

**CHANGES IN AGRICULTURAL LAND USE IN
ESTONIA: OPPORTUNITIES FOR STABLE LAND
USE**

**PÕLLUMAJANDUSMAA KASUTUSE MUUTUSED
EESTIS: TASAKAALUSTATUD MAAKASUTUSE
TAGAMISE VÕIMALUSED**

MARI RASVA

A Thesis
for applying for the degree of Doctor of Philosophy
in Engineering Sciences

Väitekirj
filosoofiadoktori kraadi taotlemiseks
tehnikateaduse erialal

Tartu 2023

Eesti Maaülikooli doktoritööd

**Doctoral Theses of the
Estonian University of Life Sciences**



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Institute of Forestry and Engineering
Estonian University of Life Sciences

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Kreutzwaldi 5, Tartu on March 9, 2023 at 12.

The English in the current thesis was revised by Dominik Bienkowski
and the Estonian by Urve Ansip.

Publication of this thesis is supported by the Estonian University of Life
Sciences and the Estonian University of Life Sciences ASTRA project
„Value-chain based bio-economy“.

Marii Rasva, 2023
ISSN 2382-7076
ISBN 978-9916-669-91-4 (trükis)
ISBN 978-9916-669-92-1 (pdf)

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LIST OF ORIGINAL PUBLICATIONS

The present thesis is based on the following publications, which are referred to by Roman numerals. The papers are reproduced with the kind permissions of the publishers.

- I** Jürgenson, E., **Rasva, M.** 2020. The Changing Structure and Concentration of Agricultural Land Holdings in Estonia and Possible Threat for Rural Areas. In *Land 2020* (Vol. 9, pp. 1-15). <https://doi.org/10.3390/land9020041>
- II** **Rasva, M.**, Jürgenson, E. 2020. Changes of agricultural producers in Estonia according to the size of land use. In *Agronomy Research 2020* (Vol. 18, No. 2, pp. 516-528). <https://doi.org/10.15159/AR.20.139>
- III** **Rasva, M.**, Jürgenson, E. 2022. Europe's Large-Scale Land Acquisitions and Bibliometric Analysis. In *Agriculture 2022* (Vol. 12, No. 6: 850). <https://doi.org/10.3390/agriculture12060850>.
- IV** **Rasva, M.**, Jürgenson, E. 2022. Agricultural Land Concentration in Estonia and Its Containment Possibilities. In *Land 2022*. (Vol. 11, No. 2270, pp 1–15). <https://doi.org/10.3390/land11122270>.

Contributions of the authors to the papers was as follows:

Paper	Original idea and structure	Data collection	Data analysis	Preparation of the manuscript
I	EJ; MR	MR	MR	EJ; MR
II	EJ; MR	MR	MR	EJ; MR
III	EJ; MR	MR	MR	EJ; MR
IV	EJ; MR	MR	MR	EJ; MR

MR–Marii Rasva; EJ–Evelin Jürgenson

LIST OF ABBREVIATIONS

ARIB	Agricultural Registers and Information Board
CAP	Common Agricultural Policy
EU	European Union
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organization
LSLA	Large scale land acquisition
SDG	Sustainable Development Goals

INTRODUCTION

Structural change in the agricultural sector in Europe is broadly characterized by a declining number of farms and an increase in the size of surviving farms. Agricultural land is concentrated on the usage of more minor large agricultural producers.

This phenomenon started to emerge decades ago, but has recently accelerated. The first scientific articles on this topic are from 1991 in the SCOPUS database (**paper III**). The ongoing process of agricultural land concentration is affecting Europe's small farms and rural areas. Agricultural land is becoming increasingly concentrated into the hands of large businesses, a situation in which small farmers are losing control over agricultural land. In the meantime, small farms are vital for rural life (von Braun and Mirzabaev, 2015).

By number, there are more than 570 million farms in the world; more than 475 million farms are smaller than two hectares (Lowder et al., 2016). Accordingly, investing in small farms is a crucial way to increase food security and nutrition for the poorest in society, as well as food production for local and global markets (European Economic and Social Committee, 2015).

In 2014, the problem of land-grabbing and land concentration was brought up by the European Economic and Social Committee (European Economic and Social Committee, 2015). In 2020, the number of farms was still decreasing, while the average utilized agricultural land area per farm increased in almost all countries in Europe (**paper IV**). This means that more attention must be paid to the phenomenon of farmland concentration in Europe.

As agricultural land becomes more and more concentrated into fewer and larger holdings, the Common Agricultural Policy (CAP) subsidy also becomes more concentrated (**paper I**). Land users who have bigger holdings receive larger subsidies that enable them to acquire land plots (Burja et al., 2020; Franco and Borrás Jr., 2013; "Land Concentration In the EU...", 2021). On December 2, 2021, the agreement on reform of the CAP was formally adopted. It aims to ensure a sustainable future for European farmers, provide more targeted support to smaller farms,

and allow greater flexibility for European countries to adapt measures to local conditions. Only time will tell whether this reform will produce the necessary effect on agricultural land concentration.

This study focuses on the issues concerning agricultural land use changes in Estonia, and offers opportunities for stable land use. Firstly, the agricultural land use pattern and its changes in Europe are addressed. Secondly, the agricultural land use and ownership pattern and its changes in Estonia are analysed. State level changes in land use are analysed according to Statistics of Estonia and Agricultural Registers and Information Board (ARIB) data. State level changes in agricultural land ownership are analysed according to the data received from the Estonian Land Register. County level land use changes are analysed according to ARIB data. Thirdly, the restrictions on agricultural land acquisition in European Union (EU) countries are addressed.

The results summarized in this thesis have already been published in pre-reviewed scientific journals or proceedings (cf. **papers I-IV**). This thesis refers to the summarized papers where appropriate.

The thesis consists of six chapters, 20 figures and 11 tables. An overview of the content of chapters follows.

Chapter 1 addresses the phenomenon of large-scale land acquisitions (LSLA). It gives an overview of land concentration and land-grabbing in Europe. For better understanding about the situation in Estonia, a historical overview of the changes taking place in the agricultural sector in Estonia is also given. Additionally, the risks associated with the concentration of agricultural land are explained, and LSLAs impact on sustainable development is involved.

Chapter 2 states the main aims of the study, and recapitulates related research questions for achieving these aims.

Chapter 3 gives an overview of the used materials and methods. The thesis is largely based on the results of the **papers I-IV**.

Chapter 4 describes the results of the study. The first section deals with the agricultural land use pattern and its changes in Europe. The second section presents the agricultural land use pattern and its changes

in Estonia. The third section deals with changes in agricultural land ownership in Estonia. The fourth section presents different restrictions on the acquisition of agricultural land in EU countries.

Chapter 5 contains a discussion of this study. Firstly, the situation in agricultural land use in Europe is discussed. Secondly, the situation in agricultural land use and landownership in Estonia is discussed. Thirdly, restrictions on the acquisition of agricultural land in EU countries is discussed.

Chapter 6 contains a general summary of this study, pointing out the most important results and recommendations for stable agricultural land use in Estonia.

1. REVIEW OF THE LITERATURE

1.1. Motivation

While the rush for land in developing countries in the Global South has captured much attention, far less has been given to the process of land concentration in Europe (Azadi et al., 2013; Eurostat, 2016; Franco and Borrás Jr., 2013). Large agricultural land users in Europe are expanding their scope widely and quickly. Tens of thousands of small farmers are being forced out of farming every year (Franco and Borrás Jr., 2013; Lowder et al., 2016). It is also evident that in many European countries, the degree of land-based inequality is similar to some countries with notoriously inequitable distribution of land ownership and land-based wealth such as Brazil, Colombia, and the Philippines (European Parliament, 2017; Franco and Borrás Jr., 2013).

The ongoing process of land concentration has particularly affected Europe's small farms: it is implied that the expansion of large farms in Europe has come at the expense of small farms (Kay et al., 2015). Agricultural land is becoming increasingly concentrated into the hands of large businesses, a situation in which small farmers are losing control of their land (Kay et al., 2015; Van Der Ploeg et al., 2015). In the meantime, small farms are important for rural life: they play an active role in the economic fabric of rural areas, conserving the cultural heritage, maintaining rural life, sustaining social life and making sustainable use of natural resources (European Economic and Social Committee, 2015). Small farms produce a sufficient amount of healthy and high-quality food, and ensure a broad distribution of land ownership in rural areas (European Economic and Social Committee, 2015; European Parliament, 2017; Eurostat, 2018; Grubbström and Sooväli-Sepping, 2012; Guiomar et al., 2018; McDonagh et al., 2017; Shucksmith and Rønningen, 2011). In short, the process of land concentration has implications for society as a whole, not only for small farms.

Scientists and official documents (European Economic and Social Committee, 2015; European Parliament, 2017; Eurostat, 2018; Grubbström and Sooväli-Sepping, 2012; Guiomar et al., 2018; McDonagh et al., 2017; Shucksmith and Rønningen, 2011) have presented the case for smaller vs. larger agricultural producers: smaller farms perform

essential tasks in rural society. However, they have also shown that smaller producers are under greater economic pressure. They often need support from the state (European Economic and Social Committee, 2015; Eurostat, 2016). If this issue is developed only under free-market principles, small agricultural producers will shut down their activity. Those who were engaged in small production remain without income and the state must pay their subsistence allowance. The alternative is for farm labourers to move to find work - normally to cities or towns.

Land is a fundamental element for our existence and, due to this, it is difficult to overstate its strategic importance for our wellbeing and prosperity. Ownership of land can be made available for community and business development, or kept in the hands of a small number of large agricultural users (**paper IV**). Investments in small agricultural producers remain one of the most direct ways to address food security and rural poverty.

Questions over the scale and equitable arrangement of future agricultural land ownership remain. Is there a need for regulations on land use and/or ownership? Some countries limit land ownership (**paper IV**). For example, it is possible to own 500 ha of land in Lithuania and 300 hectares in Hungary (**paper I and IV**). Limits for land ownership or use are absent in Estonia. It is theoretically possible for a person with enough money to acquire as much land as is available on the market.

1.2. Europe's large-scale land acquisitions

The issue of land concentration in the EU and many parts of the world remains basic, and is one of the most serious land issues in the district today. **Paper III** includes systematic analysis of the existing literature on land-grabbing and concentration in Europe.

Agriculture is a serious user of natural resources (Bruinsma, 2003; *Transforming Food Systems...*, 2022), although in diverse ways and to diverse extents, depending on the operating system. This raises a question (**paper II**): will family farms lead to a future of sustainable agriculture and feeding of the population, or should we depend on large corporate agricultural businesses or mega-farms? Either way, there is a need to take steps towards greener agriculture. In the move towards sustainability, the European Green Deal and Sustainable Development Goals (SDGs)

(United Nations, 2019) set out necessary goals. Some of the objectives in the SDGs are directly linked with agriculture and its sustainability. Their aims include ending world hunger and ensuring sustainability in agriculture. In the 2019 United Nations Decade of Family Farming 2019–2028 (FAO and IFAD, 2019) report, it is stated that family farming supports the SDGs by:

- making food systems more sustainable;
- creating income generation opportunities in rural areas;
- implementing resilient and highly productive agricultural practices;
- delivering inclusive rural services and contributing to territorial development;
- promoting food systems that are more resilient to climate change;
- preserving biodiversity;
- strengthening sustainable integration between urban and rural areas.

From the beginning of the financial crisis in 2007–2008, land was acquired not only by investors keen on agriculture of food crops, but also by financial institutions that expected an increase in its value (Ayalew and Deininger, 2021; Borghesi et al., 2019; Mechiche-Alami et al., 2019; Šljukić and Šljukić, 2019). Suddenly, many influential economic actors started to invest in farmlands, either by buying them up, or by renting as much farmland as possible (**paper III**). International and domestic large-scale land deals became a growing global phenomenon. Today's structural arrangement in agriculture has seen resources transfer from smaller and less productive farms to larger ones (**paper I**). This increase, driven by a need for survival, will lead to larger farms, sometimes creating larger parcels, and this upscaling can lead to a decrease in landscape diversity and ecological value (Beckers et al., 2018).

Structural change in the agricultural sector in the EU is also largely characterized by a decreasing number of farms and a growing size of surviving farms (**paper I**; Plogmann et al., 2020; *Regulation (EU) 2018/841...*, 2018; Schnepf, 2021). Consequently, the critical choice of farms can be summarized as “grow or go”. Therefore, the EU faces land concentration, but there are no reliable data about its scope (Borras Jr et al., 2020; Bunkus and Theesfeld, 2018; Grant and Das, 2015). Different studies have shown that, in recent years, the number of agricultural

producers has dropped in the EU, while the size of farms has increased (Bunkus and Theesfeld, 2018; **Paper I**; Schnepf, 2021). These qualitative case studies on the effect of land concentration, pushed by further investments in rural societies, can rather be found in post-socialist EU countries (Bunkus and Theesfeld, 2018). For example, in 2001, there were 55,748 agricultural producers in Estonia; this number decreased each subsequent year to 18,755 in 2013 and 16,696 in 2016, while, concurrently, the area of utilized agricultural land remained almost stable (Bunkus and Theesfeld, 2018; **Paper II**; Schnepf, 2021). This decrease took place largely at the expense of small producers (**Paper II**).

In Romania, small-scale farms have been vanishing quickly, and between 2002 and 2010, 150,000 small-scale farms disappeared, while large-scale farming increased by 3% (Petrescu-Mag et al., 2017). In 2020, the average monocultural land parcel situated in Slovakia reached a size of 12 hectares (Palsova et al., 2021). In 2010, the number of farms in Hungary was 351,000, which dropped to 235,000 by 2020 (Kováč et al., 2022). The decrease in the number of farms in Hungary was 33% between 2010 and 2020. Meanwhile, these numbers do not show how much land the agricultural producers own and how much they rent.

LSLA transforms land use and food systems in their targeted regions worldwide (Oberlack et al., 2021). It has been found that LSLA threatens socio-economic loss, including income generation and food access (Chahongnao, 2021). The European farming model is built on the recognition of the multifunctionality and diversity of European agricultural systems (Gaupp-Berghausen et al., 2022). It is estimated that by 2040, an additional 6.4 million farms may disappear in Europe (Gaupp-Berghausen et al., 2022). Toma, Redman, Czekaj et. al. found that the programming of the EU's Common Agricultural Policy at national and regional level does not respond to small farms' needs (Toma et al., 2021). At the Food and Agriculture Organization (FAO) regional conference for Europe 2022 it was suggested that member states strengthen their resilience by investing in smallholders and family farms, and updating agrifood systems to be better prepared, adaptable and autonomous ("The road to transformative agrifood...", 2022).

Different studies are searching for the answer to the question of which farming model (large-scale agriculture or small farms) is most suitable for the environment and for ensuring food security in the future. It has been

detected that farm size has a large influence on agricultural sustainability from the viewpoints of economy, environment, and society (Ren et al., 2019). Some studies have found that environmental harm resulting from large-scale industrial farming practices includes the loss of soil fertility, pollution of water sources, loss of biodiversity, and draining of wetlands, and large-scale landowners in the agricultural labour market depress labour income in the primary sector (Constantin et al., 2017; Falkinger and Grossmann, 2013; Grant and Das, 2015). Nevertheless, there are contrary statements, which claim that small-scale farming does not lead to more sustainable farming practices (Wuepper et al., 2020). The conclusion of this study was that small-scale farms are less likely to conserve structural elements, while leaving a higher share of their soils bare during winter, and using more of their fields for monoculture farming.

Therefore, land policy is crucially important in shaping who farms, how farming is done, and the future of rural communities. For example, there are few congruous land policy tools with direct intervention in the land market in Estonia (**paper III**). Restrictions on the acquisition of immovables used as profit-yielding land were enacted through the Restrictions on Acquisition of Immovables Act under Chapter 2. There are limitations for legal persons of the Contracting States and persons of third countries.

In Poland, there are strict rules maintained for potential buyers, in order to prevent a mass buy-out of land following the easing of regulations restricting land purchases by foreigners (Stacherzak et al., 2019). Restrictions on agricultural land acquisitions are necessary to avoid large tracts of land ending up in the ownership of a few large companies. Nevertheless, even if there are restrictions against companies acquiring large tracts of land, the links between companies can be very complicated, and through complex relationships between different companies, it is still possible to circumvent these restrictions. It is challenging, if not impossible, to track down how much land different companies really use, whether through ownership or rental, for agricultural production.

The problem of the complexities of evaluating land use concentration regarding closely related companies was addressed by Rea, 2018 (Rea, 2018). The study's outcome showed the complexity of the relationships between companies in Estonia, and the result was that it is hardly

possible to estimate the land use concentration based on simple and easy inquiry. Schemes based on extracts included simple systems containing one company as well as more complicated ones (Rea, 2018). Finally, the thesis pointed out that it is essential to develop a methodology that would allow us to determine the scope of land use concentration concerning connections between companies. Visser, Mamonova, and Spoor (Visser et al., 2012) also described these complex relations between companies. A broad distribution of land ownership is the basis for the welfare of local economies and rural communities (Palsova et al., 2021). An increase in the area of agricultural land farmed by large agricultural producers raises concerns that agricultural development may not be favouring small-scale farming and has a significant environmental footprint (Lowder et al., 2021). Farming should provide livelihoods for farmers, while retaining natural ecosystems and services (Giller et al., 2021).

1.3. Historical overview of changes in the agricultural sector in Estonia

From **paper II** it is possible to see that agriculture in Estonia has been through significant structural changes. From 1919 until today, there have been five major land reforms, each influencing Estonian agriculture. After the independence of Estonia in 1918, an extensive area of agricultural land was owned and used by large farms (owned mostly by Baltic Germans)(Grubbström, 2011; Grubbström and Sooväli-Sepping, 2012; Jürgenson, 2017). At the same time, the peasants had a strong desire for land ownership. These circumstances created a suitable environment for the 1919 land reform, the purpose of which was to create more landowners (Grubbström, 2011; Jürgenson, 2017). As a result, there evolved more than 40,000 landowners, while more than 20,000 land users were in the process of acquiring land (Rosenberg, 2019). The average area of one farm was 23 ha (Rosenberg, 2019). The number of small farms increased more than twofold; however, the reform also created some bottlenecks. For example, there emerged many tiny and economically unprofitable farms, and there were no longer enough workers on large farms (Jürgenson, 2017; Rosenberg, 2019).

In 1940, the Soviet Union occupied Estonia and started a new land reform. Private ownership was abolished, and land was included in state property (Grubbström, 2011; Jürgenson, 2017, 2016). The previous landowner became a land user, and the ceiling of the land use area was

designated as 30 ha (Jürgenson, 2017; Rosenberg, 2019). The area of the state land fund was over 758,000 ha (Rosenberg, 2019). The outcome was that successful farms were weakened, and many small, economically inefficient farms were created. These were steps towards later agricultural collectivization.

In 1941, Germany occupied Estonia, and the reform enacted by the Soviet Union was overturned. The land was partly returned to the use of its earlier/rightful owners; however, the state still owned the land. Three years later, the Soviet Union occupied Estonia once again, and picked up its land reform where it had left off. All the changes made under German occupation were overturned (Jürgenson, 2017). This time, the land reform comprised of 42,274 landowners and equitable owners, and 972,000 ha of land (Rosenberg, 2019). By now, there were only 136,000 farms left in the ESSR, and living conditions in rural areas were getting worse (Rosenberg, 2019). The next step was compulsory collectivization, resulting in the creation of large collective farms and the disappearance of small farms.

In the Soviet Union's planned economy, there was only one suitable form of agriculture: state farms - kolkhozes and sovkhoses (Jürgenson, 2017; Pöder, 2017). Because of this, the number of people living in rural areas and working in agriculture shrank rapidly. A further result was the diminishing number of villages and peripheries that arose.

