricultural land, Slovakia

INTRODUCTION

Agroforestry systems are traditional land use systems that were and are used in Europe, and over the world (Riguerio-Rodriguez, McAdam, Mosquera-Losada (eds) 2009, MacDicken, Vergara (eds) 1990, Gold, Garrett 2009). They can be defined as those land use systems which involve two main components – trees/shrubs and an agricultural crop (including pasture) and are artificially managed (Shepard 2013). Agroforestry is a system of combining perennial crops to get multiple benefits and yields within an area. By integrating crops that mutually support each other and use space efficiently, the benefits to the farm and farm resilience grow (Mosquera-Losada 2009, Gordon, Newman, Coleman (eds) 2018, Newman, Gordon 2018). There are several strategies in the agroforestry lexicon: silvopasture – grazing livestock within tree crops (Etienne (ed) 1996, Boron 2005, McAdam 2005, Peri *et al*. 2018, Smith *et al.* 2022), alley cropping – alternating rows of perennial trees and/or shrubs with annuals, herbaceous perennials (Garrett, McGraw & Walter 2009) or even a nursery (MacFarland 2017); and riparian buffer production – where crops suitable for streamside conditions are grown for both farm yields and conservation value (Trozzo, Munsell, Chamberlain 2014, Huxley (ed) 1983). Other strategies include windbreaks, hedge-

rows, and forest farming (Blažejová, Pástor, Martiník 2020). Agroforestry systems can be implemented at a temporal and spatial scale for a landowner who can use different agroforestry practices.

Since human interaction with the environment in Europe, it is very important and has occurred for a long time, there are different types of agroforestry practices in Europe that are named as silvoarable, forest farming, riparian buffer strips, silvopasture, improved fallow and multipurpose trees (EEA 2006, European Parliament 2020). A brief description of the main agroforestry practice components, i.e., trees and agriculture (including pasture and livestock) in Europe will give an overview of several cases in Europe like in Swiss (Buttler, Kohler & Gillet 2008), in Italy (Pardini 2008), in the USA (Garrett (ed) 2009), in Spain (Roces-Diaz *et al.* 2018), in United Kingdom (Newman, Pilbeam & Briggs 2018), in China Chang, Wang, Wu, Zhu & Peng (2018),

Agroforestry systems, which are sustainable and multifunctional, provide many environmental benefits. They contribute to climate change adaptation and mitigation, protect the soil, enhance biodiversity, and improve the overall condition of the landscapes (Kidd, Pimentel (eds) 1992, MaDicken, Vergara (eds) 1990). That way, they are also beneficial to the local rural economy, as those improved landscapes offer cultural and recreational opportunities (Gordon, Newman, Coleman (eds) 2018). But whatever the strategy, a key distinction between agroforestry and other types of farming and forestry systems are that they are intentional, intensive, interactive, and integrated.

In agriculture of the Slovak Republic, in relation to the Common Agricultural Policy measures agroforestry systems will play a crucial role in solving the current problems of sustainability (Jankovič 2015, Jankovič, Hrebík 2016, Pekárová, 2011, Pekárová 2023). Agroforestry system can use several tree/shrubs species as is stated in Bakay, Pástor (2014), Bakay, Kollár, Pástor (2014), and Bublinec (2002).

Sweet chestnut (*Castanea sativa* Mill.) is one of the oldest trees in the world. In all southern European countries where the chestnut is an economically important fruit tree, from Portugal in the west through Spain, France, Italy to Greece and Turkey in the east, it is grown in hundreds of varieties bred for specific fruit properties (Bounous *et al.* 2001). Each country has its domestic old varieties, selected from local sweet chestnuts grown in the area for several centuries. They are regional varieties adapted to local conditions, especially altitude and exposure. *Castanea sativa* Mill. is one of the oldest introduced trees also in Slovakia with a long tradition of cultivation since the 13th century (Benčať 1960, Adamčíková *et al.* 2014). Among the oldest plantings of sweet chestnut in Slovakia is probably the Jelenec chestnut grove in the vicinity of Gýmeš Castle, which played a significant role in the spread of sweet chestnuts in the past. Pekárová (2021) lists location of sweet chestnut in Slovakia (Tab. 1).

