Research Paper

Perceived benefits from agroforestry landscapes across North-Eastern Europe: What matters and for whom?

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HIGHLIGHTS

- We identify benefits and values attributed to agroforestry landscapes across Europe.
- Agroforestry landscapes deliver multiple nature's contributions (NCP) to people.
- Non-material NCP are the most frequently acknowledged across all studied contexts.
- Relational values are crucial for people's quality of life across all contexts.

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ABSTRACT

Agroforestry landscapes are crucial to human wellbeing; however, they are in sharp decline across Europe. Improved understanding of the complexity of agroforestry landscapes within different biophysical, social-cultural, economic and governance contexts is essential for designing effective policy and management interventions that are more tightly aligned with societal expectations and aspirations. This paper identifies and compares values that people attribute to agroforestry landscapes across North-Eastern Europe, using case studies in Sweden, Latvia, Belarus, and the Russian Federation. We apply the multiple-value approach developed for the conceptual framework of the Intergovernmental Platform on Biodiversity and Ecosystem Services to an assessment of agroforestry landscapes. Using data from a total of 1634 face-to-face structured interviews, we (i) analyse and explore the preferences of diverse groups of respondents for agroforestry landscapes; (ii) identify a broad range of nature's contributions to people (NCP) that were attributed to agroforestry landscapes by respondents; and, (iii) analyse values of agroforestry landscapes across different contexts in NorthEastern Europe. We found that a highly heterogenous group of people – broadly irrespective of age, education, gender, place of residence, as well as political, economic, or social-cultural context – perceive agroforestry landscapes to be important to their quality of life. Respondents attributed multiple NCP to agroforestry landscapes, and non-material NCP are the most frequently assigned in all four countries. An absolute majority of respondents across all case studies considered relational values of agroforestry landscapes to be important for their quality of life with *identity* as the most often associated with agroforestry landscapes.

We discuss how relational values might be incorporated in policies and practices related to agroforestry landscapes in North-Eastern Europe.

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1. Introduction

Agroforestry landscapes in Europe, including its North-East, have evolved historically as tightly coupled social-ecological systems (Rigueiro-Rodríguez, McAdam, & Mosquera-Losada, 2009) where bio-physical elements, socio-economic variables, and institutional frame-works interact with values, traditions, and knowledge systems (Setten et al., 2012). These landscapes combine woody vegetation with crops and/or animal grazing and production through a set of diverse and partially simultaneous land-management activities, resulting in multiple tangible and intangible benefits for human societies (Fagerholm et al., 2016; Plieninger et al., 2015). Agroforestry landscapes currently occupy 15.4 million hectares across the European Union (EU) – 3.6% of its total territorial area (den Herder et al., 2017); much less unified and updated information is available about the extent and types of these landscapes in other European countries.

Agroforestry landscapes make multiple important contributions to biodiversity and to the quality of life of people (Bugalho, Pinto-Correia, & Pulido, 2018; Plieninger et al., 2015). This has been well documented at global (Jose, 2009) and EU levels (Fagerholm et al., 2019). However, a sharp qualitative and quantitative decline in agroforestry landscapes across the European continent has raised concerns across scientific, policy-making, and land management communities (Almeida, Azeda, Guiomar, & Pinto-Correia, 2016; Eichhorn et al., 2006; Godinho, Guiomar, & Gil, 2016; Plieninger et al., 2015). This decline is largely driven by the parallel processes of rapid intensification of agriculture and forestry in suitably fertile and accessible areas, and farmland abandonment in more marginal areas (IPBES, 2018). In EU countries, largely uncoordinated and at times even contradictory public policies and funding schemes have encouraged farmers to follow largely un-sustainable trajectories in agroforestry landscapes (Almeida et al., 2016; Pinto-Correia & Azeda, 2017). An important driver in this regard is the comparatively lower economic competitiveness of agroforestry-based farming systems in the context of delocalized, financialized and glob-alized markets (Mosquera-Losada et al., 2009; Torralba, Fagerholm, Hartel, Moreno, & Plieninger, 2018). In the case of Eastern European countries this process of landscape degradation is framed in the transi-tion towards a market economy following the break-up of the USSR in 1991, a political shift that has led to rapid land-use change, including land-use intensification, as well as the depopulation of rural areas leading to the loss of remaining cultural landscapes and traditional and local knowledge (IPBES, 2018). Based on these socio-cultural and historic-political differences, one should assume that across Europe the degradation of agroforestry landscapes ought to be perceived and valued differently by local populations and other relevant stakeholders.

This paper aims to identify and compare the perceived benefits attributed to agroforestry landscapes and their values across four countries in North-Eastern Europe – Sweden, Latvia, Belarus, and Russia. While many previous studies on agroforestry landscapes have covered EU countries and Switzerland (Rigueiro-Rodríguez et al., 2009), this is the first study that considers a EU/non-EU gradient also including Eastern European countries.

A number of empirical assessments of ecosystem services provided by agroforestry landscapes confirm their multi-functionality and rele-vance for biodiversity and human wellbeing (Garrido, Elbakidze, Angelstam, Plieninger, et al., 2017; Garrido, Elbakidze, & Angelstam, 2017; Kay, Graves, Palma, Moreno, & Herzog, 2019; Plieninger & Bieling, 2013; Pinto-Correia et al., 2018; Torralba et al., 2018). None-theless, given that people-nature interactions are a core characteristic of agroforestry systems, at least three sets of challenges can be identified for addressing the complexity of agroforestry landscapes using the ecosystem services framework. The first set of challenges is related to the interpretation of the types of 'services' that are provided by agroforestry landscapes, and the trade-offs incurred. Agroforestry landscapes are the result of a delicate balance of multiple human activities, transforming sensitive and valuable ecosystems. The multiple tangible and intangible

benefits derived should thus be considered as "social-ecological ser-vices" rather than services that are purely supplied by ecosystems and received by human societies (Huntsinger & Oviedo, 2014). In addition, the roles of farmers and land managers to deliver social-ecological ser-vices are often disregarded (Garrido, Elbakidze, Angelstam, Plieninger, et al., 2017; Garrido, Elbakidze, & Angelstam, 2017). Furthermore, some of these services become only apparent at the landscape scale, where patches with different densities and structures of land cover types are combined. Consequently, some authors have suggested moving to-wards "landscape services" for planning and management of ecosystems of strongly cultural nature (Termorshuizen & Opdam, 2018).

The second set of challenges is related to limitations in capturing the diversity of intangible benefits provided by agroforestry landscapes (Kay et al., 2019; Kadykalo et al., 2019). Numerous socio-cultural assess-ments have pointed out that various ecosystem services, particularly cultural services, essential for human wellbeing correlate poorly with, or cannot be placed within, any standard ecosystem service sub-category (Bieling et al., 2014; Fagerholm et al., 2020). This has resulted in an on-going debate regarding how to best assess, account for, and communicate many intangible benefits, especially cultural ones, with decision-makers, land managers and the general public (Fish, Church, & Winter, 2016).

The third set of challenges is connected to the incapacity of current, largely sectoral, policy frameworks and regimes to consider multiple values and multi-functionality (Díaz et al., 2018; Kay et al., 2019). One of the main concerns is that "the voices of those who benefit on the ground, or affect ecosystem services, or are affected by their use, are less heard" (p. 264, Jax et al., 2013). Inequity in addressing social values (Kenter et al., 2015) or disrespectful attitudes towards such values in decision-making processes often trigger conflicts in land management and governance, downgrading the efficacy with which decision-makers, land managers or landowners perceive and address sustainability chal-lenges (Díaz et al., 2015; Pascual et al., 2017; UNEP, 2014).

Considering these three sets of challenges, the assessment of the multiple tangible and intangible benefits that people attribute to land-scapes is increasingly acknowledged as a key research priority for the sustainable governance and management of agroforestry landscapes (Arias-Arévalo, Martín-López, & Gómez-Baggethun, 2017; Plieninger, Dijks, & Oteros-Rozas, & Bieling, C., 2013). Gaining a better under-standing of such values is an essential step to more effectively disen-tangle the societal relevance of agroforestry landscapes under different social-cultural, economic, and governance conditions (Fagerholm et al., 2016; Plieninger et al., 2015). Furthermore, it is expected that the acknowledgment of a broader set of values will aid the design of alter-native management and governance options that are best adapted to meet complex and changing sets of expectations and aspirations. In Europe, some studies were applied in agroforestry landscapes, but these were located mainly in Southwestern Europe and have been performed mainly at the local or regional scales (Surová & Pinto-Correia, 2008; Garrido, Elbakidze, Angelstam, Plieninger, et al., 2017; Garrido, Elba-kidze, & Angelstam, 2017). However, cross-regional comparative studies from all over the Europe are urgently required to better inform conservation, sustainability and rural development policies (Plieninger et al., 2015).

In response to these requirements, the objectives of this cross-regional comparative analysis are:

1. To contrast differences in the preferences for agroforestry landscapes between people in four North-Eastern European countries, both within and out with the EU – Sweden, Latvia, Belarus, and Russia.
2. To identify and compare sets of tangible and intangible benefits attributed to agroforestry landscapes by respondents with different demographic and socio- cultural characteristics across all case study areas.
3. To analyse values linked to specific tangible and intangible benefits across different economic, political and socio-cultural contexts.