There was a severe shortage in the public food supply and it did not improve. In the middle of 1980, the Soviet regime decided to allow family farms and small co-operatives. By the year 1986, there were 206 collective farms in Estonia (Jürgenson, 2017; Rosenberg, 2019). Socialist agriculture was in a jam, and one way to snap out of it was found in establishing rental farms in the peripheries. Shortly thereafter, talks about proper farms and self-sufficiency were opened. By the end of 1988, there were about 100 farms in Estonia; only a year later, at the end of 1989, there were over 1,000 farms (Rosenberg, 2019).

The demise of the large socialist farms had already started in December 1989. A single farm of up to 50 ha was permitted (Rosenberg, 2019). After the regaining of Estonian independence in 1991, restitution of farmlands based on the pre-Second World War ownership and privatization of collective farms took place (Grubbström, 2011;

Grubbström and Sooväli-Sepping, 2012; Jürgenson, 2017; Pöder, 2017; Viira, 2014). The land reform law, and subsequently the agriculture reform law, both favoured agriculture based on small farms (Kasepalu, 1991; Lillak, 2003; Pöder, 2017; van Dijk, 2007). In the first ten years of regaining independence, the number of farms in Estonia increased from 7.4 thousand in 1991 to 55.7 thousand in 2001 (Viira, 2014). Many small agricultural users arose (Pöder, 2017; Viira, 2014) but in the following years this number decreased (Grubbström and Sooväli-Sepping, 2012; paper I; *OECD...*, 2018).

The small size of the land use area is one of the characteristics of small farm systems (FAO). The concept of small farms lacks an agreed definition. The FAO explains that many sources define small farms as those with less than two hectares of cropland. In an Estonian context, small farms are family farms that were established due to the restitution of land, the disintegration of former collective farms, or the expansion of household plots (Jürgenson, 2017; Viira, 2014). Large-scale producers are mostly corporate or co-operative farms, with a few exceptions found in individual farms that have grown and continue to expand (Viira, 2014). Although the number of agricultural holdings has decreased, the number of end users of their production is steadily increasing – there are eight billion inhabitants in the world, and they all need food (Viira, 2014).

1.4. Risks associated with the concentration of agricultural land

Agricultural land concentration is a topic of discussion in different countries, but particularly current in post-Soviet countries. Land concentration is a process by which large agricultural corporations increasingly buy up or lease land from other agricultural producers (**paper III**).

The process of agricultural land concentration started decades ago but has recently accelerated. Large agricultural enterprises are increasingly flooding our markets with low-cost food and agricultural commodities (**paper III**). This has created a situation where small farms become less capable of competing in the marketplace. This means that growing numbers of farms are likely to go out of business and be forced to sell their land.

Small-scale farmers are vanishing rapidly, and places of employment in rural areas are decreasing (**paper IV**). The rural living situation is worsened by job losses, poor social infrastructure, and disappearance of the younger generation (**paper IV**). The process of land concentration is generally not reversible (EC, 2021; European Economic and Social Committee, 2015). Land concentration is negatively affecting development of rural communities. At the same time, small agricultural producers are vital for rural communities as they conserve rural cultural heritage and rural life. They are enlivening rural social life, producing valuable products, using natural resources sustainably and assuring a large number of landowners in rural regions (European Economic and Social Committee, 2015).

Land is a finite resource, and more of it cannot be produced. Because of land concentration, small agricultural producers and a new generation of farmers are having trouble acquiring land (**paper IV**). At the same time, broad distribution of land ownership is the basis of the social market economy and social cohesion (European Parliament, 2017). It also ensures job creation in rural areas, adds great value to agricultural production, and is an important prerequisite for ensuring peace in society (European Parliament, 2017). The future of the agricultural sector depends on a new generation of farmers. The will of innovation and investments in young people is vital for rural areas. The ageing of the agricultural sector can be stopped and the continuity of rural life secured through this.

The SDG report (United Nations, 2019) states that small-scale food producers play a large part in the solution to world hunger and guaranteeing sustainability in agriculture. An increase in farm size is associated with a statistically significant decrease in fertilizer and pesticide use per hectare, showing clear benefits for environmental protection (Ren et al., 2019). Yet, it has also been found that large-scale farming has no direct negative impact on the environment, and can lead to a positive environmental impact (Ren et al., 2019).

Large agricultural producers, whose main purpose may be to earn as much profit as possible, might be the outcome of further agricultural land concentration (**paper IV**). The cost of this kind of behaviour may result in serious and irreversible environmental damage (Constantin et al., 2017; Grant and Das, 2015). A large number of owners can help ensure

more economical use of land resources and food security (Graeub et al., 2016; Rada and Fuglie, 2019; van der Sluis et al., 2016). The fragmentation of landownership does not disturb land use the way agricultural land use fragmentation does (Hartvigsen, 2014). Restrictions on acquisition of agricultural land do not wreak havoc on agricultural production, and a larger number of landowners is healthy from the point of view of national security. Ownership is also a prerequisite for sustainable land use and responsible cultivation of agricultural land (Graeub et al., 2016; Llambí, 2010). A relationship between large agricultural producers and small-scale farms must be enabled, so that both farming types can remain in fair market competition (Juhász, 1991).

The most extreme example of land concentration in Europe is Scotland, where the local environment favoured agricultural land concentration into the usage of few large producers over a long period (**paper IV**). While starting to deal with the problem, 50% of the land belonged to 0.008% of the country's population (Glass et al., 2019). The seriousness of the problem was understood after a report on this topic was completed in 2014. Following this, a land reform was enacted to stop and reverse land concentration ("Land Reform (Scotland) Act 2016," 2016).

Land concentration in Scotland is one of the most unique examples of this phenomenon because of its extremism (**paper IV**). Historically, land ownership that was based on monopolies developed in those regions in Scotland, and today the rural life there has largely disappeared (**paper IV**). Since realizing the seriousness of the problem, the state has made serious efforts to restart rural life with large investments (**paper IV**).

1.5. Agricultural land market regulations influencing land concentration

The agricultural land market is subject to various regulations across the countries of the world. The importance of a well-functioning agricultural land market is difficult to overemphasize. Agricultural land cannot be left to market principles alone, because the supply of land does not respond to prices like ordinary goods (Courleux, 2019). Agricultural land is an important ingredient of national sovereignty; it is a common resource whatever the scale considered (Courleux, 2019). It is the most important asset for food production, and the development of rural regions in particular. A well-functioning land market firstly provides access to land

for the farmers who are the most productive, but who own less land than they require (Ciaian et al., 2012a). Secondly, it allows the exchange of land as the off-farm labour market further develops (Ciaian et al., 2012a). Thirdly, it facilitates the use of land as collateral to access credit markets (Ciaian et al., 2012a).

EU countries have put in place various national laws establishing various conditions and restrictions for agricultural land market transactions covering rental markets, sales markets, or both (Vranken et al., 2021). As there is no specific EU legislation regulating land market transactions, the adoption and implementation of agricultural land market regulations are the decision of the member states themselves. However, EU treaties prohibit imposing restrictions on the movement of capital (Vranken et al., 2021). Free movement of capital is one of the four fundamental freedoms of the EU internal market. Restrictions on free movement are justifiable on grounds of overriding public interest (but these must be proportionate) (Sandwell, 2016). The Court of Justice of the European Union has recognized the objective of preventing land speculation and preserving traditional forms of farming as legitimate (Sandwell, 2016). Free movement of capital is not an absolute right in the case of land transactions, and land property rights should be differentiated from other property rights (Sandwell, 2016).

In Western Europe, the share of agricultural land that is transacted each year is very small, ranging from 0.4% of the total utilized agricultural area (Ciaian et al., 2012a). In Eastern Europe, credit and capital market imperfections play a crucial role in the efficiency of the rural land market (Ciaian et al., 2012a). Land reforms of new EU countries created a situation where there were suddenly large tracts of land on the market (Ciaian et al., 2012b). This situation created a good basis for agricultural land concentration, particularly to large-scale corporate farms (Żróbek-Różńska and Zielińska-Szczepkowska, 2019).

In these cases, allowing trade to be regulated by the market alone can lead to over-concentration of agricultural land; therefore, various instruments should be used to maintain or improve the structures of agricultural producers (Żróbek-Różńska and Zielińska-Szczepkowska, 2019).

The dominance of large corporate farms in the land market leads to imperfect competition, where large farms use their market power in local or regional land markets to influence land prices and rental contract conditions in their favour (Ciaian et al., 2012b). Besides differences in rental prices, large-scale corporate farms also rent land for longer periods to effectively lock in agricultural land (Ciaian et al., 2012b).

In most countries, land transactions are free and unrestricted. Yet, some EU countries have heavily regulated markets. Countries with heavily regulated land markets are mainly among the new EU member states (Ciaian et al., 2012a; Vranken et al., 2021). In Croatia, Hungary, Poland and Romania, many regulations exist to protect small- and medium-sized agricultural producers (Vranken et al., 2021). In some EU countries, the acquisition of agricultural land is subject to the condition of agricultural experience by the acquirer (Vranken et al., 2021). In other EU countries, pre-emptive rights are used to give an advantage to neighbouring farmers (Vranken et al., 2021).

Rapid changes in land prices in Germany have prompted questions over whether the land market works effectively as an allocation device to serve societal interests, and whether there is a need for political measures to reduce potential negative implications (Heinrich et al., 2019). Because of the price developments on the land market, many farms - especially smaller, family-operated farms - are concerned about losing their ability to compete on the land market (Heinrich et al., 2019). Research carried out on the example of Germany showed that setting an upper limit to the acquisition of agricultural land has a limited effect on small farms (Heinrich et al., 2019). It was noted that some additional farms may survive, but most of the land which would be lost by very large farms is reallocated towards other large farms that initially farm less than the maximum size (Heinrich et al., 2019). Acquisition caps are considered to be a heavy instrument against land concentration, but may be justified in some circumstances (Sandwell, 2016).

However, family farming forms the core of European agriculture, and increasing concentration is making it harder for family farmers to access land. While regulation of land markets is a national competency, EU countries are not completely free in this decision-making. Countries need to provide indications of why they are introducing measures, and

they may be challenged in the European Court of Justice (Sandwell, 2016).

As for certain policies, farmers may respond strategically, such as splitting up very large farms into subsidiaries if it is necessary to put an end to complex structures of agricultural producers. There is a need to know who the final beneficiaries of EU funding are (Sandwell, 2016).

2. AIMS OF THE STUDY

This thesis examines changes in agricultural land use in Estonia, and possibilities for stable land use. The main objectives of this thesis are to i) explore the general changes in agricultural land use in Europe ii) present the situation in agricultural land use and ownership in Estonia, and iii) point out examples from different countries that might help prevent agricultural land concentration and support stable land use in Estonia. To achieve these objectives, the following research questions had to be answered:

- What is the situation in agricultural land use in Europe? (**Paper I**).
- What is the situation in agricultural land use and land ownership in Estonia? (**Papers I, II, IV**).
- What kind of restrictions have EU countries implemented to protect their agricultural land against concentration? (**Papers III, IV**).

3. MATERIAL AND METHODS

3.1. Study areas

The thesis deals with changes in agricultural land use in Estonia, and offers opportunities for stable land use. To get a wider view of the situation in agricultural land use, the first study area is Europe. The second study area is the entire state of Estonia. Subsequent study areas are counties in Estonia and agricultural land users in Estonia.

The study regarding the situation in agricultural land use in **Europe** firstly covered all EU member states and the United Kingdom. Data concerning the utilized agricultural land area and the number of producers were analysed in this case. Secondly, the purchase prices of agricultural land in 17 EU countries were studied; and thirdly, rental prices of 13 EU countries were included in the study. Only countries with available data about purchase and rental price in 2011 and 2020 were included in the study. 2011 was the first year where this data about Estonia was available. Table 1 gives an overview of the level, coverage and aim of the study. Figure 1 gives an overall picture of the countries involved in the study.

Table 1. The level of studies, their coverage and aim

Level of study	Coverage	Aim
Europe	27 countries from EU and United Kingdom	Situation in agricultural land use in Europe (cf. paper I, IV)
	17 countries from EU	
	13 countries from EU	
State	All counties in Estonia (before 01.01.2018)	Situation in agricultural land use and ownership in Estonia (cf. paper I, IV)
County	Türi municipality	Land use of the largest agricultural producer in 2016 (cf. paper II)
Land user	All agricultural land users according to ARIB in 2011, 2016 and 2020 in Estonia	Situation in agricultural land use in Estonia in size groups (cf. paper I, II, IV)
	Two agricultural land users according to ARIB in 2016 in Estonia	Location of land use plots of two large producers (cf. paper II)
	49 largest agricultural land users according to ARIB 2020 in Estonia	Land ownership of 49 largest agricultural land users in 2001, 2016 and 2021 according to ARIB 2020 from the Land Registry (cf. paper IV)
		Land use of 49 largest agricultural land users in 2003, 2016 and 2021 from ARIB

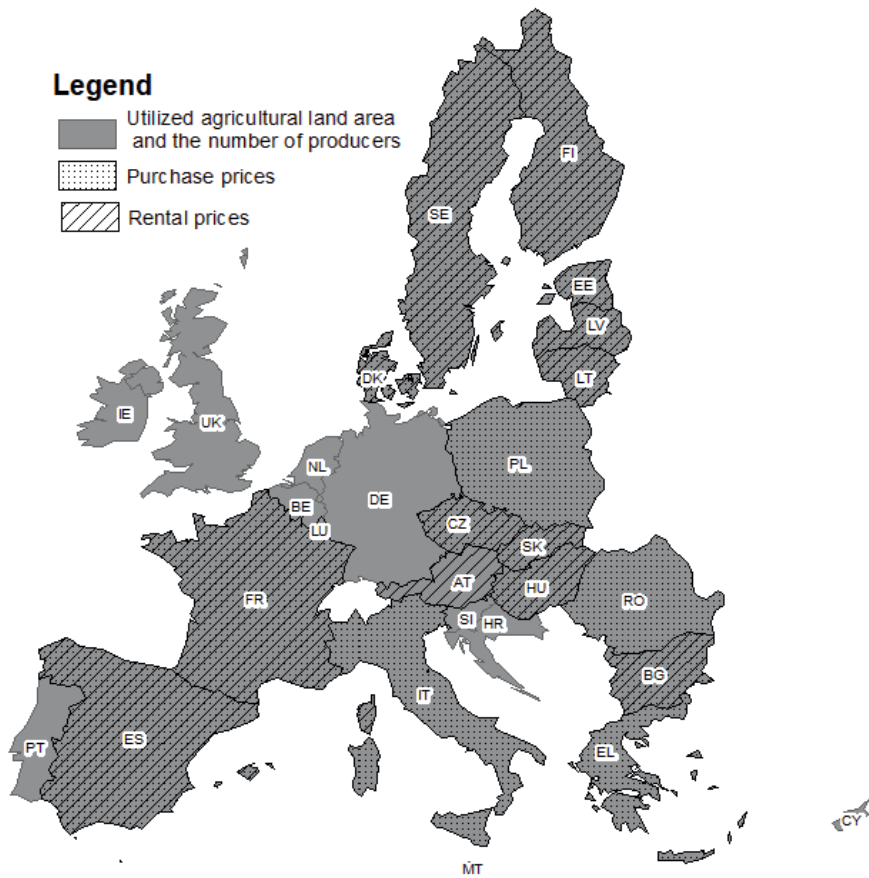


Figure 1. Coverage of the study on the European level: utilized agricultural land area and the number of producers (27 EU countries and UK), agricultural land prices (17 countries) and rental prices (13 countries) (**paper IV**).

The study area of the **state level** covered all the counties (figure 2). The administrative division that existed before 01.01.2018 is used in the study. The state level study is used for analysing the situation in agricultural land use and ownership in Estonia.

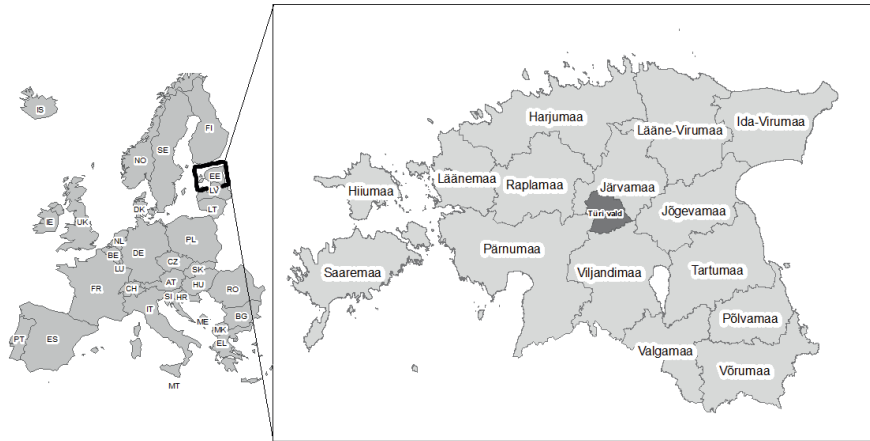


Figure 2. Location of Estonia (study area) in Europe, and division and locations of counties in Estonia. Location of Türi municipality (**paper IV**).

The county level was used to analyse the land use of the largest agricultural land user in 2016. As the land plots used in this case were situated in one municipality, the coverage of this study level was correspondingly Türi municipality.

Analyses on the land user level covered all agricultural land users according to ARIB data in 2011 (**paper I, II, IV**), 2016 (**paper I, II**) and 2020 (**paper IV**). An overview of the situation was given by dividing Estonian agricultural land users' landholdings into six size groups. These six size groups were created to obtain a better overview of the changes taken place in Estonian agricultural land use (explanation follows in 3.3. Methods used). Secondly, two large land users, and the location of their land plots in Estonia in 2016, were analysed to get an overview of some extreme examples of land plot scatteredness.

3.2. Data

The general overview of the content and source of data used in the thesis are presented in table 2. The content and source of the data are presented according to the research questions.

The aim of the **first research question** is to obtain an overview of the situation of agricultural land use in Europe. Firstly, data from Eurostat (**paper I**) was used to compose an overview of agricultural land use in European countries, including data on utilized agricultural land use,

number of farms, and average utilized agricultural land area per farm. This data was from the years 2005, 2007, 2013 and 2016. The year 2016 or 2013 was used as the base year for calculating the changes that took place in the area of utilized agricultural area, number of farms, and average utilized agricultural land area per farm.

Additionally, data from Eurostat was used (**paper IV**) to compile an overview of agricultural land sale and rental prices in Europe. This data was from the years 2011 and 2020. 2011 was selected because no earlier data is given by Eurostat on these prices in Estonia. Countries where one of the selected years was not covered were left out from analyses.

Table 2. Content and source of the data

Research question	Content of the data	Source of the data	Reporting
What is the situation of agricultural land use in Europe?	utilized agricultural land use, number of farms and average utilized agricultural land area per farm in Europe in 2005, 2007, 2013 and 2016; agricultural land selling and rental prices in Europe in 2011 and 2020	FAOSTAT ¹ Eurostat ²	chapter 4.1. paper I
What is the situation of agricultural land use and land ownership in Estonia?	number of agricultural households and agricultural land use area in 2001, 2003, 2005, 2007, 2010, 2013, 2016 and 2020; agricultural land area and number of producers were analysed in 2011, 2016 and 2020; 49 land users landownership in 2001, 2016 and 2021; 49 producers agricultural land use area in 2003, 2016 and 2021	Statistics Estonia ³ ARIB ⁴ Land Registry ⁵	chapter 4.2., 4.3 paper I, II and IV
What kind of restrictions have EU countries implemented to protect their agricultural land against concentration?	text of legal acts: Restrictions on Acquisition of Immovables Act (Estonia), Republic of Lithuania Law on the Acquisition of Agricultural Land, Land Reform (Scotland) Act 2016, Act on Land Privatization in Rural Areas (Latvia); information from reports, regulations and scientific articles	Riigi Teataja, e-seimas.lrs.lt, legal acts of the republic of Latvia, legislation.gov.uk; website of FAO, EUR-Lex, OECD, SCOPUS	chapter 4.4. paper I,III and IV

¹ FAOSTAT. <https://www.fao.org/faostat/en/#data/RL>

² Eurostat. https://ec.europa.eu/eurostat/web/products-datasets/-/ef_m_farmleg

³ Statistics Estonia. PMS416, PMS422 <https://andmed.stat.ee/et/stat>

⁴ ARIB. The Register of Agricultural Support and Agricultural Parcels

⁵ Land registry. <https://www.rik.ee/et/e-kinnistusraamat>

Secondly, data from FAOSTAT was also used (**paper I**) to provide an overview of agricultural land use in European countries. This data was from 2005 and 2016. The base year for calculating the changes in the area of agricultural land was 2016. It was necessary to add FAOSTAT data to the study because it differs slightly from Eurostat data on the utilized agricultural land area.