Table 1

Locations of sweet chestnut in Slovakia (Pekárová 2021)

Geographic unit	**Cadastre**
Malé Karpaty Mts.	Bratislava, Svätý Jur, Pezinok, Modra, Častá, Radošina, Prašice, Lefantovce, Jelenec
Krupinská highland	Tlstý vrch, Horné Príbelce, Dolné Príbelce, Stredné Plachtince, Horné Plachtince, Modrý Kameň, Rovňany, Krná
Ondavská highland	Kalnište, Malé Ozorovce, Michalovce
Žitavská plain	Žirany, Topoľčianky

It is a long-lived deciduous tree with a wide crown and a deep root system. It is a distinctly light-loving tree, and from the point of view of climatic requirements, it is a typical mesothermal tree that occurs in the warmer highlands of Slovakia. It can survive several centuries in health and fertility.

According to several sources, the area of chestnut plantations in Slovakia having the character of fruit orchards is about 130 ha; of this number, about 95 ha are old – 100 or more-year-old plantings of seed origin. On an area of 35 ha, the plantings are 30–35 years old (Bolvanský *et al.* 2011). About 15 types of sweet chestnuts are known in the world, two Slovak varieties Bojar and Mistral persist in our country,

which is found e.g., in the Malé Karpaty Mts., on the Žitavská plain, the Krupinská highland or the Ondavská highland. A map of sweet chestnut localities is illustrated on the Fig. 1.

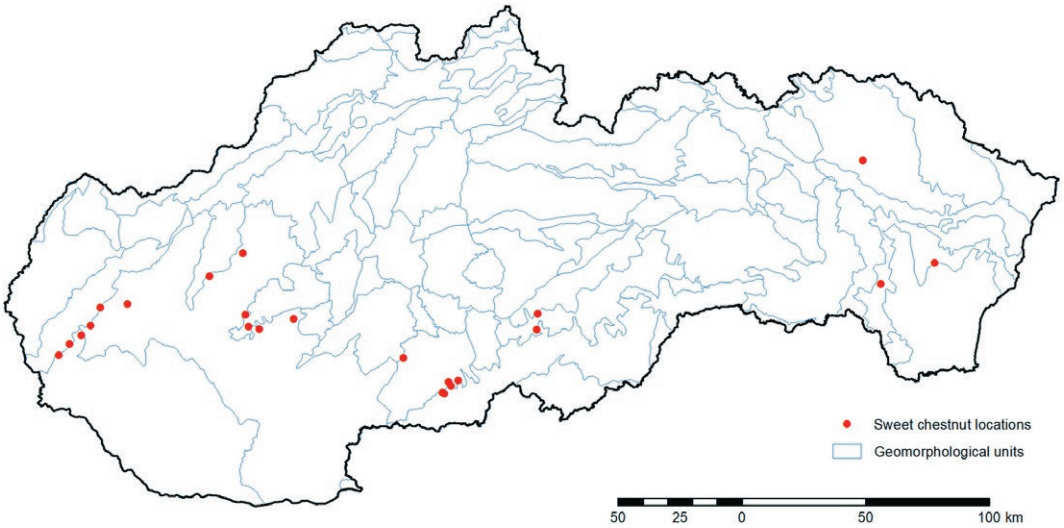

Figure 1 Map of sweet chestnut localities occurred in Slovakia

Even though in our conditions the chestnut has already rejuvenated naturally and the habitat conditions, i.e., the acidic quartzite base with weakly acidic soils and mild climate meet its ecological requirements, after many decades of unsparing plundering of chestnut forest stands, the gradual elimination of chestnuts in Slovakia is coming (Pekárová 2021). Sweet chestnut wood is comparable in quality to oak and beech wood. Its advantages include durability, stability, and resistance to moisture. Chestnut wood, like oak, also contains a lot of tannin. Wood is very durable and naturally resistant to external environmental factors (Bakay, Pástor 2015). Chestnut flowers have a very attractive scent and attract a wide variety of insects, especially pollinators. This species is an important pollinating and nectar-producing tree (Pástor *et al.* 2019). The honey is of high quality, as it provides the highest dry matter content of all types of honey, and its mineral content is unique in terms of quality and quantity.