To tackle these objectives, we applied the nature's contributions to people (NCP) analytical paradigm. This is a novel approach under the scientific line of the multiple-value approach (Díaz et al., 2018; Pascual et al., 2017) that was developed for the conceptual framework of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (UNEP, 2014). The IPBES multiple-value approach acknowledges culturally different worldviews, visions, and strategies to achieve an improved quality of life by considering a widened rage of values of nature, including the values attributed and perceived by indigenous people and local communities (IPBES, 2018). In the context of our study, values are analysed via proxies represented by the relative importance assigned by local residents to specific types or states of agroforestry landscapes for an improved quality of life. The multiple-value approach identifies two main value classes: non-anthropocentric and anthropocentric (Díaz et al., 2018). Non-anthropocentric, or intrinsic, values are inherent to nature and are thus independent of human action. In contrast, anthropocentric values place human activities at their core, and can be simultaneously understood in terms of their instrumental and relational qualities (Pascual et al., 2017; Díaz et al., 2015). The instrumental or utilitarian values are associated with tangible and intangible benefits that allow people to achieve an improved quality of life, be it through the production of a commodity, aesthetic pleasure, or spiritual enlightenment. In contrast, relational values are those that arise during or as a result of the processes of people being in, or interacting with, nature (Chan et al., 2016; Díaz et al., 2015; Pascual et al., 2017). NCP are the most central elements of a multiple-value approach (Díaz et al., 2018). NCP are defined as "all contributions, both positive and negative, of living nature (diversity of organisms, ecosystems and associated ecological and evolutionary processes) to people's quality of life" (Díaz et al., 2018, p. 270). The NCP approach recognizes the central role that culture and local/indigenous knowledge play in defining all links between people and nature (Díaz et al., 2018), and thereby aligns closely with a consideration of landscapes as inherently social-ecological and multifaceted phenomena (*sensu* Matthews & Selman, 2006).

2. Methodology

2.1. Case study areas

The cross-regional comparison study was conducted in four countries – in Dalarna, Västmanland and Örebro counties in Sweden; the Zemgale Planning Region in Latvia; the Vitebsk region in Belarus; and the Pskov region in the Russian Federation (hereafter – Russia) (Fig. 1 and Table 1). The criteria for selecting these case study areas include capturing a diverse range of agroforestry landscapes, which adequately reflect the socio-economic heterogeneity across Europe (from landscapes in countries with historically consolidated market economies – Sweden – to countries with transitioning economies within the EU – Latvia – and outside of the EU – Belarus and Russia); diverse land management approaches (from traditional agroforestry landscapes to small-scale self-subsistence landscapes), and historical trajectories (Tables 1 and 2). We focused on three types of European agroforestry landscapes based on livestock agroforestry practices (*sensu* den Herder et al., 2017) that are very common in North-Eastern Europe both within and out with the EU: (1) livestock-based agroforestry landscapes with woodlands; (2) livestock-based agroforestry landscapes with arable land and sparse trees; and (3) livestock-based agroforestry landscapes with grassland and sparse trees. A comparison across a broad span of socio-cultural and historical-economic contexts allows us to explore the potential commonalities and divergences encountered in social values of agroforestry landscapes across North-Eastern Europe (Table 2).

Dalarna, Västmanland, and Örebro counties in central Sweden (Fig. 1) are representative of the country's complex land-use history, beginning with the clearing of old-growth forests for agricultural and animal husbandry more than 5000 years ago. While wood, metal and water once served as the primary basis for forest and agricultural commodity production, immaterial values are lately becoming an increasingly valuable asset for rural development. Livestock-based agroforestry landscapes with woodlands as well as those with arable land and sparse tree cover are the two dominant agroforestry types in the area (see Table 2). These landscapes are renowned for their biodiversity, as well
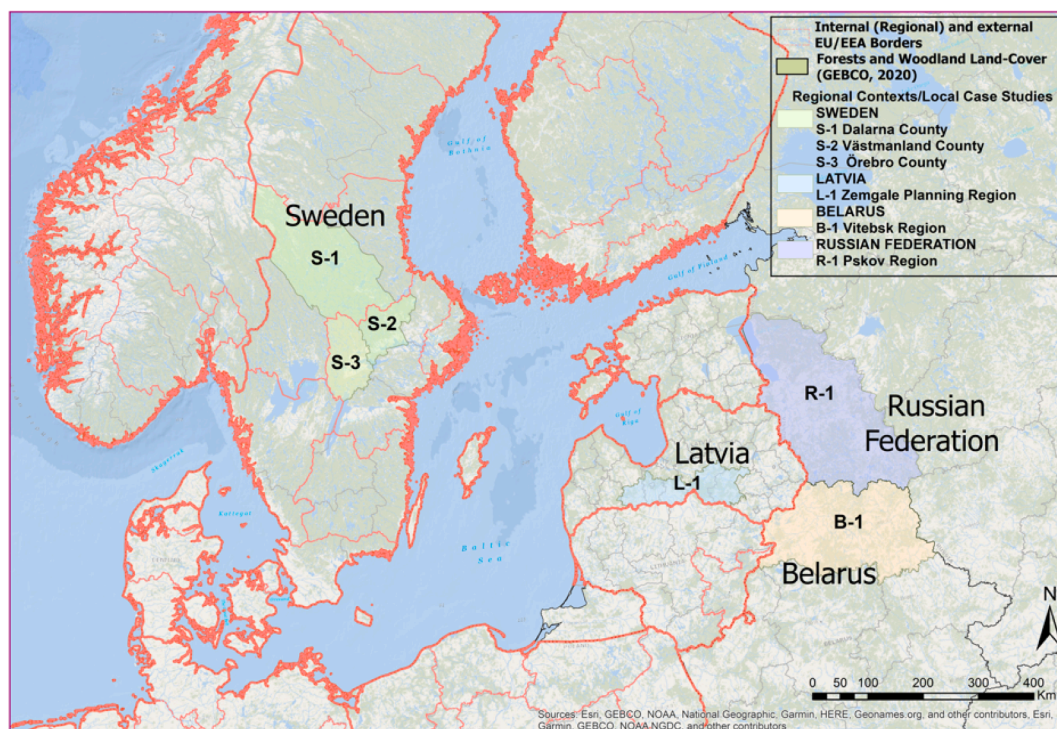

Fig. 1. Location of case studies in four countries along an EU-non-EU gradient: Sweden, Latvia, Belarus, and Russia.

Table 1
Main characteristics of the case study areas in four European countries – Sweden, Latvia, Belarus, and Russia.

Country	Sweden	Latvia	Russia	Belarus
Name of study area	Dalarna, Västmanland, Örebro counties	Zemgale Planning Region	Northern part of Pskov Oblast	Western part of Vitebsk region
Size (km^2)	41 651	10 732	30 500	22 300
Population density (persons per km^2)	32	23	12	31
Human population trend	Ageing and declining	Out-migration and urbanization	Out-migration and urbanization	Out-migration and urbanization
Land ownership	Private	Public/private	Public	Public
Dominant land covers	Forest	Forest and arable land	Forest	Forest
Dominant agroforestry practices	Livestock-based agroforestry on woodland	Livestock-based agroforestry on woodland	Livestock-based agroforestry on woodland and grassland	Livestock-based agroforestry on woodland
	Livestock-based agroforestry with arable land	Livestock-based agroforestry with arable land	Livestock-based agroforestry with arable land	Livestock-based agroforestry with arable land
Current trends in agroforestry practices	Protection and abandonment	Subsistence and abandonment	Subsistence	Subsistence
EU membership	1995	2004	No	No
USSR subject	No	1940–1991	1917–1991	1922–1940

as their cultural heritage and recreational values (Garrido, Elbakidze, Angelstam, Plieninger, et al., 2017). However, during the last few decades, land-use changes, depopulation of rural areas, and the abandonment of traditional practices have led to the deterioration of the values that are generally attributed to these landscapes (Garrido, Elbakidze, Angelstam, Plieninger, et al., 2017).

The Zemgale Planning Region in Latvia (Fig. 1) covers an area of 20 administrative districts, which corresponds to 17% of the country. Forestry and agriculture are the primary land-use practices. Two types of agroforestry landscapes – livestock-based agroforestry landscapes with woodlands and livestock-based agroforestry landscapes with arable land and sparse tree cover – occur in the region (Table 2). Agroforestry landscapes have been essential for the subsistence of local populations for centuries, providing multiple tangible benefits crucial to food security of the majority of the rural population. However, during the post-Soviet transition period, subsistence agroforestry practices were largely abandoned or transformed due to the intensification of land use, and the rapid depopulation of rural areas (Elbakidze, Hahn, et al., 2018).