The **second research question** is to find out the situation in agricultural land use and landownership in Estonia. Firstly, data from Statistics Estonia was used (**paper I, IV**) to analyse changes in Estonian agricultural land use, including data on the number of agricultural households and agricultural land use area. This data was from the years 2001, 2003, 2005, 2007, 2010, 2013, 2016 and 2020.

The statistical unit is agricultural holding. A list is generated from the statistical register of agricultural holdings above the threshold. The population includes 11,369 sites, and the sample size for the 2020 modules was 4,798. An agricultural holding (until 2019) was a single unit, both technically and economically, which had single management and which produced agricultural products or maintained its land in good agricultural and environmental condition, and where there was at least one hectare of utilized agricultural land or there was less than one hectare of utilized agricultural land and agricultural products are produced mainly for sale. From 2020, an agricultural holding is a single unit both technically and economically, where there are at least five hectares of utilized agricultural area; two hectares of arable land; 0.5 hectares of potatoes; 0.5 hectares of vegetables and strawberries; 0.2 hectares of aromatic and medicinal plants and herbs, flowers, seeds, and nurseries; 0.3 hectares of fruit and berry plantations or other permanent crops; 100 m² of greenhouses; or 1.7 livestock units (PMS 422).

Utilized agricultural area is the area utilized in the survey year by agricultural holdings for agricultural production or maintained in good agricultural and environmental conditions (incl. arable land, permanent grassland, fruit and berry plantations, nurseries, and kitchen gardens) (PMS 422).

To conclude a more detailed overview of the recent changes in the pattern of agricultural landholdings in Estonia (**paper I, II, IV**), ARIB Field Register data from 2011, 2016 and 2020 were used. The ARIB Field

Register is a digitalized database of agricultural plots, and is required for payment of area supports from the budget of the EU. This register includes information on agricultural land in actual use and covered by subsidies.

It is a more comprehensive study that covered all agricultural producers' land holdings registered in the ARIB, which applied for support from the EU. ARIB data on the agricultural land area and the number of producers were analysed in order to get an overview of changes in Estonian agricultural land users' landholdings presented in **papers I, II and IV**.

Thirdly, data from the Land Registry was used (**paper IV**) to analyse changes in landownership of the 49 largest agricultural producers according to 2020 ARIB data. The data from the Land Registry covered the years 2001, 2016 and 2021. Land use changes were also studied in the case of the 49 largest agricultural land users. ARIB data from 2003, 2016 and 2021 were used.

Paper II is based on the administrative division that existed before 01.01.2018. After the administrative-territorial reform, the division was revised, and with it, the borders of counties also altered to some extent. The administrative division that existed before 01.01.2018 (figure 2) was used because the data from other sources also precede the administrative-territorial reform. Information about those 15 counties with their name, area (ha), agricultural land use area (ha) in 2016 and 2011, and the number of land users in 2011 and 2016 is presented in table 3.

Table 3. Agricultural land use and the number of agricultural land users in 15 counties in Estonia (**paper II**)

County	County area (ha) ¹	Agricultural land use area				Number of agricultural land users	
		2016 (ha)	2011 (ha)	2016 (%)	2011 (%)	2016	2011
Harjumaa	432,669	71,098	61,417	16	14	1,232	1,023
Hiiumaa	103,244	13,957	12,188	14	12	364	352
Ida-Virumaa	297,158	36,384	31,028	12	10	570	606
Jõgevamaa	254,486	74,817	69,268	29	27	1,029	1,117
Järvamaa	267,415	80,544	76,776	30	29	785	785
Läänemaa	181,558	52,117	43,052	29	24	852	809
Lääne-Virumaa	369,572	109,356	101,711	30	28	1,129	1,133
Põlvamaa	182,335	53,310	48,377	29	27	1,102	1,212
Pärnumaa	541,873	85,783	78,622	16	15	1,535	1,556
Raplamaa	276,506	69,520	64,911	25	23	1,129	1,204
Saaremaa	293,765	53,637	46,822	18	16	1,200	1,116
Tartumaa	334,931	84,071	75,921	25	23	1,248	1,380
Valgamaa	191,709	45,265	41,333	24	22	1,144	1,220
Viljandimaa	342,003	85,601	77,829	25	23	1,156	1,254
Võrumaa	277,314	52,358	47,781	19	17	1,794	2,038
Estonia	4,346,538	967,816	877,036	22	20	15,456	16,226

¹County area before 01.01.2018.

These papers (**I, II, IV**) concentrated on agricultural land users' land holdings that covered all plots which were used for agricultural production in Estonia. No distinction was made between land held in ownership and leasehold land, or between different production groups.

The **third research question** is to determine what kind of restrictions EU countries have implemented to protect their agricultural land against concentration. Firstly, information from reports and scientific articles was used to find countries where such restrictions are implemented. Secondly, some legal acts (that were available online and in English) from these countries were studied to determine the exact regulations.

3.3. Methods used

This thesis examines changes in agricultural land use in Estonia and opportunities for stable land use. The agricultural sector in Europe has shifted from a large number of small- and medium-sized farms to minor large agricultural producers. The option for farms can be summarized as “grow or go”. Accordingly, the pragmatic worldview of this thesis reflects the phenomenon of agricultural land concentration. Instead of focusing on methodology, in the pragmatic worldview researchers emphasize the research problem and use all approaches available to understand the problem (Creswell, 2014; Molina-Azorin and Cameron, 2010).

The qualitative approach was used in the study. In qualitative research, the researcher generally explores meanings and insights in a given situation. The purpose of qualitative research is to describe and interpret issues or phenomena systematically (Mohajan, 2018). The methods and work processes used are reflected in table 4.

Table 4. The relationship between research questions, method and work process, and results

Research question	Method and work process	Results	Reporting
What is the situation in agricultural land use in Europe?	<ul style="list-style-type: none"> descriptive statistics 	<ul style="list-style-type: none"> agricultural land use area per farm is growing purchase price of agricultural land has increased rental prices of agricultural land have increased 	chapter 4.1 paper I, IV
What is the situation in agricultural land use and land ownership in Estonia?	<ul style="list-style-type: none"> descriptive statistics GIS application: analyses with ARIB data (Analyses Tools, Editing Tools calculations in Table etc.), and mapping the situation 	<ul style="list-style-type: none"> the number of agricultural households in Estonia is decreasing average land use per agricultural household in Estonia is increasing the land use of corporate bodies is growing at the expense of self-employed workers land ownership is concentrating alongside land use 	chapter 4.2. paper I, II, IV
What kind of restrictions have EU countries implemented to protect their agricultural land against concentration?	<ul style="list-style-type: none"> desk studies of books, scientific papers, reports, acts of law, regulations and documents 	<ul style="list-style-type: none"> restrictions on how much agricultural land a person or group of persons can own (Hungary, Lithuania, Latvia, Poland) obligation to have special qualification to purchase agricultural land (Hungary, Poland) permit obligation before agricultural land transaction (Germany, France, Austria, Poland) obligation to use purchased land only for agricultural purposes in a fixed time period (Lithuania, Latvia, Hungary) pre-emptive right to purchase agricultural land (Germany) ban on persons from third countries to purchase agricultural land (Hungary, Latvia, Lithuania) 	chapter 4.4 paper I, III, IV

Descriptive statistics were used to provide an overview of the changes in agricultural land use in Europe and Estonia. *Microsoft Excel* was used to describe and provide graphical outputs of the data from Eurostat, FAOSTAT, Statistics Estonia, the Land Registry and the ARIB.

GIS application was used to analyse data from the ARIB. ARIB data on agricultural land users and land area per producer were summarized using GIS software *ArcGIS (version 10.4)*. Producers were divided into six groups according to the size of their landholdings: 0–<2 ha, 2–<40 ha, 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 ha; data were taken on the basis of these size groups. The basis for this division comes from the Farm Accountancy Data Network (FADN¹), where agricultural land area was divided into four size groups (0–<40 ha, 40–<100 ha, 100–<400 ha, >400 ha) in 2015. In order to get a closer look at the smallest agricultural land users, the FADN size group 0–<40 ha was divided into size groups 0–<2 ha and 2–<40 ha. The FADN size group >400 ha was divided into size groups 400–<1000 and >1000 ha in order to characterize the largest agricultural land users. FADN data collection and analysis methods have changed over the years, and they now reflect a farm's economic size, not its land use area. In this thesis, small producers are in size groups 0–<2 ha and 2–<40 ha. Medium size farms are in size groups 40–<100 ha and 100–<400 ha. Large producers are in size groups 400–<1000 ha and >1000 ha.

Ownership and land use changes of 49 producers were analysed using GIS software *ArcGIS (version 10.4)* and producers were divided into size groups 0 ha, less than 100 ha, 101–200 ha, 201–400 ha, 401–1000 ha and more than 1000 ha, data was taken on the basis of these size groups.

To get an overview of county level changes in agricultural land use in Estonia, open data on county boundaries from the Estonian Land Board were intersected with ARIB data. *ArcGIS* was also used for mapping the results of GIS analyses. To picture the location of the land plots of the largest agricultural producer in 2016, Estonian Land Board data on municipalities boundaries were used.

During **desk study**, the available books, scientific papers, reports, acts of law, regulations and documents were worked through. Important facts were gathered and presented in the thesis. A literature review has also been provided.

¹ <https://maainfo.ee/index.php?page=9&>

4. RESULTS

4.1. Agricultural land use pattern and its changes in Europe

The outcome of **paper I** showed that, according to Eurostat, between 2005 and 2016 (figure 3), the utilized agricultural land area grew in Bulgaria, Estonia, Ireland, Greece, Croatia, Latvia, Lithuania, Luxembourg, Hungary, Malta, Slovenia, Slovakia and the United Kingdom. It decreased in other European countries, in greatest quantities in Germany, Spain, Romania and Switzerland.

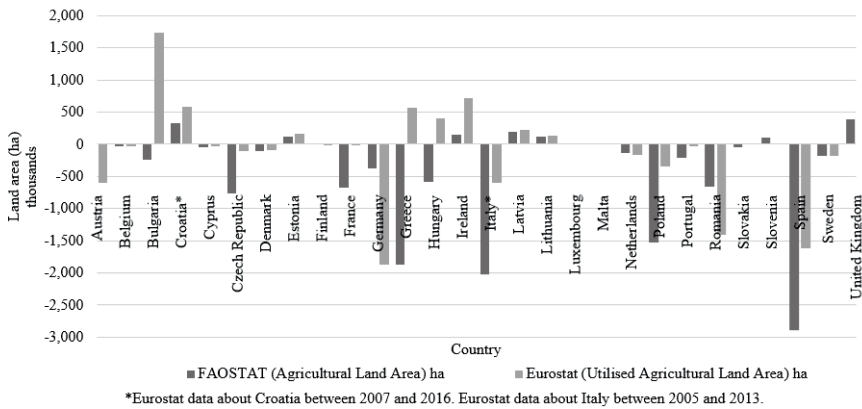


Figure 3. Utilized agricultural land and agricultural land use change in Europe between 2005 and 2016 (**paper I**).

Unlike Eurostat data, FAOSTAT data showed that utilized agricultural land area has decreased in Bulgaria, Greece and Hungary. These indicators were more similar in other countries. One reason for the differences seen in figure 3 is that utilized agricultural land and agricultural land are not precisely the same concept. Agricultural land area is land used for cultivation of crops and animal husbandry. The total of areas under “Cropland” and “Permanent meadows and pastures.” Utilized agricultural land area is the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of common land.

The total number of farms in Europe between 2005 and 2016 (figure 4) decreased by four million, affecting all countries except for Ireland, where the amount of farms increased by 4,860. According to **paper I**, the largest decrease in the number of farms (-1,065,770) occurred in Poland, but the decrease was also remarkable in Romania (-834,120) and Italy (-718,200).

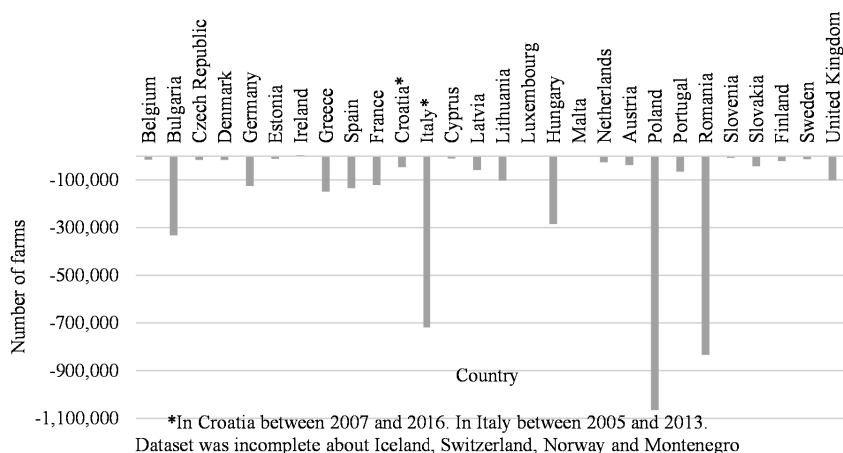


Figure 4. Change in the number of farms in Europe between 2005 and 2016 (**paper I**).

According to **paper I**, the average growth of agricultural land use per farm between 2005 and 2016 in Europe was 4.8 ha. The biggest growth in agricultural land use per farm occurred in Slovakia (46.2 ha) and in the Czech Republic (46.0 ha) (figure 5). In Estonia, the growth of agricultural land use per farm was 29.7 ha. Cyprus was the only country where the average utilized agricultural area per farm decreased slightly (-0.2 ha).

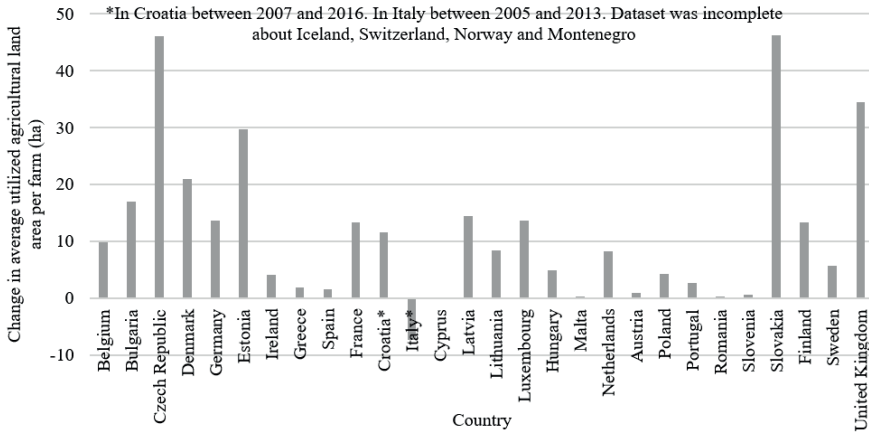


Figure 5. Change in average utilized agricultural land area per farm between 2005 and 2016 (**paper I**).

Paper I states that, while agricultural land use has changed in Europe, the utilized agricultural areas have changed less, having decreased only 1% as compared to the years 2005 and 2016. The decrease was larger in some countries (Germany, Spain and Romania) while the average utilized agricultural area per farm increased almost in all countries.

According to **paper IV**, the purchase price of agricultural land in Europe has increased in most countries during the period 2011-2020 (figure 6). The purchase price of agricultural land has remained almost the same or decreased in Denmark, Greece and Slovakia. The lowest price is in Estonia. The price of agricultural land was 1,062 eur/ha and 3,772 eur/ha in Estonia in 2011 and 2020, respectively. Over a ten-year period, the purchase price of agricultural land in Estonia has increased by 2,710 eur/ha (255%). Estonia is followed by Lithuania, Latvia, Hungary and Bulgaria, who also have low agricultural land prices.

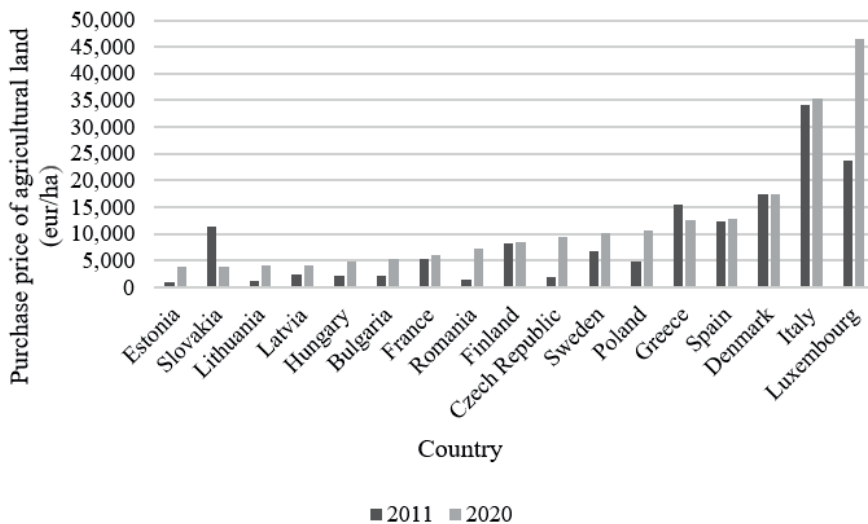


Figure 6. Average purchase price of agricultural land in Europe in 2011 and 2020 (paper IV).

The highest purchase price of agricultural land can be found in Luxembourg. In 2011, the price of agricultural land in Luxembourg was 23,648 eur/ha, and in 2020 it was 46,500 eur/ha. In Luxembourg the purchase price also increased the most (+22,852 eur/ha and 97 %). Luxembourg is followed by Italy, Denmark, Spain and Greece, who also have high prices. However, prices have decreased in Greece. The highest percentage increase in purchase price (424%) took place in Romania (+5,797 eur/ha).

Rental prices of agricultural land have also increased in most of the countries presented in figure 7 (paper IV). Rental prices of agricultural land have decreased only in Sweden. The lowest rental price of agricultural land can be found in Slovakia, where the rental price was 37 eur/ha and 57 eur/ha in 2011 and 2020 respectively. Slovakia is followed by Latvia, Estonia and Lithuania. The average rental price of agricultural land in Estonia was 26 eur/ha and 76 eur/ha in 2011 and 2020 respectively.

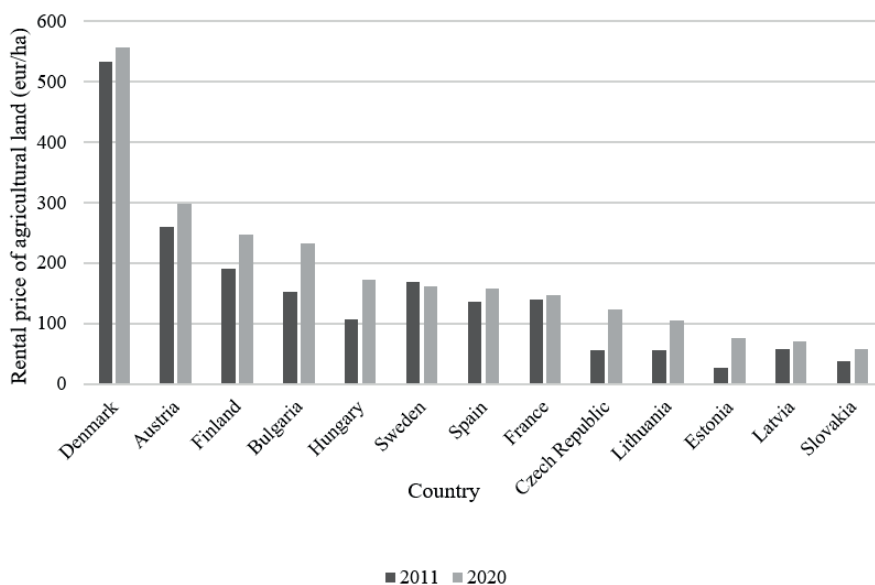


Figure 7. Average rental price of agricultural land in Europe in 2011 and 2020 (**paper IV**).