The chestnut in agroecosystems also provides a habitat for a wide range of macromycetes which support increasing diversity and biodiversity (Conedera *et al.* 2004). Without constant care (regular mowing and cattle grazing) chestnuts are highly susceptible to damage and disease. They slowly wither and stop the production of quality fruits. Determination of the optimal chestnut conditions for the cultivation relating to agroforestry systems are partially introduced in several studies as Baptista *et al.* (2005), Bounous (2006), Cabanettes (2006), Conedera *et al.* (2004), and Gergeľ *et al.* (2020). An influence of abiotic conditions on chestnut damage by fungi (Knetigová 2010, Stoič, Yoshiyama, Kimura 2016) or effect of irrigation on chestnut management (Linhares *et al.* 2005) or effect on chestnut fertilizing (Mattoni *et al.* 2008, Pires *et al.* 2005, Poretela *et al.* 1999, Revord *et al.* 2022) was studied in several (mainly Mediterranean) European countries and in the USA. Similar works can be found in Slovakian studies Sobocká *et al.* (2022), Pástor *et al.* (2017), Pekárová Hanisko, Kováčiková (2013), Pekárová (2012), Vilček, Bedrna (2007).

Mature chestnut trees reach a height of up to 20 m and a width of 12–15 m. It is recommended to plant more varieties to ensure good pollination. Depending on the growing conditions there is chosen a clip of (10–15) × (10–20) m. In the first years, chestnuts are not cut, they must be allowed to grow freely. Chestnut bears the first fruits only after ten years. In our country, chestnuts are mainly propagated by seed fruit, and splitting is used to reproduce higher quality varieties. The trees bloom at the beginning of June and since they do not freeze, annual fruiting is ensured. The fruits are collected from the middle of September to the end of October.

Chestnuts are often attacked by parasitic fungi which then cause bark cancer and subsequent drying.

In such a case, it is advisable to make a vigorous rejuvenation cut and remove some main branches (Juhásová 1999).

The objective of the paper is recognition and identification of soil-ecological conditions of sweet chestnut to be used for potential cultivation in agroforestry systems of Slovakia. To meet this task, there was a need to establish pilot research-demonstration plot for verification of the natural conditions of chestnut plantation in cooperation with practitioners. The BPEJ database became as a basis for the compilation of synthetic map of the growing sweet chestnut suitability processed by GIS tools. It allows current modification of national legislation that facilitates the development of methodology of agroforestry systems implementation in Slovakia in accordance with the European Union legal order.

MATERIAL AND METHODS

Regarding all above mentioned conditions for sweet chestnut cultivation production-ecological parameters were identified and determined for potentially agroforestry management. This tree requires a deep, light to medium-heavy soil, aerated, well supplied with nutrients, with a slightly acidic reaction. Thanks to its deep roots, it can overcome even longer droughts without damage. The trees are not very resistant to frost, so it is not recommended to plant them in higher places. Average annual temperatures should range from approximately 9°C to 12°C with a sufficiently long dry summer period. It requires a minimum of 700 mm of rainfall per year with a wet spring and late summer when it begins its growing season, and the core takes its definitive shape.

Database of soil-ecological evaluation units (BPEJ © VÚPOP Bratislava) was recognized and applied for the map of suitability of sweet chestnut compilation. This database implicitly includes a vector layer which has been developed in the Soil Science and Conservation Research Institute in Bratislava in the last century at a scale of 1: 5,000 and digitized in 1993 (http://www.podnemapy.sk/default.aspx). This geo-referential database represents polygonal vector layer in ESRI Shape with a total of approximately 8,000 individual types of the BPEJs (Džatko, Sobocká, *et al*. 2009).

The soil-ecological evaluation unit (BPEJ) represents a quasi-homogeneous spatial unit expressed by a 7-digit code (Fig. 2) which involves the climate-soil-topography components: climate region, soil type, slope + exposure, stoniness + soil depth, and soil texture.