The Vitebsk region is located in the north of Belarus (Fig. 1). Agricultural land covers about half of the region. During the Soviet era, conventional agricultural production was the mainstay of the regional economy, followed by forestry. A large proportion of collective agricultural state forestry enterprises remain in operation today. Three types of agroforestry landscapes remain – livestock-based agroforestry landscapes with woodlands, livestock-based agroforestry with arable land and a sparse tree cover, and livestock-based agroforestry with grassland and a sparse tree cover (Table 2). A majority of rural inhabitants in the region continue to maintain subsistence-oriented agroforestry. Simultaneously, the abandonment of the least productive agricultural lands, including small-scale farms, has become a widespread phenomenon in the region during the past decade (Elbakidze, Hahn, et al., 2018).
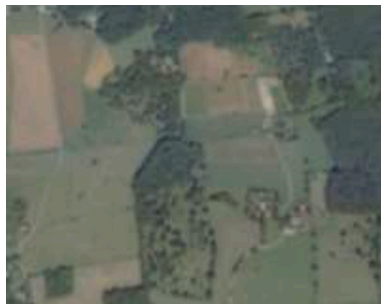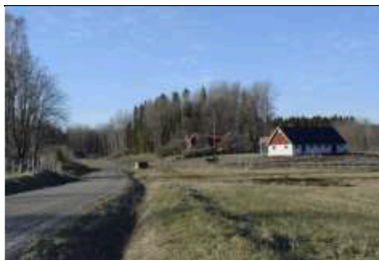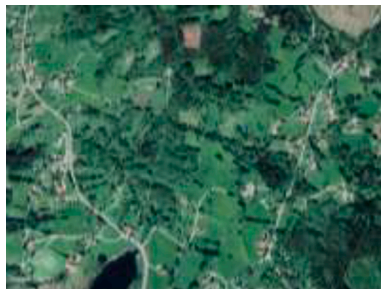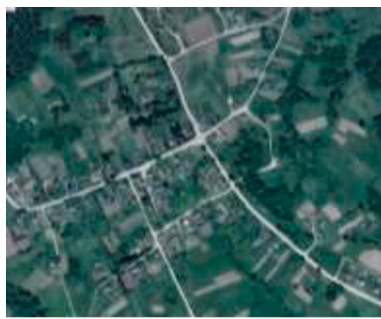
The Pskov region is located in north-western Russia (Fig. 1). Until the collapse of the Soviet Union in 1991, collective agriculture remained a significant branch of the regional economy, while rural people maintained self-subsistence small-scale agroforestry practices. As in the Belarusian case study, the predominant agroforestry landscapes still found in Pskov are livestock-based agroforestry landscapes with woodlands, livestock-based agroforestry with arable land and sparse tree cover, and livestock-based agroforestry with grassland and sparse tree cover (Table 2). The current trends in land use and landscape change are similar to those in Latvia – agroforestry landscapes are increasingly abandoned due to multiple social-ecological drivers, mainly the extremely rapid transition towards a free-market economy, the intensification of land use and related depopulation of rural areas (Elbakidze, Hahn, et al., 2018).

2.2. Photograph-based qualitative survey

We conducted photo-based surveys in all four case studies. This technique has been applied in a diverse set of participatory social science and landscape research contexts (e.g., Dandy & van der Wal, 2011; Milcu, Sherren, Hanspach, Abson, & Fischer, 2014), including for understanding preferences or social values for ecosystem services (García-Llorente et al., 2012).

The survey was developed and conducted using Survey Monkey software (www.surveymonkey.com), and consisted of three sections (see Appendix 1). In the first section of the survey, respondents were asked to rank the relevance and meaning of the tangible and intangible benefits of landscapes for their quality of life, using a predetermined list of four categories: 'important', 'slightly important', 'not important', and 'do not know'. Benefits derived from natural and semi-natural land cover types were presented as a list of ecosystem services based on the Millennium Ecosystem Assessment (MA, 2005). This first section of the questionnaire was crucial to equip each respondent with the whole spectrum of tangible and intangible benefits as potential choices for the last block of questions. The second section of the survey included respondents' personal data. In the third section of the survey, respondents were asked to choose amongst photographs of land cover types that were most important for their quality of life among a set of photos of the dominant land covers within each study area. Each land cover was considered as so called 'service-providing unit', i.e. "ecosystem structures and processes that provide specific services at a particular spatial scale'' (Scholes, Reyers, Biggs, Spierenburg, & Duriappah, 2013) and mirrored the dominant landscape types in the case studies (see Table 2 for photos of the agroforestry land covers that reflect the agroforestry landscape types in the study areas). The set consisted of photographs that captured a land-use gradient including natural/semi-natural forests, forests undergoing different forest management intensities, agroforestry systems, large-scale agriculture, rural and urban areas and roads, and water objects (lakes, rivers, and the sea). The range of graphic materials used consisted of 26 photographs of dominant land covers in the Swedish case study, 28 in the Russian case study, and 27 in both the Latvian and Belarusian case studies (see Appendix 2). Following the photo selection, respondents were asked to explain their choices in terms of what benefits the chosen land cover(s) provided to their quality of life. Open-ended responses with related comments were recorded in the field and later categorised as NCP by the researchers. Respondents were randomly approached in various public and private places where the daily social life and routines of residents mainly take place. Interviewers sought to intentionally balance the socio-demographic characteristics of respondents during the data collection process, in terms of age distribution and gender, in order to obtain a sufficiently representative sample.

Table 2

Dominant agroforestry landscapes in the selected case study areas located in Sweden, Latvia, Belarus, and Russia.

Agroforestry landscapes in study areas: main components and products	Agroforestry landscape patch	Agroforestry landscape (satellite images from Google Earth)
Livestock-based agroforestry landscapes with woodlands (case studies in Sweden, Latvia, Belarus, and Russia): Agroforestry systems with grazed woodlands (with *Quercus robur*) and grasslands with sparse trees. There landscapes are traditionally used for animal (sheep and cows) husbandry, including grazing and hay-making. Main products for household consumption and for commercial purposes are meat, milk, fodder, wild food, wild game, and wood.		
Livestock-based agroforestry landscapes with arable land and sparse trees: (i) case study in Sweden, and (ii) case studies in Latvia, Belarus and Russia: (i) Agroforestry systems with grassland for hay-production and grazing areas for cows and horses, with arable land and with fruit trees and patches of forests. Main products for subsistence and commercial purposes are meat, milk, fodder, fruits, vegetables, wood and firewood.		
(ii) Agroforestry systems with meadows for hay, grazing areas for cows; fruit and vegetable gardens; and sparse trees for fire-wood. Main products for household consumption and local trade are milk, meat, eggs, fruits, vegetables firewood, wild food (e.g., wild berries, mushrooms, sap), and wild medicine.		
Livestock-based agroforestry landscapes with grassland and sparse tree cover (case studies in Belarus and Russia): Agroforestry systems with meadows for hay, grazing areas for cows and horses; and sparse trees for fire-wood. Main products for household consumption and local trade are hey, firewood, milk and meat, wild food (e.g., wild berries, mushrooms, sap), and wild medicine.		

In total, 1634 local people were interviewed across Sweden (N = 400), Latvia (N = 429), Belarus (N = 405), and Russia (N = 400) in 2015 and 2016, all of which were local residents. All interviews were conducted face-to-face in native languages in all case studies. The socio-demographic characteristics of respondents in the four case study regions are synthesized in Appendix 3.

2.3. Determination of NCP categories and their values

In our study, we used a generalizing interpretation of the NCP framework (Díaz et al., 2018), employing a universally applicable set of NCP that is arranged into three partially overlapping groups –

regulating, non-material and material – and covers 18 NCP categories, many of which might belong to several NCP groups.

First, we converted all tangible and intangible benefits that respondents attributed to agroforestry landscapes during the surveys into NCP categories – non-material, material, and regulating – and their groups (e.g., supporting identity, food, climate regulation etc.) using the generalizing perspective provided by Díaz et al. (2018) as a reference (Table 3). Some NCP categories were included in two groups simultaneously. For example, various food products (e.g., meat, hay, eggs, milk, berries etc.) that respondents attributed to agroforestry landscapes were included in the material group of NCP, whilst some respondents also acknowledged that these tangible benefits from agroforestry landscapes

Table 3

'Converting' tangible and intangible goods and services that were attributed to agroforestry landscapes into the NCP categories and NCP groups (see Diaz et al. 2018 as a reference).

Tangible and intangible goods and services attributed to agroforestry landscapes	NCP categories	NCP groups
Sense of place	Supporting identity	Non-material
Cultural heritage		
Spiritual meaning		
Opportunity for recreation	Physical and psychological experiences	
Opportunity for health		
Opportunity for learning and education	Learning and inspiration	
Inspiration		
Species, habitats	Maintenance of options	
Food	Food and feed	Material and non-material
Fodder		
Wild food		
Wood products	Materials, companionship and labor	
Wild medicine	Medicinal, biochemical and genetic resources	
Climate regulation	Regulation of climate	Regulating
Air quality regulation	Regulation of air quality	
Noise regulation	Regulation of hazards and extreme events	
Disease regulation		
Natural hazard regulation		
Erosion regulation	Formation, protection and decontamination of soils and sediments	
Biological processes regulation	Regulation of detrimental organisms and biological processes	

were associated with traditional knowledge. NCP categories that provided both tangible and intangible benefits were included in both material and non-material groups of NCP.

Secondly, we identified the various values that respondents identified as part of their personal preference for individual NCP impacting on quality of life. Considering that the IPBES multiple-value approach is still under development, there are no commonly agreed or adopted approaches to the classification of values. In this study, we used Arias-Arévalo et al. (2017), and Díaz et al. (2018) as references to identify value classes related to different categories of NCP (Table 4). Respondents' comments regarding contributions of tangible or intangible benefits (or NCP) to their quality of life were coded into value domains – anthropocentric values belonging to two sub-classes: instrumental and relational (see Table 4). For example, respondents' references to material NCP were coded as instrumental values. Relational values included references to identity, inspiration, livelihood etc. Given their multiple, often convergent, interpretations (Chan et al., 2016; O'Connor & Kenter, 2019), we chose to not identify objective intrinsic values in this study, whilst considering subjective intrinsic values as relational values (O'Connor and Kenter 2019), and including them into the anthropocentric value class. O'Connor and Kenter (2019) argue that intrinsic values can be considered as objective or subjective with the main divergence 'in assumption where the evaluative properties of things reside' (p. 1252). Objective intrinsic values capture properties that exist independently of the evaluator; whilst subjective intrinsic values reflect properties, which are attributed by the evaluators individually. During the surveys, the main challenge was to grasp the difference between subjective and objective intrinsic values, as respondents most often valued agroforestry landscapes considering their own preferences or needs. Another reason why respondents did not identify exclusively non-anthropocentric values may be due to a perception that agroforestry landscapes exist only if there is a human activity and are thus inherently perceived as inseparable social-ecological systems.