The largest increase (+80 eur/ha (52 %)) in the average rental price of agricultural land was found in Bulgaria. Here, the rental price was 153 eur/ha and 233 eur/ha in 2011 and 2020 respectively. The largest percentage increase in average rental price (192%) took place in Estonia. The highest rental prices of agricultural land can be found in Denmark. Here, the rental price was 534 eur/ha and 557 eur/ha in 2011 and 2020 respectively. Denmark is followed by Austria, Finland and Bulgaria.

4.2. Agricultural land use pattern and its changes in Estonia

4.2.1. State level changes according to Statistics Estonia data

According to statistical analyses in **papers I and IV**, the number of agricultural households in Estonia has decreased yearly (figure 8). In 2001, there were 55,748 agricultural households in Estonia, but by 2020 the number had decreased to 11,369. However, the area of utilized agricultural land has remained almost the same. The utilized agricultural land area was 871,213 ha and 975,323 ha in Estonia in 2001 and 2020 respectively (figure 8).

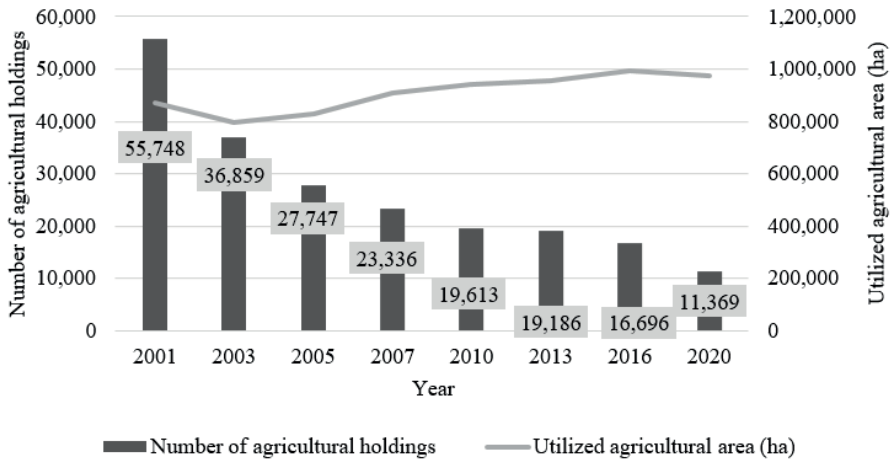


Figure 8. The number of agricultural households and agricultural land area in Estonia between 2001 and 2020 (paper IV).

The results in papers I and IV showed that average land use per agricultural household in Estonia has increased due to the decrease in the number of households and an almost constant agricultural land area (figure 9). In 2001, the area of agricultural land use per household was 16 ha, but by 2020 it had grown to 86 ha. The average agricultural land use area per user grew from 2 to 26 ha per year.

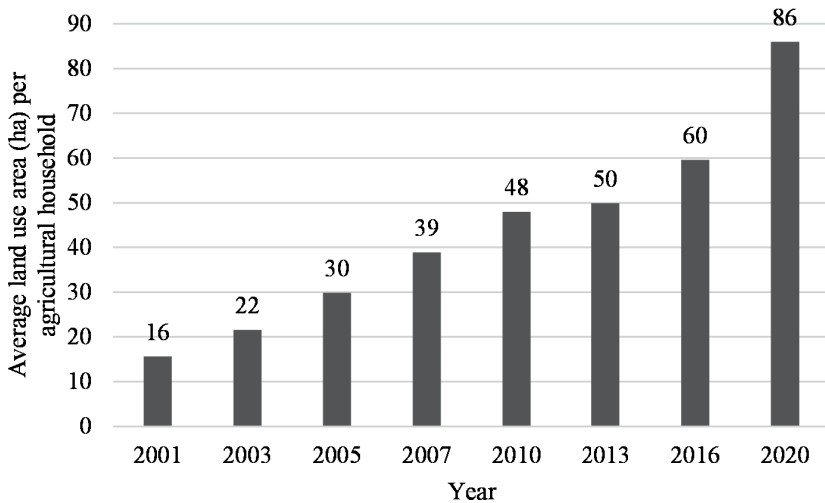


Figure 9. Average land use per agricultural household in Estonia between 2001 and 2020 (paper IV).

In 2001, corporate bodies used 327,788 ha, which was 38% of all agricultural land (figure 10). While self-employed workers used 543,426 ha of all agricultural land, corporate bodies used 215,638 ha less.



Figure 10. Percentage of corporate bodies and self-employed workers in Estonian agriculture between 2001 and 2016 according to the agricultural area (ha) used by agricultural producers (**paper I**).

By 2016, the situation had changed significantly (**paper I**). Corporate bodies used 645,598 ha (65%) of agricultural land. At the same time, self-employed workers used 349,505 ha, which is 193,921 ha less than 2001 and 296,093 ha less than corporate bodies in 2016.

4.2.2. State level changes according to ARIB data

According to ARIB data analyses in **papers I** and **IV**, agricultural land use area has grown 12% and the number of land users has dropped 7% in Estonia between 2011 and 2020. Table 5 presents the data for land users, which were divided into groups according to the size (area) of their landholdings.

Table 5. Data for land users' groups formed according to the area of land users' landholdings for the years 2011 and 2020 (**paper IV**)

Groups (ha)	2011			2020		
	number	area (ha)	area (%)	number	area (ha)	area (%)
<2	1,475	2,140	0	1,211	1,778	0
2 –<40	11,654	132,888	15	9,785	107,119	11
40 –<100	1,460	91,563	10	1,615	91,578	9
100 –<400	1,174	225,708	26	1,660	275,696	28
400 –<1,000	337	207,844	24	556	244,574	25
>1,000	126	216,893	25	212	257,964	26
Total	16,226	877,036	100	15,039	978,711	100

Comparing the years 2011 and 2020 (**papers I and IV**), the number and the area of these land users decreased in the three smallest land users' (0–2 ha, 2–<40 ha and 40 –<100 ha) groups, and increased in the three largest (100–<400 ha, 400–<1000 ha and >1000 ha) groups (table 5). Analysis of land users according to the area of their landholdings in six size groups shows that between 2011 and 2020, the agricultural land area used by land users in size groups 100–<400 ha and >1000 ha has grown the most. Meanwhile, the agricultural land area used by land users in size groups 0–<2 ha and 2–<40 ha has decreased, and the agricultural land area used by size group 40–<100 ha has remained almost the same.

There were 768 agricultural land users in Estonia with land holdings over 400 ha in 2020. They were using 502,539 ha, or 51%, of the agricultural land utilized in Estonia in 2020. In 2011, there were 463 agricultural land users with land holdings over 400 ha. They used 424,736 ha, or 48%, of the utilized agricultural area in 2011. The agricultural land area used by larger land users has grown, while that used by smaller ones has decreased (figure 11a). The number of households in size groups 0–<2 ha and 2–<40 ha has decreased (figure 11b). In 2011, there were 1,475 agricultural users in size group 0–<2 ha using 2,139.72 ha of agricultural land. In size group 2–<40 ha there were 11,654 agricultural land users using 132,888.41 ha. In 2020, there were 264 fewer land users in size group 0–<2 ha using 361,57 ha less land. In size group 2–<40 ha there were 1,869 fewer users; they were using 25,769.19 ha less land than in 2011.

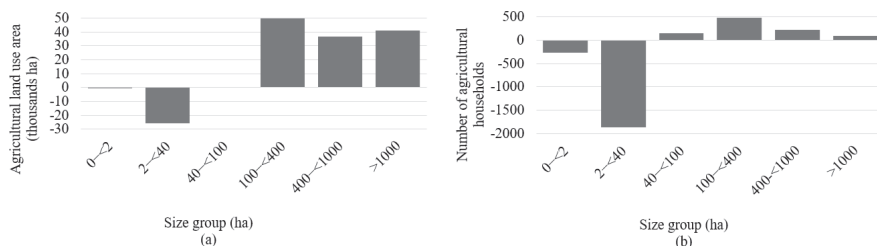


Figure 11. (a) Difference in the area of agricultural land use, and **(b)** difference in the number of agricultural households in size groups between 2011 and 2020 (**paper IV**).

According to **papers I** and **IV**, households in size groups 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 have grown in number. In 2011, there were 337 land users in size group 400–<1000 ha and they were using 207,843.80 ha of agricultural land. In size group >1000 ha, 126 land users were using 216,892.61 ha. By 2020, there were 219 more users in size group 400–<1000 ha and 86 more in size group >1000 ha. Agricultural land use area had grown 36,730.39 ha in size group 400–<1000 ha and 41,071.78 ha in size group >1000 ha.

In 2020, there were 275 corporate bodies and 936 self-employed workers in size group 0–<2 ha (figure 12). In size group 2–<40 ha there were 4,203 corporate bodies and 5,582 self-employed workers. In these two size groups, self-employed workers formed the majority. In size groups 400–<1000 ha and >1000 ha there were no self-employed workers. In size group 400–<1000 ha there were 556 corporate bodies, while in size group >1000 ha there were 212 corporate bodies.

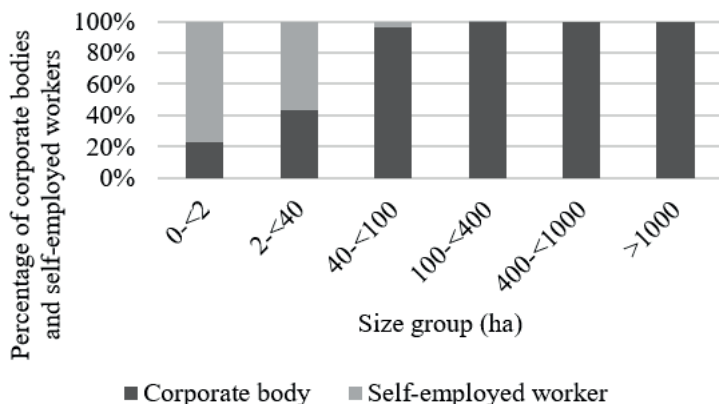


Figure 12. Percentage of corporate bodies and self-employed workers in size groups in 2020 (**paper IV**).

According to **papers I and IV**, the number of users in size group 0–<2 ha formed 8.1% of the total number of agricultural land users in Estonia (figure 13a), using 0.2% of the total land use (figure 13b) in 2020. The number of land users in size group 2–<40 ha amounted to 65.1% of the total number of land users in Estonia, using 10.9% of the total land use.

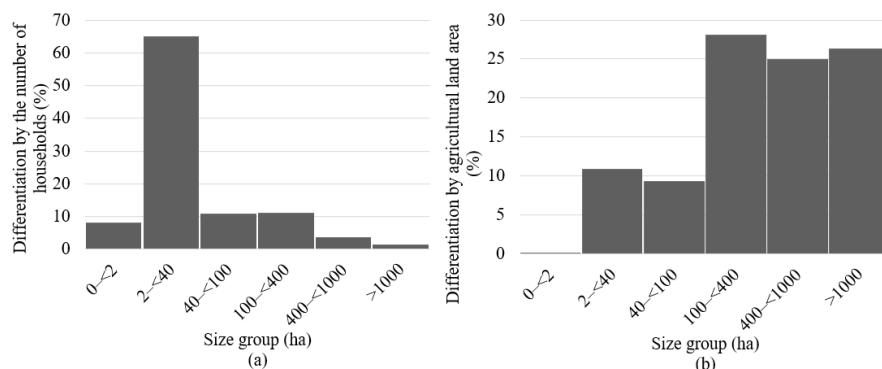


Figure 13. (a) Differentiation of size groups by the number of households, and (b) differentiation of size groups by agricultural land area in 2020 (**paper IV**).

Concurrently, the number of agricultural land users in size group 400–<1,000 ha accounted for 3.7% of the total number, using 25% of the total land use in Estonia. The number of agricultural land users in size group >1,000 ha accounted for 1.4% of the total households, using land 26.4% of total land use in Estonia.

4.2.3. County level changes according to ARIB data

According to **paper II**, agricultural land use area in Estonia grew 11% between 2011 and 2016; this growth took place in all counties (figure 14). The largest growth of agricultural land use was in Läänemaa county (21%) and the smallest was in the county of Järvamaa (5%).

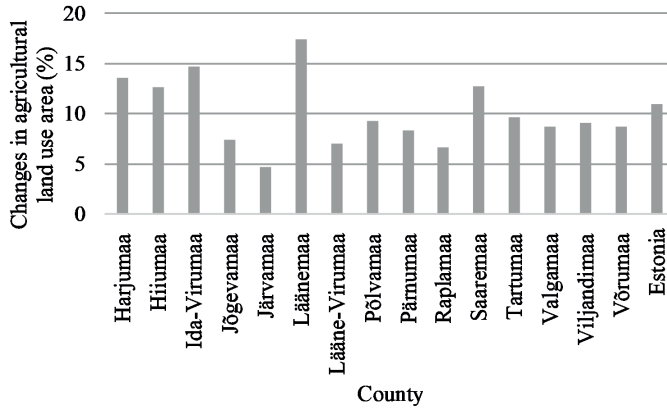


Figure 14. Changes in agricultural land use area in counties between 2011 and 2016 (paper II).

The number of land users between 2011 and 2016 (figure 15) dropped on average 5% in nine counties (Ida-Viru, Jõgeva, Põlva, Pärnu, Rapla, Tartu, Valga, Viljandi, and Võru). The number of land users increased in four counties (Harju, Hiiu, Lääne, and Saare) and it remained almost the same in two counties (Järva and Lääne-Viru). The most significant drop (-12%) in the number of agricultural land users took place in the county of Võrumaa; the largest increase (17%) in the number of agricultural land users took place in the county of Harjumaa.

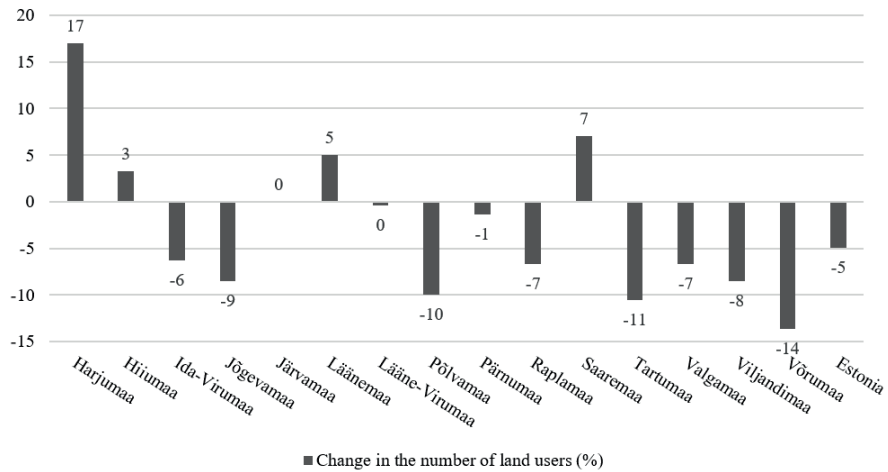


Figure 15. Changes in the number of agricultural land users in counties between 2011 and 2016 (paper II).

According to the data analysed in **paper II**, the majority of producers were in size group 2–< 40 ha (table 6). The number of producers in size group 2–< 40 ha was the largest (1,338) in Võru county and smallest (249) in Hiiu county. The number of producers using land in size group >1,000 ha was the smallest in every county. The largest number (25) of producers were in size group >1,000 ha is in Järva county. In Hiiu county, there were no producers using land over 1,000 ha. There were also very few producers in counties in size group 400–< 1,000 ha (in total 546). Producers' division between size groups 0–< 2 ha, 40–< 100 ha and 100–< 400 ha was quite similar across Estonia.

Table 6. Division of the agricultural users according to size groups in counties in 2016 (**paper II**)

County	Number of agricultural land users in size groups					
	0–<2	2–<40	40–<100	100–<400	400–<1,000	>1,000
Harjumaa	79	845	119	129	47	14
Hiiumaa	33	249	43	32	7	0
Ida-Virumaa	52	375	52	63	21	8
Järvamaa	63	486	88	93	38	25
Jõgevamaa	92	691	93	97	39	23
Lääne-Virumaa	72	684	130	153	65	22
Läänemaa	48	568	91	105	34	8
Pärnumaa	115	1,058	152	152	44	13
Põlvamaa	153	691	104	111	44	11
Raplamaa	69	747	144	115	39	13
Saaremaa	110	850	121	93	18	8
Tartumaa	126	821	113	115	51	23
Valgamaa	81	831	104	87	30	11
Viljandimaa	80	766	125	124	43	19
Võrumaa	187	1,338	116	121	26	7
Total	1,360	11,000	1,595	1,590	546	205

The largest area of agricultural land was used by land users in size groups 400–< 1,000 ha (in total 237,671 ha) and 100–< 400 ha (in total 260,957 ha) (table 7). In counties like Järva, Jõgeva, Viljandi, Lääne-Viru and Tartu, land users in size groups 400–< 1,000 ha and >1,000 ha were using over 50% of the agricultural land. Most of the agricultural land in Estonia was used by size groups 100–< 400 ha, 400–< 1,000 ha, and

> 1,000 ha (in total 750,739 ha). A small part of the agricultural land in counties was used by those in size group 0–< 2 ha, 2–< 40 ha and 40–< 100 ha (in total 217,077 ha).

Table 7. Division of agricultural land use between land users in different size groups in counties in 2016 (**paper II**)

County	Agricultural land use area in size groups (ha)					
	0–<2	2–<40	40–<100	100–<400	400–<1,000	>1,000
Harjumaa	112	9,790	6,403	21,507	22,745	10,540
Hiiumaa	51	2,696	2,662	5,652	2,896	0
Ida-Virumaa	77	3,741	3,133	9,859	9,257	10,334
Järvamaa	93	6,343	4,766	15,127	11,727	43,377
Jõgevamaa	135	7,511	5,083	16,158	14,551	31,471
Lääne-Virumaa	106	8,115	8,143	27,074	32,361	32,827
Läänemaa	71	6,787	5,196	18,040	14,402	7,832
Pärnumaa	175	12,286	9,136	25,180	20,362	18,380
Põlvamaa	228	6,884	5,600	13,470	16,773	10,649
Raplamaa	103	9,433	9,069	19,201	15,938	15,658
Saaremaa	166	9,491	7,353	16,172	11,001	9,454
Tartumaa	185	8,397	6,616	19,331	25,488	23,995
Valgamaa	125	8,886	5,565	12,689	10,563	7,170
Viljandimaa	120	9,331	7,696	23,333	19,478	25,646
Võrumaa	279	12,266	6,671	18,165	10,131	4,783
Total	2,026	121,959	93,092	260,957	237,671	252,111

Data analyses in **paper II** showed that the area of landholdings varies considerably. For example, there were land holdings from 0.1 ha up to 5,756 ha in the year 2011. In 2011, the largest agricultural landholding was in the county of Järvamaa; it used 5,756 ha of land. The smallest was in the county of Harjumaa, and it used 0.1 ha of land. In 2016, the largest landholding remained the same as in 2011, and it used 5,523 ha land in the county of Järvamaa. In Tartumaa county, the smallest agricultural landholding was 0.3 ha in 2016; a different landholder used 0.1 ha of land in 2011. Land users with the smallest landholdings in 2011 and 2016 were self-employed workers, and the largest users were corporate bodies.

The largest agricultural landholding area was 5,523 ha in 2016, situated in the county of Järvamaa (figure 16). The land plots were scattered over the Türi municipality. The area of these land plots formed 27% of the Türi municipality total land use area registered in the ARIB.