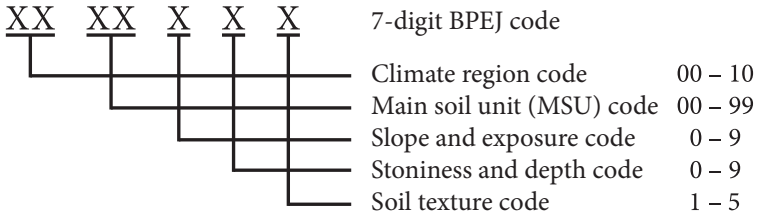

Figure 2 Structure of the BPEJ code

The BPEJ´s vectorised database presents an important tool widely used at the national level for several purposes, such as: assessment of the soil quality of agricultural land, legislative protection of soils, spatial planning, land take legislation, land consolidation, re-cultivation measures, and others.

In terms of processing georeferenced databases, the most modern tools of GIS products were used: GIS tools, commercial product ArcMap Version 9.3 f. ESRI (©ESRI) and using the BPEJ database (© VÚPOP Bratislava). Determined areas were calculated as overlapping vector layers to produce final map of the most suitable conditions of the chestnut spatial distribution. Areas of the suitability of the sweet chestnut were ranked:

1. very suitable
2. moderately suitable
3. non-suitable.

As the pilot research-demonstration plot was selected a sweet chestnut plantation in Suchá nad Parnou

(Trnava county). This chestnut farm is managed by Magula Ltd., and the cultivation is supplemented by animal farming (about 50 pieces). The area can be a representative climate-soil-growth conditions in the Danube Lowland concretely hilly land of the Trnava loess hills (Fig. 3).

The location Suchá nad Parnou was chosen because of the already established system of agroforestry, where long-term permanent cultures (sweet chestnut, domestic plum) are grown on one area and domestic animals are raised with a specific time and space arrangement. At the same time, there is a mutual ecological interaction between both components.

Figure 3. Agroforestry farm on the cadastre map

RESULTS AND DISCUSSION

Soil-ecological requirements of the sweet chestnut cultivation requires:

Climate: it thrives in areas with an average temperature of 8–9 °C, rainfall of 600–800 mm and a growing season of 160–190 days. The deep root system also overcomes the temporary dry summer period well. The limiting factor for sweet chestnut growth is low winter temperatures, as frosts below –25 °C can irreversibly damage especially young trees.

Soil: chestnut requires lighter, deep, moderately moist aerated soils, well supplied with nutrients, with a slightly acidic reaction (pH/KCl 5,6–65, pH/H_2O 6,1–6,5), a lighter and moderately moist aerated soil that is rich supplied with nutrients. Soil type most suitable for sweet chestnut plantation are (IUSS Working group WRB 2014): Fluvisols, Anthrosols, Chernozems, Mollic Fluvisols, Luvisols, and several Cambisols. These soils are supposed to have loamy or sandy-loamy or clay-loamy texture.

Location: the focus of its occurrence in Slovakia is the hilly areas of southern and southwestern Slovakia at an altitude of 200 to 500 m above sea level. The relief of the hills creates favourable conditions

for mitigating the differences between the annual and daily temperature fluctuations. In this way, the chestnut can survive the adverse effects of low temperatures, summer heat or lack of moisture. There is a need to think about the fact that it is a massive tree, so grow it only if you really have enough space. Sweet chestnut likes drier conditions in the summer and, conversely, requires plenty of moisture in the spring.

Date: 20. 10. 2022
Municipality: Suchá and Parnou, county Trnava
Locality: Vino Magula, Ltd., 1.2 ha plot (physical blocks: 1308/1sad, 1304/2sad)
Weather: air temperature 14 °C, sunny, without clouds
Height above sea level: 176 m
Sloppiness, exposure: slight slope, South-West exposure
Ground water level: 10 m
Current use: orchard, planting of sweet chestnut with a clip of approx. 10 m, permanent grass, approx. 50 pieces poultry (hens, geese), horses and cows on the property

Soil profile description:

Akj(p) (0 – 10 cm) – cultivated ploughing horizon, colour 10YR 4/3, loamy (30 – 45 % particles <0.01 mm), sub-angular structure, dry, loose, moderately biological life and rooting, sharp transition to

Akj(Bt)1 (10 – 35 cm) – cultivated amelioration horizon, colour 10YR 4/2 clayey-loamy, angular structure, dry, coherent, moderately biological life and rooting, sharp transition to

Akj(Bt)2 (>35 cm) cultivated amelioration horizon, colour 10YR 4/4, clayey-loamy, angular blocky structure, dry, coherent to compacted.