2.4. Statistical analysis

The Pearson Chi-square test was used to compare responses between countries. Multiple logistic regression (Hosmer, Lemeshow, & Sturdivant, 2013) was used to investigate associations between dependent variables (e.g., preferences for specific NCP and attributed value classes, see Tables 3 and 4) and socio-demographic variables (i.e.., age, education, gender, childhood residence, and rural versus urban residence place). Multiple logistic regression is a standard technique to sort out the effect of each explanatory variable separately on a binary (yes/no) outcome variable, considering the effects of the other explanatory variables. The effect measure is an odds ratio, between odds of a "yes" (prob_yes/prob_no) for a certain level of an explanatory variable compared to its reference level. Logistic regression was not performed if either the number of "yes" or the number of "no" was less than 10% of the smallest sample. Associations with p-value less than 0.05 were considered statistically significant. Stata version 15 (Stata.com) was used for all statistical analyses.

The identified socio-demographic variables that had a significant effect on respondents' preferences for (i) agroforestry landscapes, (ii) different NCP groups and their categories provided by agroforestry landscapes, and (iii) values attributed to NCP categories are summarised in Table 5 (see for more details in Appendixes 4 and 5).

3. Results

3.1. Who preferred agroforestry landscapes?

Overall, 81% of the sampled population across all case study regions chose one or more agroforestry landscapes as preferred living environments. A majority of respondents, ranging from 69% of respondents in Latvia to 90% in Belarus, identified agroforestry landscapes as important for their quality of life (Fig. 2). However, preferences for different agroforestry landscapes varied among case studies and within each case study (Appendix 6). In Sweden, most respondents acknowledged both types of agroforestry landscapes – livestock-based agroforestry with woodlands and livestock-based agroforestry with arable land and sparse trees – as important for their quality of life. In Latvia, relatively more respondents selected livestock-based agroforestry landscapes with woodlands and in Russia livestock-based agroforestry with grassland with sparse tree cover. In Belarus, a relatively equal number of respondents acknowledged all three types of landscapes as important for their quality of life.

Maximum likelihood estimates of socio-demographic parameters applied in the logistic regression models characterizing preferences for agroforestry landscapes are presented in Table 5. Overall, very few socio-demographic variables were significantly associated with respondents' preferences for agroforestry landscapes. In the Swedish case study, respondents with higher levels of education showed greater preferences for the agroforestry landscapes. In addition, rural childhood residence was significantly associated with peoples' preferences for agroforestry landscapes in Sweden. Gender proved significant in two countries – Latvia and Russia, – where women preferred agroforestry landscapes more than men. No statistically significant relationships were found between socio-demographic variables and preferences for agroforestry landscapes in the Belarusian case study.

3.2. What NCP were attributed to agroforestry landscapes?

Generally, respondents attributed multiple NCP to agroforestry landscapes (Fig. 2 and Appendix 7). NCP from the non-material category were the most frequently assigned in all four countries. The proportions of respondents who attributed this category of NCP to agroforestry landscapes ranged from 81% in Russia to 92% in Sweden. Among all non-material NCP, only *supporting identity* was acknowledged by a majority of respondents (50% of respondents) in all case studies (Fig. 3). We

Table 4

Perceived values of NCP provided by agroforestry landscapes (modified from IPBES, 2018) (codes of interviews are in the brackets, the first two cap letters of each code indicate the official abbreviation of a country).

Value class	Focus of values	Identified NCP for valuation	Quotes
Anthropocentric: instrumental	Nature's services as a means to achieve utility	Regulating NCP	'I have lived in the city, but over the years I have realized that for me and my family, living in a rural environment is much more valuable, both in terms of air quality and natural environment around me' (LA103)
	Tangible goods as a means to achieve utility	Material NCP (food, fodder, wooden products, wild food and medicine)	'Agricultural fields and forest feed us' (BE131) 'As an entrepreneur in the agricultural sector, it is important for me to handle every possible piece of land for profit. We have to keep land manageable' (LA283)
Anthropocentric: relational	Subjective intrinsic Health (physical, mental, holistic)	Maintenance of options Conditions for healthy life (regulating NCP in general, and air quality regulation in particular) Opportunities for recreation and tourism	'Oak landscapes are biotopes for species; I think it is important' (SE240) 'Phototherapy close to oaks is important for my health' (SE240) 'I perceive town as unhealthy environment, and am using any chance to go to my village' (RU164) 'We have to live in nature – in villages' (BE73) 'I am happy to marry to a woman who owns a rural property. Although a city dweller, I dreamed deeply of the countryside of pure nature, fresh air, and freedom' (LA359) 'Although I live in an urban environment, without forests and rural landscapes I would not be able to live around. It charges me and gives me strength and of course health' (LA300)
	Opportunity for recreational, leisure	Opportunities for recreation and tourism	'I just like it to be in oak landscape, it makes me relaxed' (SE246)
	Inspiration	Opportunities for inspiration	'A living countryside is important for our community and for Sweden' (SE361) 'Scent of grass, bees, - inspiration' (BE148) 'I live in my rural house and have a small birch grove where I can pick mushrooms and pick some berries. It is what strengthens and inspires me' (LA145)
	Identity	Cultural heritage, knowledge	'Small-scale farming is very important part of the Swedish culture' (SE278) 'Oak landscape is our cultural heritage' (BE62) 'It is good that oak landscapes are maintained. This is a part of our cultural heritage' (LA305) Oak landscape is important for sustainable food production and for our culture' (SE153)
		Sense of place	'Our villages are disappearing. I brought my kids to the village, and still have a nostalgy' (RU200) 'I love rural landscapes, it is my home' (BE100)
	Livelihood	Traditional products: food, fodder, cork, wooden products, wild food, wild medicine	'Want to maintain rural areas – we have to eat locally produced food' (RU234) 'Oak landscape is important for sustainable food production and for our culture' (SE153) 'Living in the countryside and growing your own food is very healthy' (LA126) 'I live in my rural house and have a small birch grove where I can pick mushrooms and pick some berries. It is what strengthens and inspires me' (LA145)
	Spirituality and religions	Spiritual/religious	'When I die I will come to oak landscape' (SE258)

found no significant socio-demographic variables to explain respondents' preferences for non-material NCP group overall (Table 5).

Several variables influenced preferences for a specific individual non-material NCP in certain case studies (Table 5 and Appendix 4). For instance, education level in Sweden, and rural residence and age of respondents in Russia were significantly associated with *supporting identity* as a value attributed to agroforestry landscapes. Urban residence was significantly associated with attribution of *physical and physiological experiences* to agroforestry landscapes in both Belarus and Russia. Rural residence and gender (female) were similarly associated with attribution of *opportunities for learning and inspiration* to agroforestry landscapes in Belarus. Benefits associated with existence of a wide variety of birds and animals (*maintenance of options*) were significantly linked with rural residence and age in Sweden, and gender (female) in Latvia.

NCP that overlap material and non-material NCP were also perceived as important for respondents' quality of life across all cases (Fig. 3), and was acknowledged by approximately 30% of respondents. Amongst the significant variables, childhood in rural area in Sweden, gender (male) and urban residence in Russia showed a significant effect on respondents' preferences for these NCP in the respective case studies (Table 5 and Appendix 4). Additionally, there are several variables that had a significant effect on preferences for specific NCP that belonged to both - material and non-material – categories. This category represents recognized aspects of agroforestry landscapes, which overlap multiple types of contributions to people. For example, several food products

from these systems represent the material contribution and the non-material ones like a traditional way of production or a "symbol" of the region or locality. Respondents who spent their childhood in a rural area in the Swedish case study, as well as male and urban respondents in the Russian case study attributed food and feed to agroforestry landscapes significantly more often than other respondents.

The proportion of respondents who associated regulating NCP with agroforestry landscapes was typically very low in all four countries (Appendix 7). For example, although regulation of climate was mentioned in all countries except Sweden, the highest proportion of respondents to do so was only 7% – in the Latvian case study.

3.3. What values did respondents attribute to diverse NCP provided by agroforestry landscapes?

One value class – anthropocentric, with instrumental and relational groups – was attributed to agroforestry landscapes across the four case studies (Fig. 4). Overall, relational values were by far the most acknowledged value group. More than 90% of respondents acknowledged multiple relational values of agroforestry landscapes as relevant for their quality of life (Fig. 5). Among them, *identity* related to agroforestry landscapes was acknowledged by more than 50% of respondents in all case studies. There was no clear pattern regarding other types of relational values attributed to agroforestry landscapes, except concerning *spirituality*, which showed similarly low rates of attribution

in all case studies (from 1% in Belarus to 5% in Sweden).