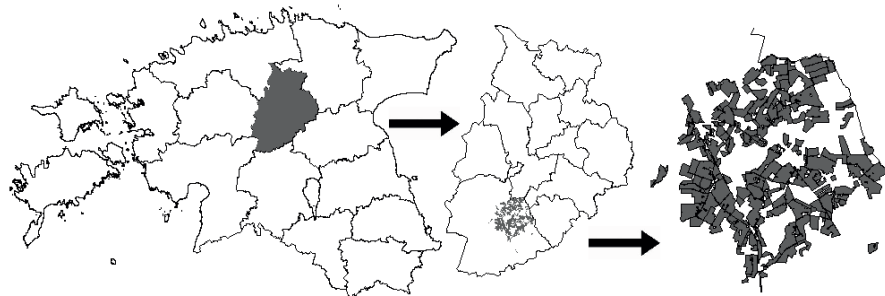


Figure 16. The location of the largest agricultural land user land plots in Järvamaa in 2016 (paper II).

While the largest land user in Estonia used land in only one municipality in 2016, some big producers used land throughout Estonia (figure 17). For example, land user ID 141094 used 1,341.37 ha of land, which was scattered over 147 plots. This user farmed land in eight different counties (Ida-Viru, Valga, Võru, Tartu, Viljandi, Põlva, Harju, and Lääne-Viru).

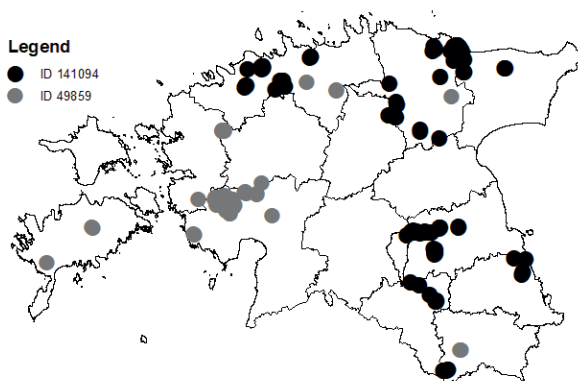


Figure 17. The location of two agricultural land users (ID 141094 and ID 49859) land plots in 2016 (paper II).

Land user ID 49859 farmed 1,149.9 ha of land that was scattered over 90 plots. This user farmed land in six different counties (Pärnu, Saare,

Võru, Harju, Lääne, and Lääne-Viru) and had land both on the island of Saaremaa and on the mainland.

4.3. Changes in agricultural landownership in Estonia in 2001-2021

According to **paper IV**, the landownership area of the 47 largest agricultural producers increased between 2001 and 2021. The landownership area of two producers decreased. Landownership of these two producers increased between 2001 and 2016. One producer owned 96.04 ha of land in 2001, and in 2016 the landownership of this producer was 2,164.94 ha. The second producer owned 76.01 ha of land in 2001, and in 2016 the landownership of this producer was 1,116.18 ha.

In 2001, there were 41 producers without landownership, or owning less than 100 ha of land (figure 18 and table 8). In 2021, there were no producers without landownership, and there were four producers owning less than 100 ha of land. In 2001, there were 20 producers owning less than 100 ha of land, and their average landownership area was 38 ha. In 2021, this area was 53 ha.

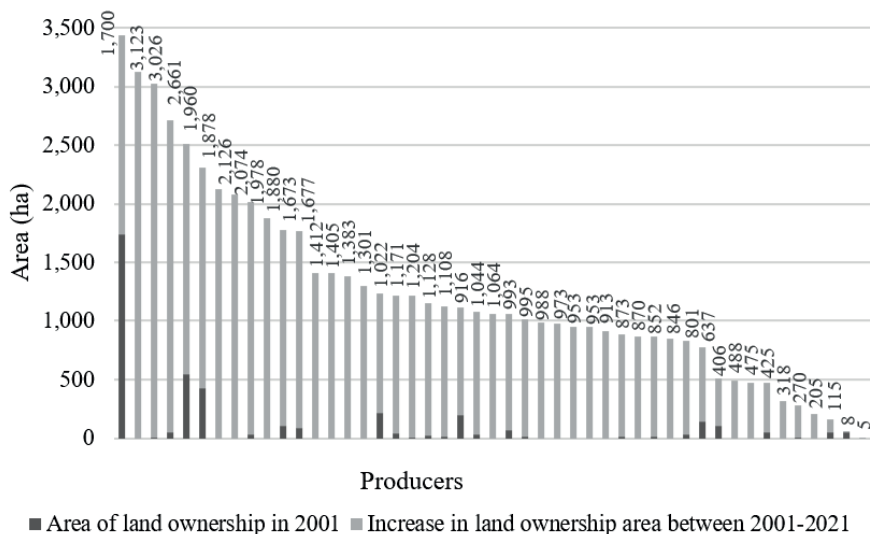


Figure 18. Area of landownership (Land Registry) of 47 agricultural producers in 2001 and 2021 (**paper IV**).

The larger size groups have grown over the years (table 8). In 2001, there were two producers in size group 401-1,000 ha, and their average landownership area was 488 ha. In 2021, there were 15 producers in this size group, and their average landownership area was 787 ha. Massive changes have taken place in size group >1,000 ha. In 2001, there was one producer owning more than 1,000 ha of land, owning 1,747 ha. In 2021, there were 26 producers with landownership larger than 1,000 ha, and their average landownership area was 1,750 ha.

Table 8. Changes in the 49 largest producers' landownership area (Land Registry) between 2001 and 2021 (**paper IV**)

Groups (ha)	2001			2021		
	number	average area		number	average area	
		ha	%		ha	%
0	21	0	0	0	0	0
<100	20	38	1	4	53	2
101-200	4	136	5	1	164	5
201-400	1	215	8	3	267	9
401-1,000	2	488	19	15	787	26
>1,000	1	1,741	67	26	1,750	58
Total	49	2618	100	49	3021	100

The average landownership area of these 49 producers was 86.48 ha in 2001. In 2016, this area was 1135.80 ha and in 2021, it was 1193.62 ha. The average landownership area of the 49 largest producers grew by an average of 1107.17 ha between 2001 and 2021. The largest growth in landownership area was 1,700.14 ha, and the smallest was five hectares (figure 18). The average growth area was 1,280.96 ha. 16 producers' landownership area grew by more than the average growth area. 10 producers' landownership area grew by more than 100,000%, and the largest growth was 312,347%.

Analysing the changes that have taken place in the 49 largest producers' land use area by dividing them into size groups, it was found that the number of producers in the largest size group grew between 2003 and 2021 (table 9). Most of the producers grew in size and moved into size group >1,000 ha. In 2001, there were 40 producers in size group >1,000 ha, five producers in size group 401-1,000 ha, two producers in size group 201-400 ha, and in size groups 101-200 ha and <100 ha there was

one producer. In 2021, there was one producer in size group 401-1,000 ha, and 48 producers in size group >1,000 ha.

Table 9. Changes in the 49 largest producers' land use area between 2003-2021 (ARIB) and proportion of their landownership (2001-2021) area (Land Registry) to land use area (**paper IV**)

Groups (ha)	2003		Proportion of 2001 land ownership area to 2003 land use area (%)	2021		Proportion of 2021 land ownership area to 2021 land use area (%)
	number	average area (ha)		number	average area (ha)	
0	0	0	0	0	0	0
<100	1	58.51	0	0	0	0
101-200	1	145.54	0	0	0	0
201-400	2	283.48	25	0	0	0
401-1,000	5	764.08	0	1	847.44	103
>1,000	40	3,040.48	3	48	2,538.01	47

Producers in size group 201-400 ha were using the largest share (25%) of owned land in 2001. In 2021, there were no producers in size groups smaller than 401-1,000 ha. All these producers moved into larger size groups. Producers in size group 401-1,000 ha had almost no owned land in 2001. In 2021, the share of owned land in this size group had grown to 103% of the total land use. Producers in size group >1,000 ha owned 3 % of the total land use in 2001. In 2021, the share of owned land in this size group was 47% of the total land use.

Comparing the increase in landownership area between 2001-2021 (Land Registry) to the changes taking place in land use (owned land and rented land from ARIB) area of the 49 largest land users, it was found that many producers' land use area has decreased, while the area of landownership has increased (figure 19).

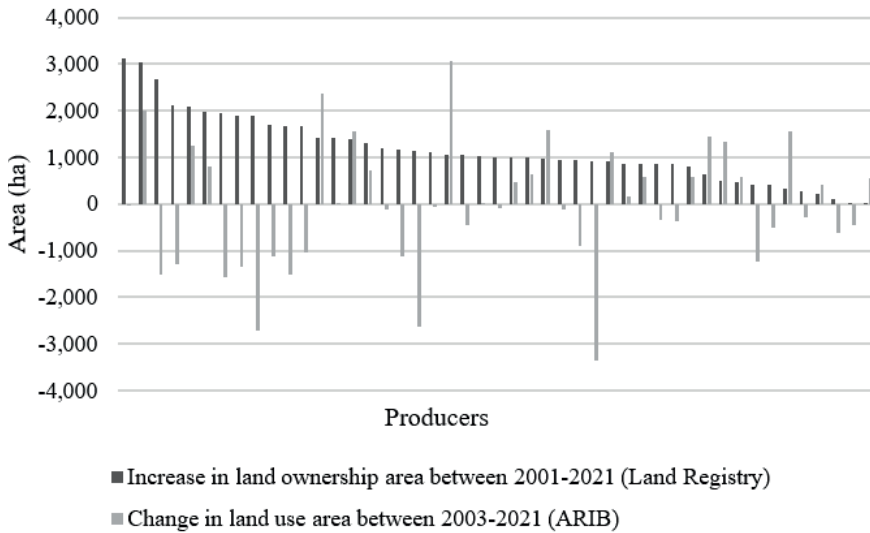


Figure 19. Increase in landownership area between 2001-2021 (Land Registry) and change in land use area between 2003-2021 (ARIB) (**paper IV**).

In 2001, the average share of landownership area in total land use (2003) was 1.02%. In 2016, the average share of landownership area in total land use was 46%, and in 2021 it was 47%. This means that in the case of the largest land users, the share of owned land is increasing.

4.4. Restrictions on the acquisition of agricultural land in European Union countries

The right to acquire, use or dispose of agricultural land falls under the free movement of capital principles in the EU. This means that restrictions on acquiring agricultural land cannot act against the Treaty on the Functioning of the European Union. The Court of Justice of the European Union has recognized a number of public policy objectives that can in principle justify restrictions on investment in agricultural land (table 10).

Table 10. Public policy objectives recognized by the Court of Justice of the European Union and cases supporting these objectives (EC, 2017)

Objectives justifying restrictions on acquisition of agricultural land	Case of the Court of Justice of the European Union
<ul style="list-style-type: none"> ● to increase the size of land holdings so that they can be exploited on an economic basis ● to prevent land speculation 	<p>Judgment of the Court of 6 November 1984, Robert Fearon & Company Limited v Irish Land Commission. Reference for a preliminary ruling: Supreme Court - Ireland. National restrictions on the possibility of owning land. Case 182/83</p>
<ul style="list-style-type: none"> ● to preserve agricultural communities ● to maintain a distribution of land ownership which allows the development of viable farms and management of green spaces and the countryside ● to encourage a reasonable use of the available land by resisting pressure on land ● to prevent natural disasters ● to sustain and develop viable agriculture on the basis of social and land planning considerations (which entails keeping land intended for agriculture in such use and continuing to make use of it under appropriate conditions) 	<p>Judgment of the Court of 23 September 2003, Margarethe Ospelt and Schlösle Weissenberg Familienstiftung. Reference for a preliminary ruling: Verwaltungsgerichtshof - Austria. Free movement of capital - Article 73b of the EC Treaty (now Article 56 EC) - A</p>
<ul style="list-style-type: none"> ● to preserve a traditional form of farming of agricultural land by means of owner-occupancy ● to ensure that agricultural property be occupied and farmed predominantly by the owners ● to preserve a permanent agricultural community, and encourage a reasonable use of the available land by resisting pressure on land 	<p>Judgment of the Court (Third Chamber) of 25 January 2007. Criminal proceedings against Uwe Kay Festeren. Reference for a preliminary ruling: Vestre Landsret - Denmark. Freedom of establishment - Free movement of capital - Articles 43 EC and 56 EC - Restrictions on the acquisition of agricultural property - Requirement that the acquirer take up fixed residence on the agricultural property. Case C-370/05.</p>

Objectives justifying restrictions on acquisition of agricultural land	Case of the Court of Justice of the European Union
<ul style="list-style-type: none"> • to maintain, for town and country planning or regional planning purposes and in the general interest • to a permanent population and an economic activity independent of the tourist sector in certain regions (48), 	<p>Judgment of the Court of 1 June 1999, Klaus Konlev Republik Österreich. Reference for a preliminary ruling: Landesgericht für Zivilrechtssachen Wien - Austria. Freedom of establishment - Free movement of capital - Articles 52 of the EC Treaty (now, after amendment, Article 43 EC) and 56 EC (ex Article 73b) - Authorisation procedure for the acquisition of immovable property - Article 70 of the Act concerning the conditions of accession of the Republic of Austria - Secondary residences - Liability for breach of Community law. Case C-302/97.</p> <p>Judgment - 05/03/2002 - Lassacher and Schäfer Case C-519/99 (Joined Cases C-524/99, C-526/99, C-540/99)</p>
<ul style="list-style-type: none"> • to preserve the national territory within the areas designated as being of military importance and protect military interests from being exposed to real, specific and serious risks 	<p>Judgment of the Court (Sixth Chamber) of 13 July 2000, Alfredo Albore. Reference for a preliminary ruling: Corte d'appello di Napoli - Italy. Freedom of establishment - Free movement of capital - Articles 52 of the EC Treaty (now, after amendment, Article 43 EC) and 73b of the EC Treaty (now Article 56 EC) - Authorisation procedure for the purchase of immovable property - Areas of military importance - Discrimination on grounds of nationality. Case C-423/98.</p>

Still, restrictions on the acquisition of agricultural land vary in different EU countries (**paper IV**). In **paper IV**, the EU countries that were included in the study were divided in two groups (figure 20). The first group included countries located in the western part of the EU (Germany, Netherlands, Denmark, France, Austria and Finland). The second group included post-Soviet EU countries (Estonia, Hungary, Poland, Latvia and Lithuania).

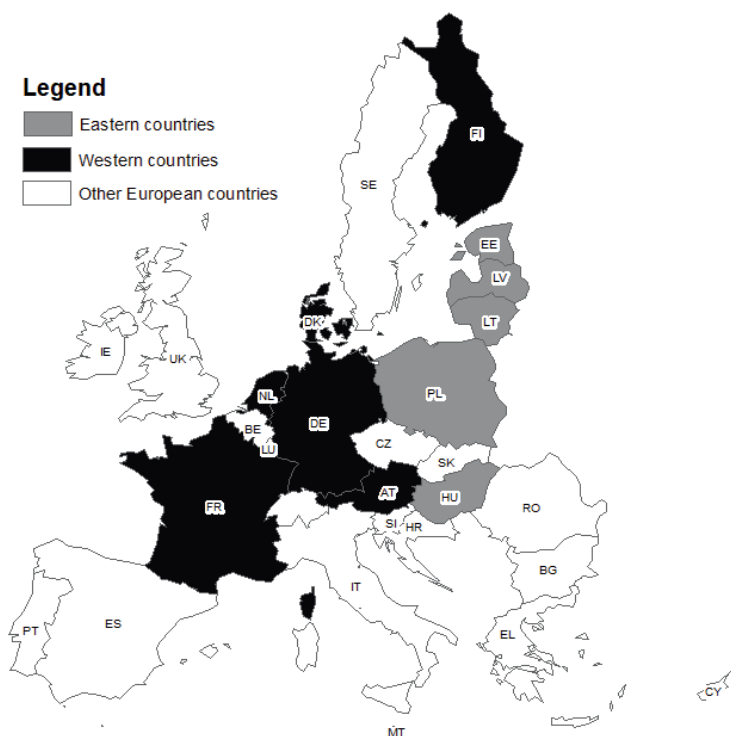


Figure 20. Division of the countries included in the study on restrictions on agricultural land acquisitions (**paper IV**).

In **paper IV**, it was found that in post-Soviet countries, there are more restrictions on acquiring agricultural land. Countries in the western part of the EU are more liberal with regards to the acquisition of agricultural land.

In Germany, the legislation concerning the ownership of agricultural land favours people engaged in farming. The aim of this approach is to protect agricultural land from being turned into development areas, to spare nature and the environment, and to assure food security

(*Analüüs Euroopa Liidu lepinguriikides...*, 2019). Because of this, there is a permit obligation prior to any agricultural land transaction (table 11). Local municipalities also possess a pre-emptive right on the purchasing of agricultural land and, in the case of inheritance, the magistrate can appoint inheritable agricultural land to one particular heir. In Germany, there is also a minimum area of agricultural land that is subject to permit obligation.

Table 11. Restrictions on the acquisition of agricultural land in EU countries

	DE	NL	FI	FR	AT	HU	PL	LV	LT	EE
Restrictions on how much agricultural land a person or group of persons can own						+	+	+	+	
Obligation to have special qualification to purchase agricultural land						+	+			
Permit obligation before agricultural land transaction	+		+	+	+		+			+
Obligation to use purchased land only for agricultural purposes in a fixed time period						+		+	+	
Pre-emptive right to purchase agricultural land	+									
Ban on persons from third countries to purchase agricultural land						+		+	+	

In the Netherlands and Finland, there are no restrictions on acquiring agricultural land on the basis of a legal form or citizenship of the buyer (Vranken et al., 2021). However, in Finland there is a permit obligation for persons from certain third countries (Vranken et al., 2021). In Denmark, there are also no longer any specific restrictions on the acquisition of agricultural land.

In France, there is an obligation for approval from *Sociétés d'Aménagement Foncier et d'Etablissement Rural* to purchase agricultural land (Vranken et al., 2021). There is a need to apply for a specific permit if persons from third countries wish to acquire land in France (**paper IV**). In Austria, there is also an obligation for approval from the *Grundverkehrs-kommission*. However, in Austria there are exceptions from this rule (**paper IV**).

In Hungary, there is an obligation to qualify as a farmer to purchase more than one hectare of agricultural land (Vranken et al., 2021). To qualify as a farmer, a person has to be a citizen of Hungary or another EU country (Balogh, 2015). A person who does not have the aforementioned qualification must firstly be able to prove that they have been engaged in agriculture for at least the last three years (Balogh, 2015). Secondly, this person must prove that they have received an income from agriculture over the last three years (**paper IV**).

In Hungary, there is a restriction on third persons using acquired agricultural land, and the owner must use this land only for agricultural purposes for at least five years from the year of purchase (Vranken et al., 2021). The agricultural land area that one person is able to purchase in Hungary is limited to 300 ha (**paper I**), and a maximum of 1,200 ha of agricultural land can be in the ownership of one farmer (Csák, 2017; Vranken et al., 2021). Corporations have no right to own land in Hungary, but there are exceptions to this rule (**paper IV**). It is very difficult for persons from third countries to obtain the farmers' qualification in Hungary (**paper IV**).

In Poland, there is an obligation for a person from Poland or the EU to qualify as a private farmer when purchasing agricultural land. A private farmer is a person who owns or uses a maximum of 300 ha of agricultural land, and is registered to live in the local municipality (Vranken et al., 2021). Purchasable agricultural land, together with already-owned land, cannot exceed 300 hectares in Poland, but there are

some exceptions to this rule (Vranken et al., 2021; Żróbek-Róźńska and Zielińska-Szczepkowska, 2019). Persons not qualified as private farmers must acquire approval from the National Support Centre for Agriculture to purchase agricultural land in Poland (**paper IV**).