Figure 4. Description of the soil profile

Soil Taxonomy MSCS 2014: Kultizem Luvic (KTl) with Luvic Bt horizon signs, loamy, non-saturated, garden form, on consolidated loessal sediments.

Soil Taxonomy WRB 2014: ANTHROSOL (Luvic Loamic).

To verify soil-ecological conditions a soil survey, soil sampling and recognition of the soil profile in the area of Suchá and Parnou were carried out on October 20th, 2022. The village of Suchá nad Parnou is in the Trnava Hills, partly in the valley of the Podháj and Parná streams. The village with an area of 1,438 ha is located at an altitude of 161–231 m, the centre of the village at an altitude of 174 m. The farm is managed by Magula Ltd. On the 1.2 ha area, and the cultivation is supplemented by poultry, horses, and cows farming (about 50 pieces).

The soil profile (Fig. 4) was evaluated and classified according to Morphogenetic Soil Classification System of Slovakia (Societas pedologica slovaca, VÚPOP 2014) and compared to the World Reference Base for Soil Resources (IUSS Working Group 2014).

Figure 5. Area of sweet chestnut in agroforestry farm Suchá nad Parnou

Figure 6. Sweet chestnut agroforestry is completed by poultry farming

Table 2

Soil laboratory analyses of the soil profile in 3 samples (961, 962, 963)
Sample No. 961 (Suchá nad Parnou 0–15 cm)

Soil properties	Value	Measure	Content evaluation	Method
pH/KCl	5.6	–	Slightly acid	STN ISO 10390
$N_{anorg.}$	3.21	mg/kg	Very low	continuous flow analyser
Cox	3.1	%	Very high	Walkey-Black
Humus	5.35	%	Very strongly humous	Recalculation
Carbonates	<0.50	%	Very slightly calcareous	Janko's lime meter
P (Phosphorus)	102	mg/kg	Convenient	Continuous flow analyser
K (Potassium)	347	mg/kg	Good	Zbíral: Soil Analysis I. (Mehlich III)
Mg (Magnesium)	532	mg/kg	Very high	Zbíral: Soil Analysis I. (Mehlich III)
Ca (Calcium)	2919	mg/kg	Good	Zbíral: Soil Analysis I. (Mehlich III)

Sample No. 962 (Suchá nad Parnou 10–30 cm)

Soil properties	Value	Measure	Content evaluation	Method
pH/KCl	5.49	–	Acid	STN ISO 10390
$N_{anorg.}$	2,21	mg/kg	Very low	continuous flow analyser
Cox	1.22	%	Moderate	Walkey-Black
Humus	2.1	%	Moderately humous	Recalculation
Carbonates	0,1	%	Very slightly calcareous	Janko's lime meter
P (Phosphorus)	114	mg/kg	Good	continuous flow analyser
K (Potassium)	133	mg/kg	Convenient	Zbíral: Soil Analysis I. (Mehlich III)
Mg (Magnesium)	418	mg/kg	High	Zbíral: Soil Analysis I. (Mehlich III)
Ca (Calcium)	2430	mg/kg	Good	Zbíral: Soil Analysis I. (Mehlich III)

Sample No. 963 (Suchá nad Parnou 30–60 cm)

Soil properties	Value	Measure	Content evaluation	Method
pH/KCl	5.87	–	Slightly acid	STN ISO 10390
$N_{anorg.}$	1.12	mg/kg	Very low	continuous flow analyser
Cox	0.66	%	Low	Walkey-Black
Humus	1.15	%	Slightly humous	Recalculation
Carbonates	0.05	%	Very slightly calcareous	Janko's lime meter
P (Phosphorus)	55.5	mg/kg	Low	continuous flow analyser
K (Potassium)	116	mg/kg	Low	Zbíral: Soil Analysis I. (Mehlich III)
Mg (Magnesium)	534	mg/kg	Very high	Zbíral: Soil Analysis I. (Mehlich III)
Ca (Calcium)	3346	mg/kg	High	Zbíral: Soil Analysis I. (Mehlich III)

According to pedological laboratory analyses, the soil profile is weakly acidic to acidic, with a very small supply of mineral nitrogen, with a high content of carbon and humus, non-carbonate with a suitable supply of nutrients (N, P, K, Mg, Ca) in the top horizon. Towards the depth there is an amount carbon and humus lower, weakly calcareous horizon with good content of nutrients except to magnesium (very high). In this aspect the given soil profile and its laboratory analysis meets conditions for cultivation of the *Castanea sativa* Mill.