In the logistic regression analyses, socio-demographic variables that influenced the attribution of relational values to agroforestry landscapes differed across the case studies (Table 5 and Appendix 5). In Sweden, rural residence and age (older respondents) corresponded with the acknowledgment of *subjective intrinsic* values; age, education and childhood in rural area were associated with attribution of *recreational value, identity, and livelihood* respectively. In Belarus, urban residence was associated with the attribution of *recreational and leisure* values. Rural residence, gender (female) and age were linked with acknowledgement of *inspiration* as an important value of agroforestry landscapes in Belarus. In Russia, multiple significant relationships were found linking socio-demographic characteristics with the attribution of various values to agroforestry landscapes: urban residence and gender with *recreational value*; rural residence and age with *identity*, and urban

residence, education, and gender with *livelihood* (Table 5).

In stark contrast to the relational values, instrumental values were only acknowledged by 11% of respondents in the Latvian case study, and by smaller proportions of respondents (1–2%) in the Swedish, Belarusian and Russian case studies (Fig. 5).

4. Discussion

4.1. Diversity of NCP from agroforestry landscapes in multiple contexts

Our cross-regional comparison along an EU–non-EU gradient expands on previous studies of landscape valuation (Fagerholm et al., 2019; Plieninger, Torralba, Hartel, & Fagerholm, 2019; Fagerholm et al., 2020) in relation to various aspects; explicitly focusing on agroforestry landscapes (rather than rural landscapes at large), assessing NCP and their values through the novel lens of the NCP framework, and considering largely under-investigated agroforestry landscapes of North-Eastern Europe. Our study shows that a majority of people across all study areas identified agroforestry landscapes as important to their quality of life. Similar to previous cross-site comparisons (Fagerholm et al., 2019; Plieninger et al., 2019; Fagerholm et al., 2020), we found few uniform statistical explanations for this preference among the socio-demographic attributes of respondents. This may indicate that agroforestry landscapes matter to most people, irrespective of age, education, gender, place of residence, as well as political, economic, or social-cultural context. Further, this study provides evidence that agroforestry landscapes deliver multiple NCP of relevance to people's quality of life in both EU and non-EU countries, with respondents attributing a total of 12 NCP categories from total number of 18 NCP to agroforestry landscapes.

Overall, this study reveals three crucial findings regarding NCP associated with agroforestry landscapes in diverse and contrasting contexts. Firstly, non-material NCP proved to be the most important group for a majority of respondents in all studied regions (similar to Fagerholm et al., 2019). This finding is surprising for each context. In Sweden, despite urbanization trends, people appear to maintain an identity-based connection to agroforestry landscapes. In post-socialist countries – Latvia, Belarus, and Russia – it seems that relations to small-scale agroforestry farms are no longer focused on utilitarian food supply as they were during the Soviet period. Rather, these landscapes (Surová & Pinto-Correia, 2008; Surová, Ravera, Guiomar, Martínez Sastre, & Pinto-Correia, 2018) are primarily valued in terms of emotion, culture, and self-identification. The connections between people, place, history, and culture may be important to consider when developing novel strategies for agroforestry landscapes. This implies the need for agroforestry stakeholders to explicitly develop and share understanding regarding the important roles that non-material NCP, such as sense of place and appreciation of cultural heritage, play in people's motivations to act on behalf of local environments (Chapin & Knapp, 2015; Masterson, Enqvist, Stedman, & Tengö, 2019).

Secondly, among all NCP, *supporting identity* appears to be strongly associated with agroforestry landscapes across all studied regions. However, we found no significant association between measured socio-demographic variables and respondents' preferences for this NCP that was common across all regions. In the Swedish case, education was a significant explanatory variable for the attribution of *supporting identity* to agroforestry landscapes. This echoes a previous study assessing preferences for agroforestry landscapes in Portugal (Surová & Pinto-Correia, 2016), which identified a relationship between preferences for "identity landscapes" and higher levels of formal education. This finding might suggest some unknown means by which the education system enables people to recognize identity embodied by, or expressed through, regional landscapes. Other explanations include a potentially greater accumulation of socio-cultural knowledge by more formally educated people, giving rise to a broader set of identity-based associations to agroforestry landscapes, and/or differences in the ways in which
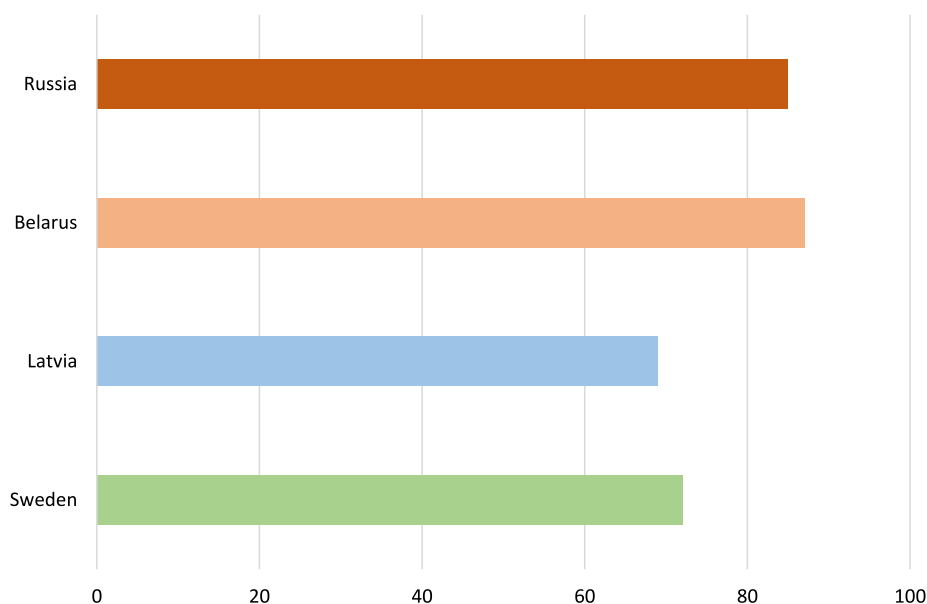
Table 5

Socio-demographic variables that had significant effect on respondents' preferences for agroforestry landscapes, different NCP groups and their categories, and on different values attributed to NCP categories (see the results of logistic regression analyses in Appendix 1–3): all variables have P-values lower than 0.05.

	Sweden	Latvia	Belarus	Russia
Preferences for agroforestry landscapes	With higher educational level Childhood in rural area	Female		Female
NCP group: non-material				
Learning & inspiration			Female Rural residence	
Supporting identity	Education			Rural residence Age
Physical & psychological experience			Urban residence	Urban residence
Maintenance of options	Rural residence Elder age	Female		
NCP group: material & non-material	Childhood in rural area			Male Urban residence
Food & feed	Childhood in rural area			Male Urban residence
Materials				
Medicinal, biochemical & genetic resources				
NCP group: regulating				
Anthropocentric value class: relational values				
Subjective intrinsic	Rural residence With elder age			
Health (mental, physical, holistic)				
Recreational, leisure	Age		Urban residence	Urban residence Female
Inspiration			Rural residence Female Age	
Identity	Education			Rural residence Age
Livelihood	Childhood residence			Urban residence With higher educational level Male
Spirituality				
Nature's services				

Fig. 2. Percentage of all respondents who have chosen at least one agroforestry landscape type by acknowledging those landscapes as important for their quality of life in the case study areas across the four European countries.

highly-educated people interact with these landscapes (e.g. chiefly through leisure and recreation activities during which people have greater opportunity to reflect and recognize identity values) as compared with less formally educated people. However, more research is required to shed light on the link between educational levels and the role of agroforestry landscapes in *supporting identity*. In Russia, it might seem obvious that rural residents relate *supporting identity* to agroforestry landscapes, which are largely represented by small-scale family farms. However, it is surprising that rural residence was not significantly associated *supporting identity* with agroforestry landscapes in our other

'post-socialist' case studies – Latvia and Belarus – where subsistence agroforestry farms have played a major role in the food security of citizens in villages, towns, and cities (Swinnen, Burkitbayeva, Schierhorn, Prishchepov, & Müller, 2017).

Thirdly, our study shows that the majority of material NCP from agroforestry landscapes also have non-material qualities resulting from strong interlinkages between people and nature. For example, some NCP – *food, wood, fodder, wild food, and wild medicine* – were simultaneously attributed to both the material and non-material groups of NCP. Such NCP are essential not only to physically sustain human populations but
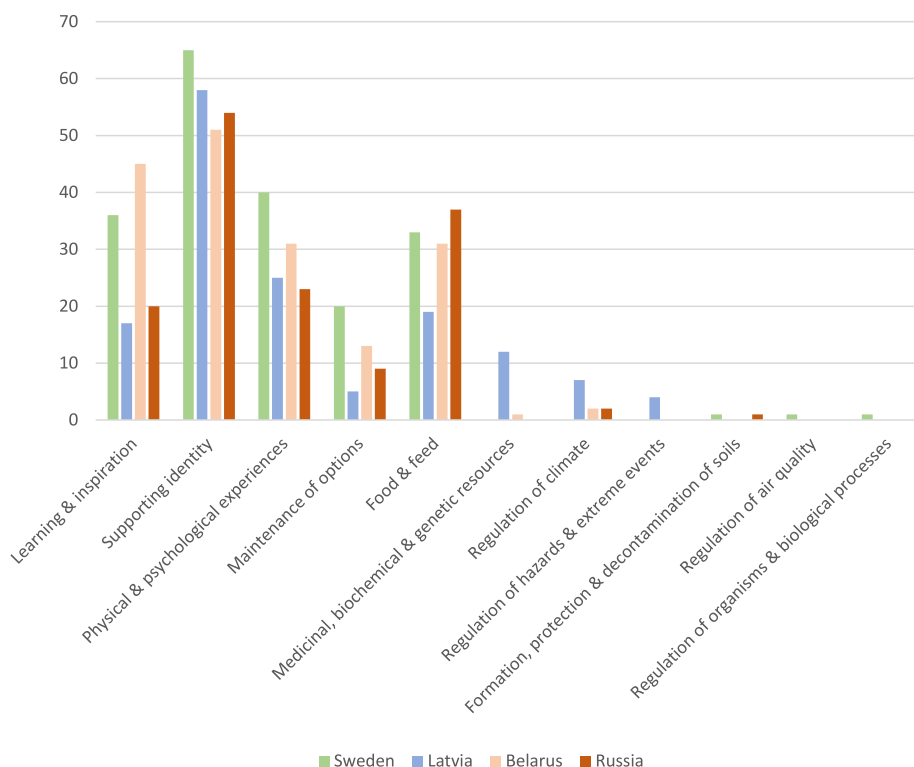