To acquire agricultural land in Latvia, a person from Latvia or another EU country must be registered to conduct business there. A self-employed person must confirm in writing that they will start agricultural activity there within a one-year period from purchasing the land (Vranken et al., 2021). From 2017, a person cannot acquire more than 2,000 hectares of land, and related persons cannot acquire more than 4,000 hectares of land (“Par zemes privatizāciju lauku apvidos,” 1992; Vranken et al., 2021). A corporate body must also prove that agricultural activities will be commenced on the purchased land, and indicate the actual profit recipients (**paper IV**). Persons from third countries are not permitted to purchase land in Latvia, but there are exceptions to this rule.

In Lithuania, there are also restrictions on how much agricultural land can be acquired and by whom. Similar to restrictions in Latvia, these are important in order to prevent further agricultural land concentration (**paper I, IV**). To purchase land in Lithuania, it is mandatory to prove that the person is going to use the land only for agricultural purposes for at least the next five years (Vranken et al., 2021). A person cannot own more than 500 hectares of total agricultural land in Lithuania (“Republic of Lithuania Law on the Acquisition of Agricultural Land,” 2003). Persons from third countries cannot acquire land in Lithuania (**paper IV**).

In Estonia, there are no distinctive restrictions on acquiring agricultural land for citizens of Estonia or EU (Riigikogu, 2021). Corporate bodies from EU countries have the obligation to be involved in agriculture in the EU for at least three years prior to purchasing land in Estonia that exceeds 10 ha (Riigikogu, 2021). Persons from third countries have the right to purchase agricultural land in Estonia only with permission from the local government, and provided the person has lived in Estonia for at least six months (Riigikogu, 2021). Corporate bodies must also be involved in agriculture to purchase agricultural land, and its affiliate has to be registered in Estonia.

5. DISCUSSION

5.1. Agricultural land use pattern and its changes in Europe

The resulting changes in the utilized agricultural area in Europe (figure 3) are diverse, increasing (Bulgaria, Estonia, Ireland, Greece, Croatia, Latvia, Lithuania, Luxembourg, Hungary, Malta, Slovenia, Slovakia and the United Kingdom) as well as decreasing (in greater quantity in Germany, Spain, Romania and Switzerland) in many European countries. It is to be expected that in some countries, agricultural land use has been transformed into other uses. For example, the Czech Republic and Poland have decreased their utilized agricultural land area, and studies (Busko and Szafranska, 2018; Václavík and Rogan, 2009) confirm that changes of agricultural land use to other uses, for example for urban needs (dwellings, infrastructure sites, businesses, commercial and retail areas) is problematic (**paper I**).

The number of farms in Europe has decreased (-4,000,00). The number of farms has decreased in all countries (figure 4) except for Ireland. The average utilized agricultural land area (4.8 ha) per farm has increased in Europe. The average utilized agricultural land area has decreased in almost all countries except Italy and Cyprus (figure 5). That means that despite a decrease in utilized agricultural area in some countries (Czech Republic, Germany, Poland) there has been an even greater decrease in the number of farms, so that the average utilized agricultural land area per farm has actually increased. For example, the average utilized agricultural land area in the Czech Republic has grown by 46 ha.

A growing population, and an aim to decarbonize the economy, mean that agricultural land is in demand for a broader range of uses than ever before (EC, 2021; Savills, 2022). The value of agricultural land in Europe has increased to 11,957.59 eur/ha (figure 6), and is expected to continue this trend (Savills, 2022). The lowest prices (3,772 to 4,182 eur/ha) of agricultural land can be found in post-socialist countries (Estonia, Slovakia, Lithuania, Latvia, etc.). The highest prices of agricultural land (10,100 to 46,500 eur/ha) are in countries located in the central and western part of Europe (Denmark, Italy, Luxembourg) (figure 6).

Restitution and privatization of state-owned land have taken place, and are still underway in some countries (Estonia, Latvia, Lithuania, etc.) in the EU. Agricultural land prices in these countries remain low compared to other member states, despite the increase in agricultural land prices seen over the last decade (2011-2020). This situation has given rise to farmers' concerns about possible interest in farmland by other investors, and has created a situation where a small number of persons has been able to acquire as much agricultural land as possible (**paper IV**). In these countries, an effective institutional framework of land use control must be developed as one of the basic tools of sustainable agricultural land protection (Palsova et al., 2021). The European Commission has adopted the Commission Interpretative Communication on the Acquisition of Farmland and European Union Law C/2017/6168, in which it has established the permitted procedures for restricting the acquisition of ownership (EC, 2017).

Scientists and official documents (European Economic and Social Committee, 2015; European Parliament, 2017; Eurostat, 2018; Grubbström and Sooväli-Sepping, 2012; Guiomar et al., 2018; McDonagh et al., 2017; Shucksmith and Rønningen, 2011) have presented the case for smaller vs. larger agricultural producers: smaller farms perform essential tasks in rural society. However, it has also been shown that smaller producers are under greater economic pressure. They often need support from the state (European Economic and Social Committee, 2015; Eurostat, 2016). If this issue is developed only under free-market rules, small agricultural producers will shut down their activity. People who were engaged in small production will remain without income, and the state will have to pay their subsistence allowance. The alternative is for farm labourers to move to find work - normally to the cities or towns.

It is important to think beyond the land use issue and also consider the topic of ownership. Will changes in the land use pattern also bring changes in the landownership pattern? **Paper I** addressed the changes in agricultural land use looking at the size of landholdings. It did not distinguish between land that is owned or leased by agricultural producers. In **paper IV**, the ownership (2001-2021) of the 49 largest land users of 2020 in Estonia was analysed alongside their land use (2003-2021). It indicated that bigger landholdings also result in a concentration of land ownership. Agricultural land users receive subsidies from the EU. Land

users who possess bigger holdings receive larger subsidies that enable them to acquire land plots, as is pointed out in documents compiled by the European Economic and Social Committee (European Economic and Social Committee, 2015) and requested by the European Parliament's Committee on Agriculture and Rural Development (Kay et al., 2015).

5.2. Changes in agricultural land use and landownership in Estonia

From its history, we can see that Estonia has been through significant structural changes that have influenced the country's agriculture. Through different periods of occupation and simultaneous reforms, Estonia has become independent once more, and has undertaken the most recent, and still unfinished, land reform. The land reform law and the agriculture reform law both favoured agriculture based on small farms. At first, the number of farms in Estonia increased between 1993-2001, and many small agricultural producers arose (**paper IV**); however, as the years went by (during years 2001-2020), this number decreased, and is continuing its downward trend.

The area of utilized agricultural land in Estonia over a 20-year period has remained almost the same (871,213 to 975,323 ha), or has increased slightly (figure 8). The number of landholdings decreased nearly five times (from 55,748 to 11,369) within 20 years (figure 8), while the area of agricultural land use per household increased 5 times (from 16 ha to 86 ha) (figure 9). While average land use per agricultural household in Estonia has increased, the agricultural land in Estonia has become increasingly concentrated into the hands of corporate bodies. Corporate bodies held approximately twice as many hectares of land (645,598 ha) in 2016 as in 2001 (327,788 ha). At the same time, agricultural land used by self-employed workers is decreasing (-193,921 ha). This suggests that corporate bodies are growing at the expense of agricultural land used by self-employed workers (**paper I**).

Agricultural development is not favouring small-scale farming. One reason for the disappearance of small farms is that the CAP does not respond to small farms' needs. Land users who have bigger holdings receive larger subsidies that enable them to acquire more land plots. Secondly, large agricultural enterprises are increasingly flooding our markets with low-cost food and agricultural commodities. This

has created a situation wherein small farms become less capable of competing in the marketplace.

The deeper case-study with the Estonian ARIB data affirms that the total number of land users has decreased (-1,187 producers) while the utilized agricultural area has increased (101,675 ha). The total number of agricultural households in Estonia has dropped, and households that have closed their businesses are mostly in size groups 0–<2 ha (-264 producers) and 2–<40 ha (-1,869 producers) (figure 11b). The biggest growth in the number of households between 2011 and 2020 appears in size group 100–<400 ha (486 producers).

In 2020, most of the self-employed workers were using land in size groups 0–<2 ha (77%) and 2–<40 ha (57%) while corporate bodies formed a majority in size groups over 40 ha (figure 12). There were also some self-employed workers that used agricultural land in size group 40–<100 ha (4%) and a few in 100–<400 ha (1%). Land users in size groups over 400 ha (100%) were corporate bodies.

These changes, presented in **papers I, II and IV**, have taken place within a short time period of only twenty years (2001–2020). Agricultural land use has steadily been concentrated and, at the same time, more land users are now corporate bodies. Additionally, it can be firmly stated according to the studies (**paper I, IV**), that while the number of small land users has decreased, the number of larger land users has increased in Estonia.

These results show that the only choice for small- and medium-sized farms is to grow or go. This means that if farms are not able to grow in size and acquire more land (move to larger size groups), they will not be able to survive. Larger and more compatible agricultural producers will push them out of the business, and agricultural land will become even further concentrated. Small farms are struggling to survive in the existing market situation where large producers have a clear advantage. Thus, the State should step in and regulate the agricultural land market so that small, medium and large producers could coexist and operate under equal conditions.

While the number of agricultural land users in Estonia has dropped, changes at the county level have been in different directions (**paper II**). As the number of land users dropped in nine counties (Ida-Virumaa,

Jõgevamaa, Põlvamaa, Pärnumaa, Raplamaa, Tartumaa, Valgamaa, Viljandimaa, Võrumaa) between 2011 and 2016, it increased in four counties (Harjumaa, Hiiumaa, Saaremaa, Läänemaa) and remained almost the same in two counties (Järvamaa, Lääne-Virumaa) (figure 15). The most significant drop in the number of agricultural land users took place in the county of Võrumaa (-12%), where the land area grew 10% over the same period. One possible reason for the change is Võrumaa's location in the southern part of Estonia, far from the capital. A large share of people living in Võrumaa are of retirement age, and not enough young people are interested in taking over the business. Estonia is undergoing urbanization, and a large number of people are living in cities (with the largest share in Tallinn). Young people are moving out of rural regions and leaving behind a sparsely populated ageing population. It is also possible that the hilly landscape of southern Estonia does not facilitate the cultivation of land, which is easier on flat terrain.

It is indicated (Beckers et al., 2018) that farm size will continue to increase further in future, with small farms disappearing. This structural shift to large, more effective agricultural producers can also be seen in Estonia (**paper II**). The OECD report (OECD, 2018) cited that farm consolidation in Estonia in the 2000s led to an increase in average farm size and in the number of larger farms.

However, analyses presented in this thesis and **paper II** show that most producers in the counties of Estonia are in the smaller size groups (0–<2 ha 2–<40 ha); and, that most of the agricultural land is indeed used by agricultural producers in size groups 400–< 1,000 ha (237,671 ha) and >1,000 ha (252,111 ha). In counties like Järva, Jõgeva, Viljandi, Lääne-Viru, and Tartu, these land users are using over 50% of the agricultural land. At the same time, the number of producers using land in size groups 400–< 1,000 ha (546 producers) and >1,000 ha (205 producers) is the smallest in every county. This indicates that a small group of agricultural producers is using a large area of agricultural land in Estonia.

It is believed (Wuepper et al., 2020) that small agricultural producers are diversified and contribute more to environmental sustainability, preservation of traditional values, and economic resilience, than large ones. Maintaining small- and medium-sized farms is vital for rural life, as agriculture is the largest employer in the world (**paper II**). A small part of the agricultural land in the counties of Estonia is used by land

users in size group 0–< 2 ha, 2–< 40 ha and 40–< 100 ha; the number of agricultural land users in those small size groups is the biggest.

Today's structural change in agriculture is still seeing resources shift from smaller and less productive farms to larger ones (**paper II**). The need to grow bigger to survive has led to larger farms, sometimes creating larger parcels, and this upscaling may lead to a decrease in landscape diversity and ecological value (Beckers et al., 2018). As in the case of Estonia, the largest agricultural producer in 2016 was using 27% of the agricultural land located in the Türi municipality (figure 16). While this user was using agricultural land within one municipality, some large agricultural producers are using land plots scattered throughout Estonia (with some plots even located on the island of Saaremaa) (figure 17).

The results of **paper IV** indicate that the area of land ownership of large land users is growing alongside the increase in land use area. This conclusion was made through analysing the land ownership of the 49 largest land users. This means that further research on changes in landownership is needed to make firm conclusions. Nonetheless, results from **paper IV** give indications that landownership is also concentrating. This is a dangerous sign. Control over land is concentrating in the hands of a small number of large corporations, and there is a need to take action against this development in Estonia.

Restrictions on the acquisition of agricultural land in Estonia are needed to stop further concentration and reverse the current situation, where small and medium farms are not able to compete with large corporate bodies. Small and medium farms are in need of more support from the State. The State should also create conditions for newcomers entering the sector. To prevent further agricultural land concentration, an upper limit should be set on how much land one person or related persons can own. To prevent agricultural land ending up in the hands of a large business with no relation to agriculture, a portfolio obligation to have a special qualification for the purchase agricultural land is needed. A pre-emptive right to purchase agricultural land should be enacted to guarantee that newcomers and small farms can acquire necessary land.

5.3. Restrictions on the acquisition of agricultural land in European Union countries

Agricultural land is a special asset that is exposed to pressure from non-agricultural uses, increasing demand for food, energy and biomass. The question is, is there a need for regulations concerning agricultural land use and/or ownership? Since 2013, Hungary, Slovakia, Latvia, Lithuania, Bulgaria, Romania and Poland have adopted land laws to address undesired developments in their land markets (EC, 2017). Such national land laws, which exist in several EU countries, pursue various objectives, from keeping farmland in agricultural use, to curbing land concentration (EC, 2017).

The aim of the regulations on acquiring agricultural land is generally to preserve the agricultural characteristics of the assets, proper cultivation of the land, viability of existing farms, and to safeguard against land speculation (EC, 2017). Some EU countries (Latvia, Lithuania, Hungary, Poland) have set an upper limit on land acquisition, require an obligation of a special qualification, and impose restrictions on persons acquiring agricultural land from third countries, and on legal entities. In some countries (Germany, France, Poland), a pre-emptive right is in use to ensure that agricultural land goes into the usage of farmers in need of land, and local government permission is required prior to the purchase of land.

For example, it is possible to own a maximum of 500 ha of land in Lithuania, and 300 ha in Hungary (**paper IV**). Limits for land ownership or use are absent in Estonia. It is theoretically possible for a person with enough money to acquire as much land as is available on the market. The largest landowner in Estonia owned 3,441.18 ha of land in 2020. The largest land user in Estonia consisted of more than 5,000 ha of agricultural land, while 212 owners use more than 1,000 ha in 2020 (**paper I and IV**). The number of such large land users is increasing - in 2011, it was 126 -, the number ten to twenty years from now cannot be predicted.

The instructions issued during the Soviet period designated the optimal agricultural land area for kolkhozes and sovkhoses: 4,500–6,500 ha agricultural land for kolkhozes or sovkhoses (Eesti NSV Teaduste Akadeemia Majanduse Instituut, 1964; Kasepalu, 1991). The larger land

users in Estonia used the optimal amount of agricultural land (5,523 ha) according to these instructions (**paper I**). However, compared to previous use, the kolkhozes' or sovkhoses' land use in the Soviet period was more compact compared to the current agricultural producers' landholdings. The land reform implementation resulted in land fragmentation, as the previous kolkhozes and sovkhoses were divided among many private owners (Jürgenson, 2016). Recent agricultural producers must acquire land plots from the land market, thus land holdings are scattered (Maasikamäe et al., 2016). The area of landholding is comparable or even higher than in the eastern EU member states that, after land reform, became corporate farms (Eurostat, 2018; Hartvigsen, 2014); but, the landholdings are more scattered. This means that current land users need more agricultural land for affordable production to compensate for the costs of plot fragmentation. As a result, landholdings will exceed the area that had previously been used by kolhozes and sovkhoses.

Questions over the scale and equitable arrangement of future agricultural landownership remain. There have been two major land reforms in Estonia (1918 and 1991), the purpose of which was to divide land holdings between farm owners (mostly German in 1918) and those Estonians who worked the land (**paper II**). Similar examples can be found elsewhere. Now, however, the advent of much larger-scale production, though economically more efficient, also means the concentration of ownership into fewer hands at the expense of small landholders. The resulting imbalance and related societal disruption to rural life and development raise issues that must be addressed.

A recent example is from Scotland, where the Government declared: "We are improving Scotland's system of land ownership, use, rights and responsibilities, so that our land may contribute to a fair and just society while balancing public and private interests." ("Land reform"). They are undertaking land reform, as landownership is in the hands of a very small number of persons: not the best circumstance for society and rural development. Palsova et al. (2021) found that, in the case of Slovakia, remedy, control, and sanction mechanisms of land protection have not been efficient, and relevant State bodies perform their activities regarding agricultural land protection only to a minimal level. It was also found that the State's malfunctioning land-protection regulatory mechanism, and the absence of indirect action instruments, may be key indicators leading to processes of agricultural land concentration

(Palsova et al., 2021). They found that restrictions on agricultural land acquisition are important, but the processes of land concentration presume the State's complex provision of regulatory mechanisms and the adoption of strategic measures aimed at sustainable land quality and food security.

Estonia requires policy direction and regulations for the agricultural land market that help to mitigate the impact of land concentration in rural areas in the long run, similar to several other European countries (**paper I**). According to decisions made in the Court of Justice of the European Union, restrictions on the acquisition of agricultural land can be implemented only if these restrictions are in conformity with EU law, and in a way which balances the need to attract capital into rural areas with the pursuit of legitimate policy objectives (EC, 2017):

- state interventions to prevent excessive farmland prices may under certain circumstances be justified under EU law;
- subjecting the transfer of agricultural land to prior administrative approval restricts the free movement of capital but can still be justified under EU law under certain circumstances;
- pre-emption rights in favour of certain categories of buyers (such as tenant farmers) can under certain circumstances be justified on the grounds of agricultural policy objectives;
- self-farming obligation as a requirement to acquire agricultural land was disproportionate because that condition reduced the possibility of leasing the land to farmers who did not have their own resources to acquire land;
- the specific qualification requirement for the acquisition of land needs special justification in any national legislation in the absence of which it would appear to be an unjustified and disproportionate restriction on the free movement of capital;
- residence requirements are incompatible with free movement of capital principles;
- national rule prohibiting the sale of farmland to legal persons is a restriction on the free movement of capital and, where applicable, the freedom of establishment;
- upper limits on the size of land ownership which can be acquired or held are restrictions to the free movement of capital as they limit investors' decisions to acquire agricultural land. Whereas they could be justified for specific policy objectives, their

proportionality may be questionable, depending on the national circumstances;

- to be compatible with free movement of capital principles, privileges for local acquirers, like other restrictions, have to pursue, in a proportionate manner, legitimate objectives in the public interest;
- EU countries may not make the acquisition of farmland by EU citizens of another Member State conditional on its own nationals being permitted to acquire farmland in the country of origin of the EU citizen of the other Member State.

Farm size plays a critical role in agricultural sustainability. Measures concerning agricultural land concentration should be implemented in an interaction between farmers and the government to promote the green development of agriculture. The Estonian agricultural land market needs to be further regulated in conformity with EU law, and in a way that balances the need to attract capital into rural areas and guarantee sustainable agriculture.

One way to stop further concentration of agricultural land is to set an upper limit to land acquisition (similar to that in Latvia and Lithuania). As Estonia has a similar history to these countries, and in all of these countries land reform has taken place, the situation with land concentration issue is also similar. Agricultural land should be owned only by those who have a particular qualification. It may be also a good idea to put a pre-emptive right into use, to guarantee small- and medium-size farms access to agricultural land.

Prior to setting restrictions on the acquisition of agricultural land, there is also a need to create a clear structure of enterprises in Estonia. It is currently very difficult to find out how much land one enterprise truly owns or rents. This also creates grounds for the circumvention of restrictions.

6. SUMMARY AND CONCLUSIONS

The issue of land concentration in the EU and many parts of the world remains basic, and is one of the most serious land issues in the region today. This phenomenon started to emerge decades ago, but has recently accelerated. The ongoing process of agricultural land concentration is affecting Europe's small farms and rural areas. Scientists and official documents have presented the case for smaller vs. larger agricultural producers: smaller farms perform essential tasks in rural society. However, it has also been shown that smaller producers are under greater economic pressure, and they often need support from the state.