In order to create a GIS layer of soil blocks suitable for growing sweet chestnut in agroforestry systems in Slovakia, it was necessary to identify and develop an analysis of the pedo-ecological requirements of chestnut on the soil, geomorphological and climatic conditions in the environment.

From the point of view of spatial analysis, a recognition of soil-ecological units (BPEJ) was carried out (Džatko, Sobocká *et al.* 2009) of the following parameters: 1. climatic region, 2. main soil unit, 3. slope, 4. exposure, 5. skeleton, 6. soil depth, and 7. soil texture. The suitability of the soil blocks in terms of requirements for growing chestnuts was categorized into three levels:

1. Non-suitable
2. Moderately suitable
3. Very suitable

GIS layer of soil blocks suitable for growing chestnut Suitability maps were developed using GIS tools ArcGIS (©ESRI) and using the BPEJ database (© VÚPOP Bratislava). In terms of processing georeferenced databases, the most modern tools of GIS products were used: GIS tools, commercial product ArcMap Version 9.3 f. ESRI. Determined areas calculated were as overlapping vector layers to produce final map of the spatial distribution (Tabs. 3, 4, 5, 6, 7, 8, 9).

Table 3
Climate conditions considering suitability pedo-ecological conditions of the *Castanea sativa* Mill.

Climate regions codes in the BPEJ (Džatko, Sobocká *et al*. 2009)		
Very suitable	**Moderately suitable**	**Non-suitable**
00, 01, 02, 03, 04	05, 06, 07	08, 09, 10

Table 4
Main soil units (BPEJ) considering suitability pedo-ecological conditions of the *Castanea sativa* Mill.

Main soil unit codes in the BPEJ (Džatko, Sobocká *et al*. 2009)		
Very suitable	**Moderately suitable**	**Non-suitable**
02, 06, 07, 17, 18, 19, 20, 22, 23, 25, 26, 30, 33, 36, 37, 44, 45, 46, 48, 49, 63, 64, 65, 73, 74	01, 03, 04, 08, 09, 11, 12, 13, 14, 15, 16, 21, 24, 31, 32, 34, 35, 38, 39, 40, 41, 42, 43, 47, 50, 51, 52, 53, 56, 57, 60, 61, 62, 66, 67, 68, 69, 70, 71, 72, 85, 88	10, 54, 55, 58, 59, 61, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 87, 89, 90, 91, 92, 93,94, 95, 96, 97, 98, 99, 00

Table 5
Sloppiness (BPEJ) considering suitability pedo-ecological conditions of the *Castanera sativa* Mill.

Sloppiness codes in the BPEJ (Džatko, Sobocká, *et al*. 2009)		
Very suitable	**Moderately suitable**	**Non-suitable**
0, 1	2, 3	4, 5, 6

Table 6
Exposure (BPEJ) considering suitability pedo-ecological conditions of the *Castanera sativa* Mill.

Exposure codes in the BPEJ (Džatko, Sobocká, *et al*. 2009)	
Very suitable	**Moderately suitable**
0, 1	2, 3

Table 7
Skeleton (BPEJ) considering suitability pedo-ecological conditions of the *Castanera sativa* Mill.

Skeleton codes in the BPEJ (Džatko, Sobocká, *et al*. 2009)		
Very suitable	**Moderately suitable**	**Non-suitable**
0, 1	2	3

Table 8
Soil depth (BPEJ) considering suitability pedo-ecological conditions of the *Castanera sativa* Mill.

Soil depth codes in the BPEJ (Džatko, Sobocká, *et al*. 2009)		
Very suitable	**Moderately suitable**	**Non-suitable**
0	1	2

Table 9
Soil texture (BPEJ) considering suitability pedo-ecological conditions of the *Castanera sativa* Mill.