Fig. 3. Percentage of respondents that attributed different NCP categories to agroforestry landscapes across all case studies in the four European countries (see Table 4 for NCP groups).
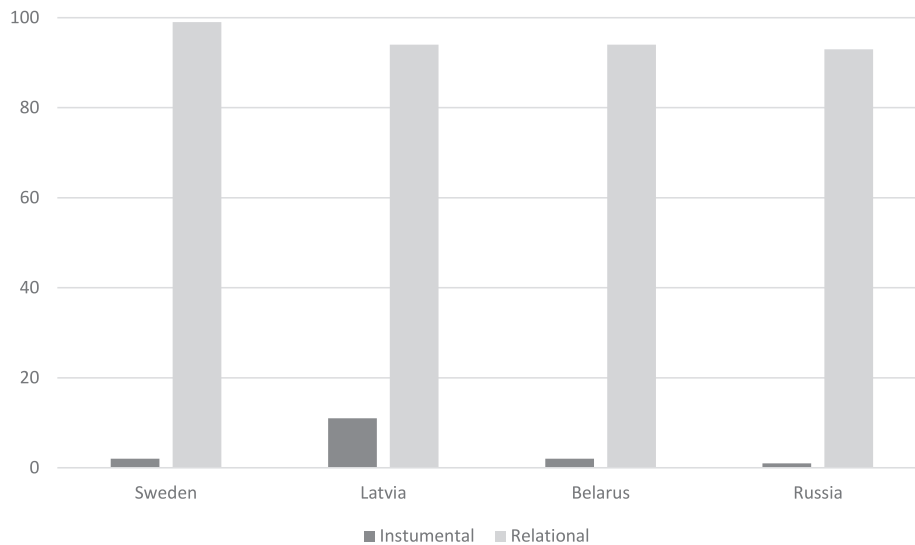
Fig. 4. Percentage of respondents that acknowledged values belonging to two anthropocentric value classes – instrumental and relational – in the four European countries.

also as bearers of symbolic or cultural meaning. This finding demonstrates the overlapping, interdependent nature of material and non-material benefits (Kadykalo et al., 2019), and amplifies evidence from studies in other parts of Europe that have demonstrated how culture penetrates many or even all tangible benefits in agroforestry landscapes (Garrido, Elbakidze, Angelstam, Plieninger, et al., 2017; Garrido, Elbakidze, & Angelstam, 2017; Plieninger et al., 2015). The proportion of respondents that acknowledged this group of NCP are relatively similar among case studies.

Additionally, regulating NCP were attributed by relatively few respondents to agroforestry landscapes in all regions. This confirms previous findings (e.g., Fagerholm et al., 2019) regarding the challenges that many people experience in intuitively understanding regulating services and how they are connected with specific ecosystems. Several studies have shown that people identify those ecosystem services more strongly that can be perceived by the senses or that are more directly

linked to anthropogenic components of landscapes (e.g., agriculture and other extractive activities) (Iniesta-Arandia, García-Llorente, Arguilera, Montes, & Martín-López, 2014). This finding suggests that regulating NCP in agroforestry landscapes may be consistently under-identified and under-valued by many residents, with potential implications for policy development.

From a methodological perspective, our study points to some advantages of applying the NCP approach to agroforestry landscapes compared to the ecosystem service approach. The NCP classification disaggregates all NCP categories with soft boundaries, allowing different NCP categories to mutually overlap. This is crucial to better enable the integrated assessment of intangible and tangible benefits, which are frequently perceived simultaneously in agroforestry landscapes. For instance, respondents across all case studies linked material NCP with culture, local knowledge, and traditions. Such fuzzy and fluid categories and groups of benefits would not be possible when using an ecosystem
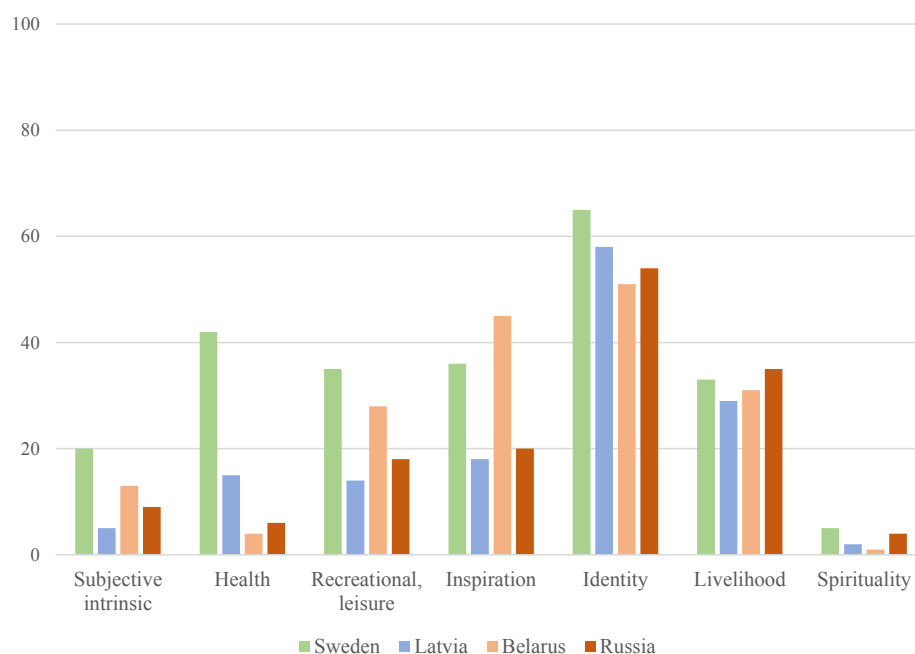

Fig. 5. Percentage of respondents that acknowledged diverse relational values to agroforestry landscapes in the four European countries.

service approach, which defines provisioning and cultural services as mutually exclusive categories, incurring in a silo-based interpretation of human-nature relationships (Schröter et al., 2014).

Additionally, we argue for a more context-specific perspective on NCP (Díaz et al., 2018; Pascual et al., 2017) concerning agroforestry landscapes. While this study identified many similarities among perceived NCP attributed to agroforestry landscapes and their values across case studies, the generalising perspective we adopted was insufficient to fully capture or integrate multiple understandings and categorizations of people-nature relations in North-Eastern Europe, where there are still many holders of local and traditional knowledge. A context-specific perspective of NCP and their values may better facilitate cooperation across knowledge systems in the co-construction of knowledge for sustainability and resilience of social-ecological systems (Díaz et al., 2018), including landscapes. However, there is a need to operationalize this approach and translate it into language capable of bridging together science and policy, ideally including experts from relevant fields (Kadykalo et al., 2019).

4.2. Importance of relational values of agroforestry landscapes across all contexts

Many studies show that differences in values attributed to agroforestry landscapes are often triggered by motivations that rest on different types of knowledge, cultural traditions and identities, historical and policy trajectories, and associated recreational activities (e.g., Hartel et al., 2014; García-Llorente et al., 2012). However, our cross-regional comparative study found no such contextual gradient underpinning values attributed to agroforestry landscapes in EU and non-EU countries. We found instead that respondents from diverse and contrasting contexts attributed similar values to agroforestry landscapes, identifying a wide range of these as important to their cultural identity and quality of life.

A majority of respondents in our case studies considered relational values of agroforestry landscapes to be important for their quality of life, particularly *identity*. This value pertains to a group of eudaimonic values, which contribute to a meaningful life in an Aristotelian sense (Chan, Gould, & Pascual, 2018). Moreover, identity is also considered as one of the fundamental aspects of a desirable relationship between people and nature (Chan et al., 2018; Christie, Martín-López, & Church, 2019; Schröter et al., 2020). Our results in this respect indicate that agroforestry landscapes are deeply meaningful for people in all studied regions, and may not be substitutable. Preferences for relational values were correlated with urban/rural residence in Sweden, Belarus, and Russia, age of respondents in Sweden and Belarus, and gender (female) in Belarus and Russia. Although this suggests some contextual influence, we found greater similarity among case studies than differences in terms of values attributed to agroforestry landscapes.

The importance of relational values in guiding environmental management has been highlighted by many scholars (e.g. Chan et al., 2016; Klain, Olmsted, Chan, & Satterfield, 2017), with an exploration of relational values beyond an intrinsic/instrumental dichotomy gaining momentum in social-ecological systems research (Arias-Arévalo et al., 2017). While we have structured relational values into seven categories, there are no strict boundaries between these categories when applied to agroforestry landscapes. Ecosystem service valuation exercises have historically conflated instrumental values with relational values (Arias-Arévalo et al., 2017). However, such an approach may prove especially problematic for the types of relational values that are frequently linked to agroforestry landscapes, and which have been continuously and intentionally shaped through long-term human–nature interactions. For example, our results show that relational values are indistinctively attributed to both material and non-material NCP delivered by agroforestry landscapes.