At the FAO regional conference for Europe 2022, it was suggested that member states strengthen their resilience by investing in smallholders and family farms, and updating agrifood systems to be better prepared, adaptable and autonomous. The agricultural sector also requires a change to reach the goals set out in the European Green Deal and SDGs. Large number of owners can ensure more economical use of land resources and ensure food security.

The number of farms in Europe has decreased in all countries except for Ireland. The average utilized agricultural land area per farm in Europe increased in almost all countries (except Italy and Cyprus). The value of agricultural land in Europe has also increased, and this trend is expected to continue. The lowest prices of agricultural land can be found in post-Socialist countries, where the problem of agricultural land concentration is the most defined. In these countries, an effective institutional framework of land use control must be developed as one of the basic tools of sustainable agricultural land protection.

From its history, we can see that Estonia has been through significant structural changes that have influenced the country's agriculture. The latest land reform - still unfinished - and the agriculture reform both favoured agriculture based on small farms. At first, the number of farms in Estonia increased, and many small agricultural producers arose; however, as time went on, this number has decreased, and continues to do so.

The study showed that, while average land use per agricultural household in Estonia has increased, the agricultural land in Estonia has become

increasingly concentrated into the hands of corporate bodies. Not only is land use concentrating, but landownership is concentrating too. At the same time, corporate bodies are increasing their land use at the expense of agricultural land used by self-employed workers. Most of the producers in the counties of Estonia are in the smaller size groups, while most of the agricultural land is used by agricultural producers in size groups 400–< 1,000 ha and >1,000 ha. The largest agricultural producer in 2016 was using 27% of the agricultural land located in the Türi municipality. Some large agricultural producers in Estonia are using agricultural land plots scattered throughout the country. There are indications that, similarly to land use concentration, landownership in Estonia is being concentrated into the usage of few large producers.

While the number of agricultural land users in Estonia has dropped, changes at the county level have taken different directions. The most significant drop in the number of agricultural land users took place in the county of Võrumaa (-12%), where the land area grew 10% at the same time. Most producers in the counties of Estonia are in the smaller size groups, while most of the agricultural land is indeed used by agricultural producers in size groups 400–< 1,000 ha and >1,000 ha. A structural shift to large, more effective agricultural producers has also been seen in Estonia.

Estonian history has shown us that, beyond a certain point, large farms are no longer sustainable. Just as large state farms in the Soviet era collapsed, we must consider what the future could hold for today's large agricultural producers. Future agricultural production must guarantee food security for the world's growing population. Productive yet sustainable agriculture is essential.

Small agricultural producers are believed to be more diversified and contribute more to environmental sustainability, preservation of traditional values, and economic resilience than large ones. It is also believed that, given the introduction of modern production technologies, large farms can achieve the expected returns much faster than small ones. The questions remain whether large-scale farming is more efficient and profitable than small- or medium-size farms, and whether it can contribute to agricultural sustainability.

The European Commission has understood the seriousness of agricultural land concentration, but little has been done to protect

agriculture against this phenomenon. To stop and reverse agricultural land concentration, steps have been taken in some EU countries. For example, Hungary, Poland, Latvia, and Lithuania have adopted regulations against excessive land concentration and other undesirable developments in their land markets. Some EU countries have set an upper limit to land acquisition, an obligation of special qualification, and restrictions on persons acquiring agricultural land from third countries and on legal entities. In some countries, a pre-emptive right is in place to ensure that agricultural land goes into the hands of farmers in need of land; and, in some EU countries, permission from local government is required prior to the purchase of land.

Land distribution is one important component that guarantees our right to food, human rights, and sustainability in agriculture and other related areas. Equitable agricultural land distribution should ensure, in addition to food supply, a range of ecosystem services at prices that sustain a living income for producers of food. The situation in agricultural land use in Estonia is similar to other post-socialist EU countries, and refers to agricultural land concentration in Estonia. Thus, Estonia requires policy directives and regulations for the agricultural land market that help to mitigate the impact of land concentration. These directives must be in accordance with EU laws, and may not go against the free movement of the capital in the EU. The right to acquire, use, or dispose of agricultural land falls under the free movement of capital principles in the EU, and restrictions on acquiring agricultural land cannot go against the Treaty on the Functioning of the European Union.

An increase in the area of agricultural land farmed by large agricultural producers raises concerns that agricultural development has an important environmental footprint. As agricultural land concentration is a serious threat to small-scale and family farms, there is a need to take action. A relationship between large agricultural producers and small-scale farms must be enabled so that both farming types may remain in fair market competition.

The direction of the policy and extent of the area of land use or ownership in Estonia is a matter for further research and debate, to determine appropriate regulations, possible limitations to land areas, and the usage of a pre-emptive right. There is also undoubtedly a need for transparency in the structure of enterprises in Estonia.

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SUMMARY IN ESTONIAN

Põllumajandusmaa koondumine on põletav teema mitmes Euroopa riigis, kuid eriti on see päevakorral just endistes Nõukogude Liidu vabariikides. See protsess algas aastakümneid tagasi, kuid on viimasel ajal hoogustunud. Põllumajandusmaa koondumise tulemusel jäävad maakasutusest eemale seda seni harinud talumajapidamised ning selle tagajärjel kaovad maapiirkondadest töö- ja elukohad. Tegemist on üldjuhul pöördumatu protsessiga.

Maakasutuse koondumise tulemusena läheb mõjuvõim toiduturul üle väheste suuretootjate kätte. Kahaneb väiketootjate võimetus oma toodangut turustada, sest ei suudeta võistelda suurtootjate pakutavate hindadega. Väiketootjate sissetulekud kuivavad kokku ning ühel hetkel ei jäägi enam midagi muud üle, kui lõpetada tootmine ja halvimal juhul maa maha müüa. Turule tulnud põllumajandusmaa ostab üles tavaliselt parema ostujõudlusega suurtootja ja maaomand koondub järjest enam suurte tootjate kätte.

Maakasutuse ja omandi koondumist soodustavad majanduslikud tegurid, sest tihtipeale saavad suurtootjad toota väiketootjatest odavamalt. Sellest tulenevalt on ka mitme riigi (nt Hiina, Brasiilia, Šotimaa) valitsused pikalt soosinud suurtootmisel põhinevat põllumajandust. Šotimaa näide maaomandi ja -kasutuse koondumisest on maailmas üks unikaalsemaid just selle äärmuslikkuse tõttu. Ajalooliselt kujunes sealsetes piirkondades välja monopolidel põhinev maaomand ja praeguseks on sealne maaelu suurel määral hääbunud. Šoti maaelu saab kirjeldada kui nn ilusat tühja maastikku. Probleemi tõsiduse mõistmisest alates 2014. aastast on riik teinud jõupingutusi, et maaelu taas suurte investeeringute abil käima lükata.

Maa on piiratud ressurss ja seda ei saa juurde toota. Väiketootjatel või põllumajandussektorisse alles siseneda soovijatel (sh noortel) on põllumajandusmaa koondumise tõttu äärmiselt keeruline maad osta. Noortest sõltub põllumajandussektori tulevik. Noorte uuendus- ja investeerimistahe on maapiirkondade jaoks otsustava tähtsusega, sest seeläbi saab peatada põllumajandusega tegeleva sektori vananemine ning tagada maal järjepidevus. Uute ja noorte sektorisse sisenejate jaoks peavad olema võimalused maa ostmiseks või kasutamiseks. Üks võimalusi

võiks olla maa rentimine, aga selleks peab selline maa ka olemas olema. Mõnes riigis (nt Taanis, Saksamaal ja Prantsusmaal) on loodud asutused, mis tegelevad vastava maapanga loomisega. Maapank on asutus, mille tegevus hõlmab maa ostu, müüki, vahetust või rentimist.

1991. aastal alanud maareformiga sooviti Eesti Vabariigis taastada talumajapidamistel põhinev põllumajanduslik tootmine. Reformi algusaastatel suurenes Eestis põllumajandustootjate arv ja 2001. aastaks oli Eestis 55 748 põllumajandustootjat. Aastate möödudes hakkas põllumajandustootjate arv Eestis vähenema. Vahemikus 2001–2020 vähenes põllumajandustootjate arv Eestis 11 369 tootja võrra. Põllumajandustootjate arvu kahanemine on toimunud väiketootjate arvelt. Põllumajandustootjatel ja eelkõige just väiketootjatel tuleb püsima jäämiseks kasvada suuremateks majandusüksusteks. Vastasel juhul ei suudeta olla majanduslikult jätkusuutlikud ja tegevus tuleb lõpetada (*grow or go* – kasvada või kaduda). 2020. aastal andsid 1300 suurimat tootjat Eesti põllumajandustoodangust 84%. Selliste tootjate kasutuses on rohkem kui kaks kolmandikku kasutatavast põllumajandusmaast. Põllumajandusliku maakasutuse jagunemise struktuur hakkab üha rohkem sarnanema taasiseseisvumise eelsete sovhooside ja kolhooside struktuuriga, erinedes vaid selle poolest, et praegustel suurtootjatel on maakasutus tunduvalt rohkem fragmenteeritud.

Eesti kontekstis on tähtis mõelda põllumajandusmaa kasutusest laiemalt ja vaadata, kas muutused põllumajanduslikus maakasutuses mõjutavad ka maaomandit. Neljakümne üheksa suurima maakasutaja maaomandi muutused 2001.–2021. aasta jooksul näitasid, et kogu maakasutuse intensiivistumise kõrval laieneb ka suurtootjate maaomandi pindala. Kõige intensiivsema maakasutusega tootjate maaomandi pindala on aastate jooksul kasvanud keskmiselt 1036%. Seega võib selle näite alusel välja tuua, et maakasutuse koondumine soodustab ka maaomandi koondumist. Kuna põllumajandustootjad saavad Euroopa Liidult toetusi pindalapõhiselt, siis saavad kopsakamaid toetusi suurema maakasutuse pindalaga põllumajandustootjad. Pealegi kerkivad sellisel juhul ka toodangult saadavad sissetulekud. Seega on suurematel maakasutajatel paremad rahalised võimalused maa ostmiseks. Sel viisil saab laieneda ka suurte maakasutajate maaomand.

Eesti naaberriigid Läti ja Leedu on maaomandi koondumise osas kehtestanud regulatsioonid ning piiravad maaomandi koondumist. Nii

Lätil kui ka Leedul on Eestiga sarnane ajalooline taust ja seal on ellu viidud ka maareform nagu Eestiski. Lätis on reguleeritud, kui palju maad maksimaalselt võib ühele isikule või ettevõttele kuuluda. Lätis ei saa üks isik omandada üle 2000 hektari maad ja seotud isikud ei saa omandada enam kui 4000 hektarit maad. Piirangu eesmärk on hoiduda olukorrast, kus ühe isiku kätte koondub kontroll suure koguse põllumajandusmaa üle. Peale selle on mõistetud, et alustaval talunikul on keeruline maad omandada ja selle soodustamiseks on kehtestatud põllumajandusmaa ostupiirang. Põllumajandusmaa omandamiskiirangu on seadnud ka Leedu, kus füüsiline või juriidiline isik ja seotud isikud ei saa riigilt ega teistelt müüjatelt osta ja/ega omada üle 500 hektari põllumajandusmaad.

Tähtis on eristada maakasutuse koondumist maaomandi koondumisest. Üldisest julgeoleku seisukohast on tähtsam ära hoida maaomandi koondumine üksikute tootjate kätte. Maakasutuse koondumine tuleneb majanduslikest oludest, sest üldjuhul on laialdasem tootmine majanduslikult tõhusam. Eestis on tähtis rakendada sellist poliitikat, mis toetaks põllumajandusmaa koondumise asemel tööstuslike suurtootjate üleminekut väiksematele tootmisüksustele ning tagaks Eestis piisava toiduga isevarustatuse ja toidujulgeoleku.

Põllumajandusmaa jätkusuutliku kasutamise huvides on vaja piirata suurte põllumajanduslike ettevõtete edaspidist laienemist, kehtestades põllumajandusmaa maksimaalse pindala, mida üks tootja või seotud tootjad saavad omada. Põllumajandusmaa kaitseks spekulantide eest on tähtis, et maa oleks üksnes nende käes, kellel on maa kasutamiseks vastavad teadmised, sest põllumajandusmaa kui ressursid peab säilima ka järeltulevatele põlvedele. Põllumajandusmaa ostmisel tuleb riigi varustatuse tagamiseks kodumaise toidutoodanguga seada vastav loakohustus. Inimeste toimetulekut maapiirkondades, toidu- ja energiajulgeolekut ega põllumajandussektori üldist jätkusuutlikkust ei tohi üles kaaluda üksnes majanduslikud huvid.

ACKNOWLEDGEMENTS

First of all, I would like to express my deepest gratitude to my supervisor assoc. prof. Evelin Jürgenson for guiding me through my doctoral studies. Thank you for always finding time and advice for me even in very busy times. I would also like to express my gratitude to my second supervisor assoc. prof. Aive Liibusk.

I would like to thank my family and friends for their unwavering support and belief in me. I am sincerely grateful for your understanding and patience. My special thanks go to my brother Ardi, who baby-sited my two year old daughter while I was writing my thesis. Without your help it would have not been possible to write this thesis.

In addition, thanks to the other people believing in me and also to those who did not believe that I could ever reach in this point with my studies.

Jürgenson, E., **Rasva, M.** (2020). The Changing Structure and Concentration of Agricultural Land Holdings in Estonia and Possible Threat for Rural Areas. *Land*, 9 (41), 1–15. DOI: 10.3390/land9020041.

Article

The Changing Structure and Concentration of Agricultural Land Holdings in Estonia and Possible Threat for Rural Areas

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Received: 5 January 2020; Accepted: 31 January 2020; Published: 2 February 2020



Abstract: In most European countries, there has been a decrease in the number of farms, while the area of agricultural land has remained almost the same. This ongoing process of land concentration can affect Europe's small farms and rural areas. The EU has acknowledged that the problem is serious and that, to solve it, it must be studied more closely. Accordingly, the aim of this study is to discuss changes in the agricultural sector from the aspect of land use, with emphasis on land concentration in Estonia, further scientific discussion about the effects of changes in land use on rural areas is encouraged. The study is carried out using two kinds of data sources: (1) statistical data from Eurostat, FAOSTAT and Statistics Estonia, (2) data from the Estonian Agricultural Registers and Information Board. The conclusion of the paper is that while the number of farms is going down, the average area of agricultural land use per farm is on the rise in Estonia. Agricultural land has been increasingly concentrated into the hands of corporate bodies. This study shows that there is a status of land concentration in Estonia that needs ongoing studies and a proper policy should be established to mitigate the impact of land concentration.

Keywords: agricultural land use; land concentration; landholding; Estonia

1. Introduction

1.1. Motivation

The agricultural sector is directly connected to the issue of food security. Land, an elemental source for the production is needed. It is scarce resource, not a “normal” market good [1] and therefore land issues may require special regulations.

The rush for land in developing countries in the Global South has caught much attention, much less has been given to the process of land concentration in Europe [2–4]. Large agricultural land users in Europe are expanding their scope widely and quickly. Tens of thousands of small farmers are being forced out of farming every year [4,5]. It is also evident that in many European countries, the degree of land-based inequality is similar to some countries with notoriously inequitable distribution of land ownership and land-based wealth such as Brazil, Colombia, and the Philippines [4,6].

A report in the European Union [7] points out that the ongoing process of farmland concentration in Europe is just as problematic as farmland grabbing. As land becomes concentrated into fewer and larger holdings, the Common Agricultural Policy (CAP) subsidy becomes more concentrated as well [4]. Although the EU considers land concentration to be a serious issue, there have been few current studies. Additional country-specific research is also needed. The present study is mainly focused on the problem of land concentration, referring to a process in which large agricultural producers are increasingly buying up or leasing land from other agricultural producers.

The ongoing process of land concentration has particularly affected Europe's small farms: it is implied that the expansion of large farms in Europe has come at the expense of small farms [7]. Agricultural land is becoming increasingly concentrated into the hands of large businesses, a situation in which small farmers are losing control of their land [7,8]. In the meantime, small farms are important for rural life: they play an active role in the economic fabric of rural areas, conserving the cultural heritage, maintaining rural life, sustaining social life and making sustainable use of natural resources. Small farms produce a sufficient amount of healthy and high-quality food and ensure a broad distribution of land ownership in rural areas [6,8–13]. In short, the process of land concentration has implications for society as a whole, not only for small farms.

There is no universally accepted definition of small or large farms [3,14]. The farms may be divided according to different parameters, such as farm structural size, economic size, herd size, labour force or utilised agricultural area [3,11]. There are many discussions about the relative productivity of large or small agricultural producers in light of the growing world population. Economic efficiency and productivity depend on many criteria. It is frequently stated that purely economic results are better for the larger farms. Even the negative impact caused by land fragmentation can be negated by the larger utilised land area [15]. At the same time, large farms can be inefficient due to the high monitoring cost, anonymity and lack of transparency [16]. However, the larger picture should include not just economic factors, but, for example, the social impacts as well.

1.2. Historical Overview of Changes in the Agricultural Sector in Estonia

Agriculture in Estonia has been through many changes, caused by different policies. Before Estonian independence in 1918 agricultural land in Estonia was owned by Baltic Germans. After gaining independence, this situation changed. There were numerous assumptions for triggering land reform. Before the reform, 58% of agricultural land was used by large agricultural holdings [17–19]. To carry out the land reform the majority of agricultural land owned by estate owners was expropriated by the state. As a result of this reform, ca 140,000 farms with an area over 1 ha were created, the previous number was 50,000 farms [17,20].

In 1940, the Soviet Union occupied Estonia and land was declared as people's property [20,21]. The largest land area that one working peasant could own was 30 ha. The rest of the land was incorporated into the State's land fund or given out to those peasants who had too small an area of land for agricultural use [20,22]. In the summer of 1941, Germany occupied Estonia and another change in agriculture followed: changes made by the Soviet Union were cancelled and the land divided during the land reform was given back to its rightful owners [20]. After three years of German occupation, the Soviet Union occupied Estonia and the declaration of 1940 was restored [21]. The state became the landowner and collectivization took place, simply as a political decision. It was believed that large agricultural holdings like kolkhozes and sovkhoses were more efficient than small farms. Forced collectivization intensification took place in 1949 when kolkhozes and sovkhoses were merged into larger ones.

The average area of kolkhozes and sovkhoses changed over the years, with the kolkhozes tending to be smaller than sovkhoses. By 1976, their average area was equalised. The total area of kolkhozes was 8086 ha, containing 4333 ha agricultural land. The total area of sovkhoses was 8015 ha, with 4542 ha agricultural land [20,23]. The optimal size of kolkhozes and sovkhoses was a research issue in the Soviet time. According to the instructions from the 1960s, the optimal area for kolkhozes and sovkhoses in Estonia would be 5500–9000 ha, that includes agricultural land 4500–6,500 ha and again arable land 1700–1900 ha [23,24]. By the year 1980 kolkhozes and sovkhoses had grown into giants and had to be divided into smaller ones [17,23].

Before independence was restored in Estonia, the Estonian SSR Farm Act was instituted in 1989, with benefit to small agricultural businesses. It didn't restore private property but it made private agricultural farming legal: 10,152 farms received the right to use 252,255 ha land [18,20,25].

As Estonian independence was restored in 1991, new winds started to blow in agriculture. Firstly, there was a goal to restore ownership of former farms. It was important to support agricultural land use that was based on small farms. To redesign ownerships based on historical, economic policy and socio-psychological subjects, it was also decided to enforce land reform [18,20,25]. The land reform law and then the agriculture reform law both favoured agriculture based on small farms [18,23]. Many small agricultural users arose in Estonia but as the years went by this number decreased.