Soil texture codes in the BPEJ (Džatko, Sobocká, *et al*. 2009)		
Very suitable	**Moderately suitable**	**Non-suitable**
2, 5	3	1, 4

As result was created a Map of agricultural land of Slovakia's for suitable for planting of the sweet chestnut (*Castanea sativa* Mill. Fig. 7).

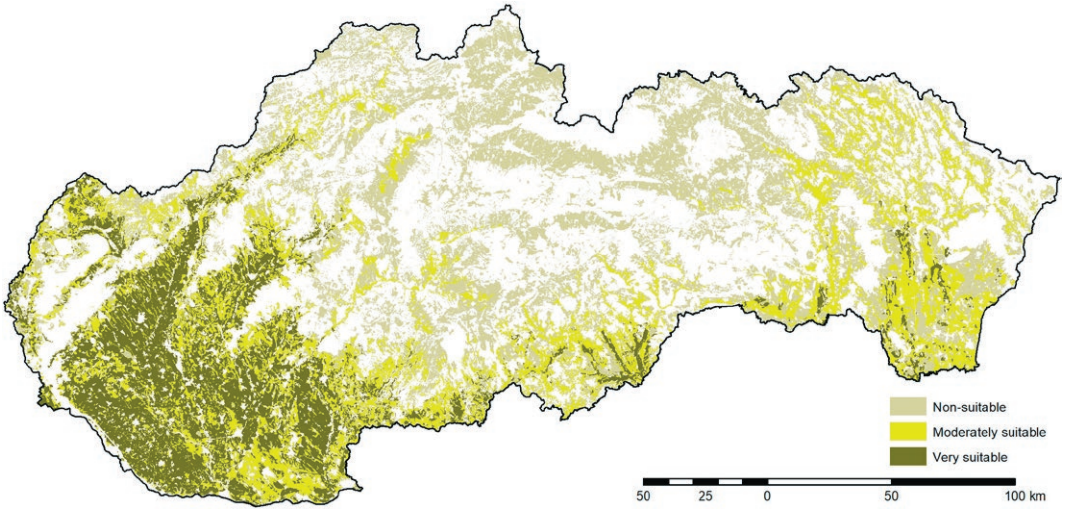

Figure 7 Map of agricultural land of Slovakia´s suitability for planting of the sweet chestnut (*Castanea sativa* Mill.)

The area of individual categories is shown in the following Tab. 10.

Table 10
Acreage of area diversified according to pedo-ecological suitability

Suitability	Sweet chestnut/m^2	Sweet chestnut/ha	Percentage (%)
Non-suitable	11724001025,151500000	**1 172 400,10**	46
Moderately suitable	7655882871,892140000	**765 588,29**	30
Very suitable	6100118343,635200000	**610 011,83**	24
Total:	25480002240,678900000	**2 548 000,22**	100

The presented results are similar to those published by Sobocká *et al* (2022). It is because a similar methodology for processing the BPEJ database was used, unique in our national conditions. It allows to map soil units and landscape components at a scale of 1:5,000 and to map soil types, soil subtypes and soil textures in detail. However, the results depend on the accuracy of this updated version, but the conditions for growing chestnut have been set and implemented in accordance with the above literature.

CONCLUSIONS

In Slovakia today, these promising trees face insufficient care from the state, as there are no specific management measures for them yet. It is possible to plant them in the open country focused on agroforestry systems. Creation of agroforestry systems with sweet chestnut on permanent grasslands, which would also be used as hay meadows, or pastures will enable combined and diversified production including farm animals with higher added value. It significantly will contribute to the preservation of the traditional agricultural landscape and is at the same time an extremely suitable tree for planting.

A map of the suitability of the sweet chestnut in terms of agro-ecological conditions for cultivation is presented. The suitability analysis showed a relatively large potential for the cultivation of the sweet chestnut in Slovakia. The areas delimited using GIS tools and BPEJ databases confirmed that the areas very suitable for cultivation are 610,011 ha and the areas moderately suitable are 765,0558 ha.

The purpose of the contribution is to support and develop methodological guidelines for the establish-

ment of agroforestry systems in Slovakia. In addition, it will support the application of new legislation for agroforestry implementation in the conditions of Slovakia.

We successfully classified this ecosystem and found that the traditional agroforestry systems are of major importance in providing ecosystem's services, as food provision or cultural services, but also biomass provision and climate regulation.

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