Incorporating relational values in environmental policies and practices poses challenges for scientists and decision-makers. With regards to

nature conservation, Mattijssen et al. (2020) distinguished six routes through which relational values can be integrated into policies and practices for nature conservation: "(1) incorporation of pluralized meanings of nature; (2) the uptake of relational language in policy discourse; (3) a prioritization of landscape-based policy; (4) empowering citizens in nature conservation; (5) re-orienting nature education to stimulate people's personal bond with nature; and (6) using digital technology to stimulate new relationships with nature" (p.402). We argue that routes 1–4 might be of particular relevance for incorporating relational values in policies and practices related to agroforestry landscapes in North-Eastern Europe.

Regarding the first route, this study shows that agroforestry landscapes are essential for people's quality of life across studied regions in North-Eastern Europe and that respondents associated multiple relational values to these landscapes. It is therefore reasonable to argue that a broader spectrum of human perceptions of and relations with agroforestry landscapes should be incorporated as a "pluralized' concept in environmental (and rural) policies recognising the non-substitutability of relational values. However, existing EU policies (in Sweden and Latvia) focus on instrumental or intrinsic values of agroforestry landscapes. In Belarus and Russia, current national policies promote the intensification of forestry and agriculture, which is a main driver of agroforestry landscapes' decline. Agroforestry landscapes are recognized by citizens for their identity values. In this regard some alternative policy incentives could be developed, including collaborative incentives and result-based environmental schemes (De Snoo et al., 2013). Agroforestry farmers could potentially be acknowledged for their contribution to landscape identity values which include also certain environmental standards. This would require encouraging farmers to cooperate between themselves with the aim to maintain identity at a landscape scale.

Regarding the second route, one option is to introduce a more explicitly relational language concerning agroforestry landscapes – e.g. links between local history, local identity and local land use – into the national rural development policies and strategies.

In relation to the third route, scholars have identified the importance of a landscape approach for maintaining multifunctional agroforestry landscapes capable of sustainably producing simultaneous benefits across intrinsic, instrumental, and relational value domains (Axelsson, Angelstam, Elbakidze, Stryamets, & Johansson, 2011; Plieninger, Muñoz-Rojas, & Buck, 2020). A relational perspective is a potentially valuable component of the landscape approach initiatives, better enabling the meaningful incorporation of a broader set of values across more diverse groups of stakeholders into landscape management and governance. Biosphere Reserves and Leader+ are international examples of landscape approach initiatives as arenas for multi-stakeholder collaboration that might be used to demonstrate the utility of relational values for landscape approach initiatives.

The greater visibility of relational values in such initiatives might also support the fourth route – empowering citizens in the landscape governance – by underlining the legitimacy of relational values and thereby empowering citizens whose interactions with agroforestry landscapes stem primarily from relational values to become involved in agroforestry landscape management and governance. As is pointed out by Mattijssen et al. (2020), people's relational values motivate them to be involved in collaborative landscape management. Giving citizens a voice may improve the degree to which agroforestry policies are suitable to address and engage with the multidimensionality of issues associated with these complex landscapes.

5. Conclusions

This study provides strong evidence that agroforestry landscapes in North-Eastern Europe, including both EU and non-EU countries, contribute multiple benefits that are important for people's quality of life – broadly irrespective of age, education, gender, place of residence,

as well as political, economic, or social-cultural context. Local residents in contrasting contexts attributed multiple common values to NCP provided by different types of agroforestry landscapes. Importantly, this paper shows a disproportionate attribution of relational values to agroforestry landscapes across all contexts, when compared to instrumental values. This result illustrates a potential misfit between the value systems that people frequently use for agroforestry landscapes and the predominantly instrumental value approaches typically applied in policy situations for evaluating the contributions provided by these landscapes for improved quality of life. Finding inspiration in Mattijssen et al. (2020), we suggest four routs for incorporating relational values in policies and practices related to agroforestry landscapes in North-Eastern Europe: (1) incorporation of pluralized meanings of agroforestry landscapes; (2) the uptake of relational language in policy discourses; (3) prioritization of landscape-based policies; and (4) empowering citizens in landscape governance. We expect that our assessment will contribute to a higher recognition of agroforestry landscapes in policy and planning decisions and will underpin more sustainable management strategies and pathways.

Declaration of Competing Interest

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.landurbplan.2021.104044.

References

Almeida, M., Azeda, C., Guiomar, N., & Pinto-Correia, T. (2016). The effects of grazing management in montado fragmentation and heterogeneity. *Agroforestry Systems, 90*(1), 69–85.

Arias-Arévalo, P., Martín-López, B., & Gómez-Baggethun, E. (2017). Exploring intrinsic, instrumental, and relational values for sustainable management of social-ecological systems. *Ecology and Society, 22*(4), 43.

Axelsson, R., Angelstam, P., Elbakidze, M., Stryamets, N., & Johansson, K. (2011). Sustainable development and sustainability: landscape approach as a practical implementation of principles and implementation concepts. *Journal of Landscape Ecology, 4*(3).

Bieling, C., Plieninger, T., Pirker, H., & Vogl, C.h. (2014). Linkages between landscapes and human well-being: An empirical exploration with short interviews. *Ecological economics, 105*, 19–30.

Bugalho, M., Pinto-Correia, T., & Pulido, F. (2018). Human use of natural capital generates cultural and other ecosystem services in montado and dehesa oak woodlands. In M. L. Paracchini, P. C. Zingari, & C. Blasi (Eds.), *Re-connecting natural and cultural capital. Contributions from Science and Policy*. Luxembourg: Publications Office of the European Union.

Chan, K., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., et al. (2016). Why protect nature? Rethinking values and the environment. *PNAS, 113*(6), 1462–1465.

Chan, K., Gould, R. K., & Pascual, U. (2018). Editorial over-view: Relational values: What are they, and what's the fuss about? *Current Opinions in Environmental Sustainability, 35*, A1–A7.

Chapin, S., III, & Knapp, C. (2015). Sense of place: a process for identifying and negotiating potentially contested visions of sustainability. *Environmental Science & Policy, 53*(part A), 38–46.

Christie, M., Martín-López, B., Church, A., et al. (2019). Understanding the diversity of values of "Nature's contributions to people": Insights from the IPBES Assessment of Europe and Central Asia. *Sustainability Science, 14*, 1267–1282.

Dandy, N., & Van Der Wal, R. (2011). Shared appreciation of woodland landscapes by land management professionals and lay people: an exploration through field-based interactive photo-elicitation. *Landscape and Urban Planning, 102*(1), 43–53.

De Snoo, G. R., Herzon, I., Staats, H., Burton, R. J., Schindler, S., van Dijk, J., et al. (2013). Toward effective nature conservation on farmland: Making farmers matter. *Conservation Letters, 6*(1), 66–72.

den Herder, M., Moreno, G., Mosquera-Losada, R. M., Palma, J. H. N., Sidiropoulou, A., Santiago Freijanes, J. J., et al. (2017). Current extent and stratification of agroforestry in the European Union. *Agriculture, Ecosystems & Environment, 241*, 121–132.

Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R., Molnár, Z., et al. (2018). Assessing nature's contributions to people. *Science, 359*(6373), 270–272.

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., et al. (2015). The IPBES conceptual framework – connecting nature and people. *Current Opinion in Environmental Sustainability, 14*, 1–16.

Eichhorn, M., Paris, P., Herzog, F., Incoll, L., Liagre, F., Mantzanas, K., et al. (2006). Silvoarable systems in Europe: Past, present and future prospects. *Agroforestry Systems, 67*, 29–50.

Elbakidze, M., Hahn, T., Zimmermann, N. E., Cudlín, P., Friberg, N., Genovesi, P., et al. (2018). Chapter 4: Direct and indirect drivers of change in biodiversity and nature's contributions to people. In M. Rounsevell, M. Fischer, A. Torre-Marin Rando, & A. Mader (Eds.), *The IPBES regional assessment report on ecosystem services for Europe and Central Asia. Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services, Bonn, Germany* (pp. 385–568).

Fagerholm, N., Oteros-Rozas, E., Raymond, C. M., Torralba, M., Moreno, G., & Plieninger, T. (2016). Assessing linkages between ecosystem services, land-use and well-being in an agroforestry landscape using public participation GIS. *Applied geography, 74*, 30–46.

Fagerholm, N., Torralba, M., Moreno, G., Girardello, M., Herzog, F., Aviron, S., et al. (2019). Cross-site analysis of perceived ecosystem services benefits in multifunctional landscapes. *Global Environmental Change, 56*, 134–147.

Fagerholm, N., Martin-Lopez, B., Torralba, M., Oteros-Rozas, E., Lechner, A., Bieling, C., et al. (2020). Perceived contributions of multifunctional landscapes to human well-being: Evidence from 13 European sites. *People and Nature*, 1–18.

Fish, R., Church, A., & Winter, M. (2016). Conceptualising cultural ecosystem services: A novel framework for research and critical engagement. *Ecosystem Services, 21*(B), 208–217.

García-Llorente, M., Martín-López, B., Iniesta-Arandia, I., López-Santiago, C., Aguilera, P., & Montes, C. (2012). The role of multi-functionality in social preferences towards semi-arid rural landscapes: An ecosystem service approach. *Environmental Science & Policy, 19*, 136–146.

Garrido, P., Elbakidze, M., Angelstam, P., Plieninger, T., Pulido, F., & Moreno, G. (2017). Stakeholder perspectives of wood-pasture ecosystem services: A case study from Iberian dehesas. *Land Use Policy, 60*, 324–333.

Garrido, P., Elbakidze, M., & Angelstam, P. (2017). Stakeholders' perceptions on ecosystem services in Östergötland's (Sweden) threatened oak wood-pasture landscapes. *Landscape and Urban Planning, 157*, 96–104.

Godinho, S., Guiomar, N., & Gil, A. (2016). Using a stochastic gradient boosting algorithm to analyse the effectiveness of Landsat 8 data for montado land cover mapping: Application in southern Portugal. *International Journal of Applied Earth Observation and Geoinformation, 49*, 151–162.

Hartel, T., Fischer, J., Campeanu, C., Horcea-Milcu, I., Hanspach, J., Fazey, I., et al. (2014). The importance of ecosystem services for rural inhabitants in a changing cultural landscape in Romania. *Ecology and society, 19*(2).

Hosmer DW., Lemeshow, S., & Sturdivant, R. (2013). Applied Logistic Regression. Wiley Series in Probability and Statistics.

Huntsinger, L., & Oviedo, J. L. (2014). Ecosystem services are social–ecological services in a traditional pastoral system: The case of California's Mediterranean rangelands. *Ecology and Society, 19*(1), 8.

IPBES. (2018). In M. Rounsevell, M. Fischer, A. Torre-Marin Rando, & A. Mader (Eds.), *The IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia*. Bonn, Germany: Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

Jax, K., Barton, D., Chan, K., de Groot, R., Doyle, U., Eser, U., et al. (2013). Ecosystem services and ethics. *Ecological Economics, 93*, 260–268.

Jose, S. (2009). Agroforestry for ecosystem services and environmental benefits: An overview. *Agroforestry Systems, 76*, 1–10.

Iniesta-Arandia, I., García-Llorente, M., Arguilera, P., Montes, C., & Martín-López, B. (2014). Socio-cultural valuation of ecosystem services: Uncovering the links between values, drivers of change, and human well-being. *Ecological Economics, 108*, 36–48.

Kadykalo, A., Lopez-Rodriguez, M., Ainscough, J., Droste, N., Ryu, H., Avila-Flores, G., et al. (2019). Disentangling 'ecosystem services' and 'nature's contributions to people'. *Ecosystems and People, 15*(1), 269–287.

Kay, S., Graves, A., Palma, J. H. N., Moreno, G., & Herzog, F. (2019). Agroforestry is paying off – Economic evaluation of ecosystem services in European landscapes with and without agroforestry systems. *Ecosystem Services*, 100896.

Kenter, J. O., O'Brien, L., Hockley, N., Ravenscroft, N., Fazey, I., Irvine, K. N., et al. (2015). What are shared and social values of ecosystems? *Ecological Economics, 111*, 86–89.

Klain, S., Olmsted, K., Chan, K., & Satterfield, T. (2017). Relational values resonate broadly and differently than intrinsic or instrumental values, or the New Ecological Paradigm. *PloS ONE, 12*(8), Article e0183962.

MA. (2005). *Millennium Ecosystem Assessment Ecosystems and Human Well-Being*. Washington DC: Synthesis Island Press.

Masterson, V., Enqvist, J., Stedman, R., & Tengö, M. (2019). Sense of place in social-ecological systems: From theory to empirics. *Sustainability Science, 14*(3), 555–564.

Matthews, R., & Selman, P. (2006). Landscape as a focus for integrating human and environmental processes. *Journal of Agricultural Economics, 57*(2), 199–212.

Mattijssen, Th., Ganzevoort, W., van den Born, R., Arts, B., Breman, B., Buijs, A., et al. (2020). Relational values of nature: Leverage points for nature policy in Europe. *Ecosystems and People, 16*(1), 402–410.

Milcu, A., Sherren, K., Hanspach, J., Abson, D., & Fischer, J. (2014). Navigating conflicting landscape aspirations: Application of photo-based Q-method in Transylvania (Central Romania). *Land Use Policy, 41*, 408–422.

Mosquera-Losada, M. R., McAdam, J. H., Romero-Franco, R., Santiago-Freijanes, J. J., & Rigueiro-Rodriguez, A. (2009). Definitions and components of agroforestry practices in Europe. In Rigueiro-Rodriguez (Ed.), *Agroforestry in Europe: Current status and future prospects* (pp. 3–19). Springer Science+Business Media.

O'Connor, S., & Kenter, J. (2019). Making intrinsic value work; integrating intrinsic values of the more-than-human world through the Life of Framework of Values. *Sustainability Sciences, 14*, 1247–1265.

Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., et al. (2017). Valuing nature's contributions to people: The IPBES approach. *Current Opinion in Environmental Sustainability, 26–27*, 7–16.

Pinto-Correia, T., & Azeda, C. (2017). Public policies creating tensions in Montado management models: Insights from farmers' representations. *Land Use Policy, 64*, 76–82.

Pinto-Correia, T., Guiomar, N., Ferraz-de-Oliveira, M. I., Sales-Baptista, E., Rabaça, J., Godinho, C., et al. (2018). Progress in identifying High Nature Value Montados: Relating biodiversity to grazing and stock management. *Rangeland Ecology and Management, 71*, 612–625.

Plieninger, T., Torralba, M., Hartel, T., & Fagerholm, N. (2019). Perceived ecosystem services synergies, trade-offs, and bundles in European high nature value farming landscapes. *Landscape Ecology, 34*, 1565–1581.

Plieninger, T., Muñoz-Rojas, J., Buck, L. E., et al. (2020). Agroforestry for sustainable landscape management. *Sustainability Science, 15*, 1255–1266.

Plieninger, T., & Bieling, C. (2013). Resilience-based perspectives to guiding high-nature-value farmland through socioeconomic change. *Ecology and Society, 18*(4), 20.

Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land Use Policy, 33*, 118–129.

Plieninger, T., Hartel, T., Martín-López, B., Beaufoy, G., Bergmeier, E., Kirby, K., et al. (2015). Wood-pastures of Europe: Geographic coverage, social–ecological values, conservation management, and policy implications. *Biological Conservation, 190*, 70–79.

Rigueiro-Rodríguez, A., McAdam, J., & Mosquera-Losada, M. R. (Eds.). (2009). *Agroforestry in Europe: current status and future prospects*. Kluwer: Advances in Agroforestry.

Scholes, R. J., Reyers, B., Biggs, R., Spierenburg, M. J., & Duriappah, A. (2013). Multi-scale and cross-scale assessments of social-ecological systems and their ecosystem services. *Current Opinion in Environmental Sustainability, 5*, 16–25.

Schröter, M., van der Zanden, E. H., van Oudenhoven, A. P. E., Remme, R. P., Serna-Chavez, H. M., de Groot, R. S., & Opdam, P. (2014). Ecosystem services as a contested concept: A synthesis of critique and counter-arguments. *Conservation Letters, 7*(6), 514–523.

Setten, G., Stenseke, M., & Moen, J. (2012). Ecosystem services and landscape management: Three challenges and one plea. *International Journal of Biodiversity Science, Ecosystem Services & Management, 8*, 305–312.

Schröter, M., Başak, E., Christie, M., Church, A., Keune, H., Osipova, E., et al. (2020). Indicators for relational values of nature's contributions to good quality of life: The IPBES approach for Europe and Central Asia. *Ecosystems and People, 16*(1), 50–69.

Surová, D., & Pinto-Correia, T. (2008). Landscape preferences in the cork oak Montado region of Alentejo, southern Portugal: Searching for valuable landscape characteristics for different user groups. Landscape preferences in the cork oak Montado region of Alentejo, southern Portugal: Searching for valuable landscape characteristics for different user groups. *Landscape Research, 33*(3), 311–330.

Surová, D., & Pinto-Correia, T. (2016). A landscape menu to please them all: Relating users' preferences to land cover classes in the Mediterranean region of Alentejo, Southern Portugal. *Land Use Policy, 54*, 355–365.

Surová, D., Ravera, F., Guiomar, N., Martínez Sastre, R., & Pinto-Correia, T. (2018). Contributions of Iberian Silvo-Pastoral Landscapes to the Well-Being of Contemporary Society. *Rangeland Ecology & Management, 71*, 560–570. https://doi.org/10.1016/j.rama.2017.12.005.

Swinnen, J., Burkitbayeva, S., Schierhorn, F., Prishchepov, A. V., & Müller, D. D. (2017). Production potential in the "bread baskets" of Eastern Europe and Central Asia. *Global Food Security, 14*, 38–53.

Termorshuizen, J., & Opdam, P. (2009). Landscape services as a bridge between landscape ecology and sustainable development. *Landscape Ecology, 24*(8), 1037–1052.

Torralba, M., Fagerholm, N., Hartel, T., Moreno, G., & Plieninger, T. (2018). A socio-ecological analysis of ecosystem services supply and trade-offs in European wood-pastures. *Science Advances, 4*. eaar2176.

UNEP, (2014). IPBES-2/4: conceptual framework for the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. In Report of the Second Session of the Plenary of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2014: <http://www.ipbes.net/images/IPBES-2-17%20%20%20-%20%20Advance%20En.pdf>.