Land reform in Estonia has had a combination of aims: to raise economic efficiency, the need to move to a market economy, and to repair historical injustice to owners whose real properties had been expropriated [25]. The same has been true in other Central and Eastern European countries that implemented land reform [26–28]. The multiple aims had a side effect—land fragmentation—in Estonia and other Central and Eastern European countries that implemented land reform [29–32]. As a result, some of the countries (for instance, Lithuania, Poland) that implemented land reform recently have developed the strategy of land consolidation [29,30], a strategy which has not taken hold in Estonia [25,29]. However, agricultural land holdings have enlarged over the years. The agricultural producers acquire available land plots that are situated at a distance from the farming centre and previous land plots. Maasikamäe et al. [33] presented that issue based on the polygons drawn over each agricultural land producer's land plots. Usually, several polygons (several agricultural producers' land holdings) overlap each other. It means workers must move from plot to plot, and sometimes these land plots are at a distance. The Estonian agricultural production situation is different from the eastern European Member States (Czech Republic, Slovakia) which implemented the land reform but went over to corporate farms [9,30]. Although administrations have changed, land use has remained more or less the same.

However, since the restoration of the Republic of Estonia in 1991, there has been considerable development. The centrally-planned economy has moved to a free-market basis. Currently, property and land reform has been almost entirely implemented. The land reform has changed the previous land relations: issues between state and private ownership have been resolved [25]. The property and land reform have led to changes in the agricultural sector as well: the kolkhozes and sovkhoses have been replaced with private agricultural producers. At the beginning of the reforms it was expected that a private small farm system would take over the system of kolkhozes and sovkhoses [20,23], but the trend did not continue: the number of small farms has decreased and continues to do so.

1.3. Aim and Scope

In 2014, the problem of land grabbing and land concentration was brought up by the European Economic and Social Committee. The European Economic and Social Committee decided to draw up its own-initiative opinion on “Land grabbing—a warning for Europe and a threat to family farming (own-initiative opinion)”. This document was adopted in January 2015 [8]. It makes clear that since land forms the basis of food production, there is an obligation for countries to recognise the right of each individual living in their own territory to adequate and safe food, that is directly linked to access to land. As land is no ordinary commodity and its supply is finite, it will be necessary to regulate the market for agricultural land and to prevent land concentration. Accordingly, there must be greater regulations on land use and ownership. It is also important to adjust the CAP so that the first few hectares can be given a stronger weighting in direct payments. This could strengthen small farms and increase their ability to compete, thus the usual market rules should not apply.

Following that European and Economic and Social Committee document [8], the European Parliament's Committee on Agriculture and Rural Development requested the study “Extent of farmland grabbing in the EU”, which was published in May 2015 [7]. In 2017, the European Parliament reported on “The state of play of farmland concentration in the EU: how to facilitate the access to land for farmers?” [6]. It points out that land, its management, and urban development rules are matters for the Member States, better account should be taken of farmland conservation and management. The report also called on the Member States to focus their land-use policies on using available tools

(taxation, aid schemes and CAP funding) to maintain a family-farm-based agricultural model. The land policy must help to ensure broad, fair and equitable distribution of land tenure and access to land.

There are different rules for the independent governing of EU Member States' land-use policies and those for the agricultural land market. The European Association for Rural Development Institutions (AEIAR) reported in 2015 on the status of agricultural land market regulation in seven European countries (Germany, Belgium, France, Hungary, Italy, Lithuania, and Poland) [34]. The report states that all addressed countries use the tools for regulations of the agricultural land market and some use the approval process. For example, in Germany, sales of agricultural land over a certain size must be approved by the administrative authority. In France, there is special private, non-profit organization SAFER that is responsible for observing land transactions, setting up and restructuring agricultural and forestry structures, supporting local development and contributing to the protection of the environment. In Hungary, the notary sends the relative documents to the agricultural administrative authority for approval of a sale. All countries in the report are allowed to use the pre-emption right if agricultural land is sold. Some countries have limits for land ownership: 500 hectares in Lithuania and 300 hectares in Hungary. Additionally, Hungary limits land possession to 1200 hectares (consisting of owned and leased land).

In addition to the concentration of land, there are several other drivers—technological, institutional, and economical—which when combined, can influence changes in the pattern of agricultural land use [35]. For example, land needed for dwellings, infrastructure and commerce has decreased the total area of agricultural land. Such changes can alter rural societies in ways that can be a threat in sparsely populated areas. All these disruptions, though not the focus of this paper, are still relevant when considering the current and future status of land use.

This paper presents the statistical data about the changes in agricultural land use and a number of producers in the European Union, giving primary attention to the changes in Estonian agricultural producers' land holdings up till 2016. The bases for analyses are the landholdings (owned or leased) area per agricultural producers. The aim of the paper is to discuss changes in the agricultural sector from the aspect of land use, with the emphasis on land concentration in Estonia, and to encourage scientific discussion about the effects of changes in agricultural land use on rural areas in Europe, using the example of changes in Estonian agricultural producers' land holdings following the property and land reform that started in 1991 in Estonia. As Estonia is a small country, the changes take place more quickly and within a shorter time frame than in larger countries. Therefore, the Estonian case can be helpful to other countries as it helps to understand the changes in other European countries as well. This paper presents the first in-depth study of the agricultural land use and holdings changes following the property and land reform that started in 1991 in Estonia.

2. Materials and Methods

Two kinds of data sources were needed for the study. The first was statistical data from Eurostat, FAOSTAT and Statistics Estonia, the second considered the data for the landholdings of agricultural producers. This information source is the Estonian Agricultural Registers and Information Board (ARIB).

Data from Eurostat (<https://ec.europa.eu/eurostat/>) is used to compose the overview of agricultural land use in European countries, including data about utilised agricultural land use, the number of farms and average utilised agricultural land area per farm. The Eurostat data is from the years 2005, 2007, 2013 and 2016. However, the figures mainly present the changes between the years 2005 and 2016. In two cases (Croatia, Italy) the data was incomplete and data from 2007 or 2013 had to be used. The year 2016 or 2013 was used as the base year for calculating the changes that took place in the area of utilised agricultural area, number of farms and average utilised agricultural land area per farm. Eurostat's mission is to provide high-quality statistics for Europe.

Eurostat defines utilised agricultural land as follows: "Utilised agricultural area, abbreviated as UAA, is the total area taken up by arable land, permanent grassland, permanent crops and kitchen gardens used by the holding, regardless of the type of tenure or of whether it is used as a part of

common land". Farm is defined as a single unit, both technically and economically, operating under single management and which undertakes agricultural activities within the economic territory of the European Union, either as its primary or secondary activity. Other supplementary (non-agricultural) products and services may also be provided by the holding.

Data from FAOSTAT (<http://www.fao.org/faostat/en/#data>) is also used in this study to provide an overview of agricultural land use in European countries. The FAOSTAT data is from years 2005 and 2016. The base year for calculating the changes in the area of agricultural land was 2016. It was necessary to add FAOSTAT data to this study because it differs a bit from Eurostat data about the utilised agricultural land area. FAOSTAT defines the agricultural land area as land used for the cultivation of crops and animal husbandry. The total of these areas falls under "Cropland" and "Permanent meadows and pastures".

Statistics Estonia (<https://www.stat.ee/about>) defines an agricultural household as a unit with uniform technical and economical management and at least one hectare of agricultural land, or where agricultural products are produced primarily for sale (irrespective of land area). From 2007, agricultural households are also units where agricultural products are not produced but the land is being conserved in good agricultural and environmental conditions. Agricultural land area in use is land that is used for agricultural production or being conserved in good agricultural and environmental conditions by agricultural households in the reference year.

ARIB data (ARIB is responsible for delivery of national and the EU subsidies for agricultural activities) from 2011 and 2016 is used for the case study to present a more detailed overview of the recent changes in the pattern of agricultural landholdings in Estonia. Figure 1 illustrates the study area and its location in Europe.



Figure 1. Location of Estonia (study area) in Europe.

The data from the ARIB Field Register is used for the study. The Field Register is one of three registers in the charge of ARIB and area support is one of the subsidies that ARIB delivers. The digitalised database of agricultural plots is required for payment of area support from the budget of the EU. In the process of delivering national and EU subsidies, ARIB collects information about the applicant (every applicant gets an ID number) and land that is filed for area support.

ARIB data about the agricultural land area and the number of producers were analysed in order to get an overview of changes in Estonian agricultural land users' landholdings. Agricultural land users and land area per producer was summarized using GIS software ArcGIS (version 10.4). Producers were divided into six groups according to the size of their landholdings: 0–<2 ha, 2–<40 ha, 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 ha, data was taken on the basis of these size groups. The basis for this division comes from Farm Accountancy Data Network (FADN) (<https://maainfo.ee/index.php?page=9&>) where agricultural land area is divided into four size groups

(0–<40 ha, 40–<100 ha, 100–<400 ha, >400 ha). In order to get a closer look at the smallest agricultural land users, FADN size group 0–<40 ha was divided into size groups 0–<2 ha and 2–<40 ha. FADN size group >400 ha was divided into size groups 400–<1000 and >1000 ha in order to characterise the largest agricultural land users.

This study concentrates on agricultural land users’ land holdings that cover all plots which are used for agricultural production in Estonia. No distinction is made between land held in ownership and leasehold land. Also, no differentiation was made between different production groups.

3. Results

3.1. Agricultural Land Use Pattern and Its Changes in Europe

Europe has 12 million agricultural land users, with 25 million people involved in agricultural production and 69% of agricultural land users having less than five hectares: the average size is 14.2 ha [36]. The total number of agricultural land users in the Baltic and Nordic countries is 607,500, which is 4.2% of the total number in the EU. In 2009, the agricultural land user had an average 59.7 ha of the agricultural area in Denmark, 42.9 ha in Sweden, 38.9 in Estonia, 33.6 ha in Finland, 16.5 ha in Latvia and 11.5 ha in Lithuania [37].

According to Eurostat, between 2005 and 2016 (Figure 2), the utilised agricultural land area has grown in Bulgaria, Estonia, Ireland, Greece, Croatia, Latvia, Lithuania, Luxembourg, Hungary, Malta, Slovenia, Slovakia and the United Kingdom. The agricultural land area has decreased in other European countries, in greater quantity in Germany, Spain, Romania and Switzerland.

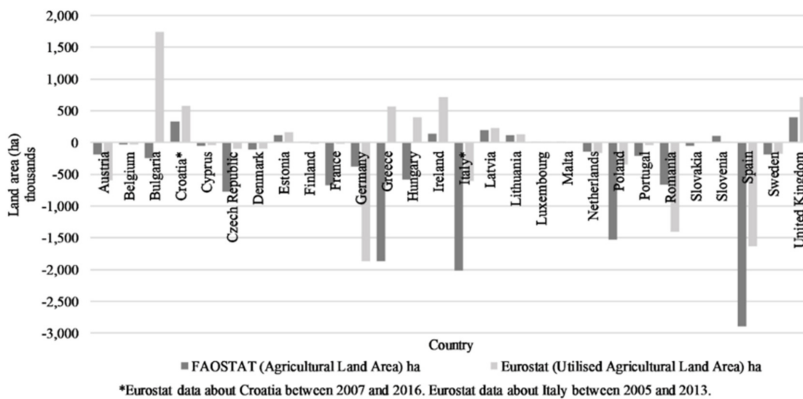


Figure 2. Utilised agricultural land (Eurostat) and agricultural land (FAOSTAT) use change (ha) in Europe between 2005 and 2016.

FAOSTAT data shows that, unlike Eurostat data, utilised agricultural land area has decreased in Bulgaria, Greece and Hungary. These indicators are more similar in other countries. Utilised agricultural land and agricultural land are not precisely the same concepts and their collecting methodology differs, therefore further study is needed regarding the differences seen in Figure 2.

The total number of farms in Europe between 2005 and 2016 (Figure 3) has decreased by four million, affecting all countries except for Ireland, where there was an increase of 4860 farms. The largest (–1,065,770) decrease in the number of farms has occurred in Poland, but the decrease is remarkable in Romania (–834,120) and Italy (–718,200) as well.

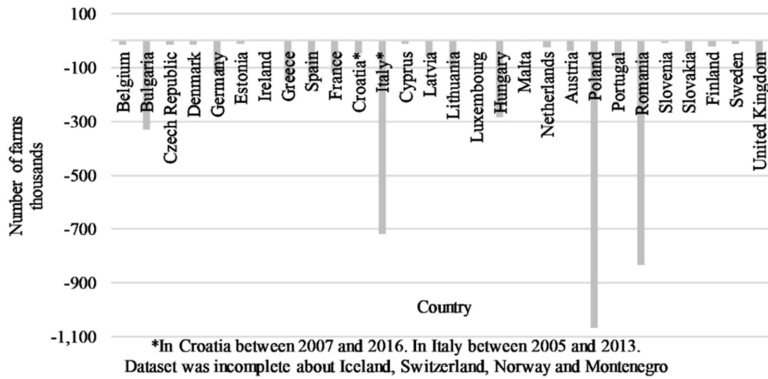


Figure 3. Change in the number of farms in Europe between 2005 and 2016 (Eurostat).

The average growth of agricultural land area per farm between 2005 and 2016 in Europe is 4.8 ha. The biggest growth in agricultural land use per farm has occurred in Slovakia (46.2 ha) and in the Czech Republic (46.0 ha) (Figure 4). In Estonia, the growth of agricultural land use per farm has been also relatively large (29.7 ha) compared to other countries in Europe. Cyprus is the only country where the average utilised agricultural area per farm has decreased slightly (−0.2 ha).

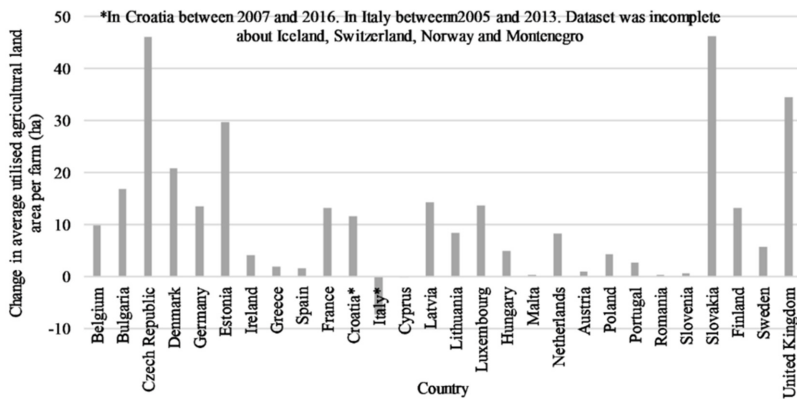


Figure 4. Change in average utilised agricultural land area (ha) per farm between 2005 and 2016 (Eurostat).

While agricultural land use has changed in Europe, the utilised agricultural areas have changed less, having decreased only 1% as compared to the years 2005 and 2016. At the same time, the shrinking number of farms is remarkable: 30% fewer farms as compared with 2005 and 2016. The decrease has been larger in some countries while the average utilised agricultural area per farm has increased in almost all countries.

3.2. Agricultural Land Use Pattern and Its Changes in Estonia

Statistics show that the number of agricultural households in Estonia has decreased yearly (Figure 5). In 2001 there were 55,748 agricultural households in Estonia but by 2016 this number had decreased to 16,696, concurrently, the area of utilised agricultural land has remained almost the same. Estonian utilised agricultural land area in 2001 was 871,213 ha and in 2016 it was 995,130 ha (Figure 5).

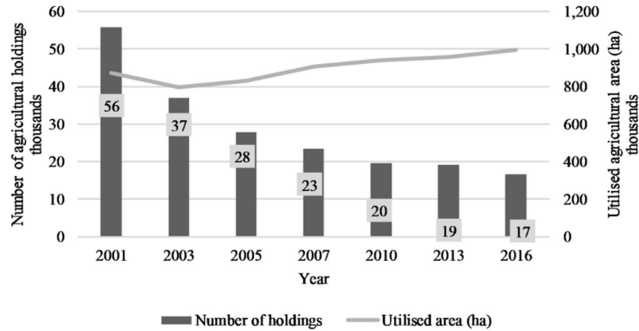


Figure 5. The number of agricultural households and agricultural land area in Estonia between 2001 and 2016 (Statistics Estonia).

The decrease in the number of households and almost constant agricultural land area shows that average land use per agricultural household in Estonia has increased (Figure 6). In 2001 the area of agricultural land use per household was 16 ha but by 2016 it had grown to 60 ha. The average agricultural land-use area per user has grown yearly 2 to 10 ha per year.

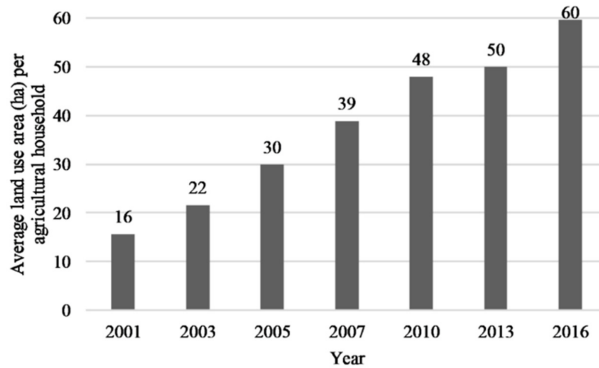


Figure 6. Average land use (ha) per agricultural household in Estonia between 2001 and 2016 (Statistics Estonia).

In 2001 the corporate bodies used 327,788 ha which was 38% of all agricultural land (Figure 7). While self-employed workers used 543,426 ha of all agricultural land, corporate bodies used 215,638 ha less. By 2016, the situation has changed a lot. Corporate bodies used 645,598 ha –65% of agricultural land (ha). At the same time, self-employed workers used 349,505 ha, which is 193,921 ha less than 2001 and 296,093 ha less than corporate bodies in 2016.



Figure 7. Percentage of corporate bodies and self-employed workers in Estonian agriculture between 2001 and 2016 according to the agricultural area (ha) used by agricultural producers (Statistics Estonia).

For a deeper understanding of the changes in the agricultural land use and users sector, the case study based on the ARIB data was undertaken. It is a more comprehensive study that covered all agricultural producers land holdings registered in the ARIB which applied for support from the EU. The data used was from 2011 and 2016. According to ARIB data agricultural land use area has grown 11% and the number of land users has dropped 5% in Estonia between 2011 and 2016. Table 1 presents the data for the land users, which were divided into groups according to the size (area) of their landholdings.

Table 1. Data for land users groups that form according to the area of land users land holdings for the years 2011 and 2016 (ARIB).

Groups ha	2011		2016	
	Number	Area (ha)	Number	Area (ha)
<2	1475	2140	1355	2026
2-<40	11,654	132,888	10,767	121,960
40-<100	1460	91,563	1481	93,093
100-<400	1174	225,708	1317	260,956
400-<1000	337	207,844	390	237,670
>1000	126	216,893	146	252,110
Total	16,226	877,036	15,456	967,816

Comparing the years 2011 and 2016, the number and the area of these land users decreased in two smaller land users' (0–2 ha, 2–<40 ha) groups and increased in the four following (40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 ha) groups (see Table 1). Analysis of land users according to the area of their landholdings in size groups 0–<2 ha, 2–<40 ha, 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 ha shows that between 2011 and 2016, agricultural land area used by land users in size groups 100–<400 and that >1000 has grown the most. Agricultural land area used by land users in size groups 0–<2 and 2–<40 ha has decreased and the agricultural land area used by size group 40–<100 ha remained almost the same.

There are 536 agricultural land users in Estonia with land holdings over 400 ha. They are using 489,780 ha or 51% of the agricultural land utilised in 2016 in Estonia. In 2011, there were 463 agricultural land users with land holdings over 400 ha. They used 424,736 ha or 48% of the totally-used agricultural area in 2011.

The agricultural land area used by larger land users has grown while the smaller ones have decreased (Figure 8a). The number of households in size groups 0–<2 ha and 2–<40 ha has decreased

(Figure 8b). In 2011, there were 1,475 agricultural users in size group 0–<2 ha using 2,139.72 ha of agricultural land. In size group 2–<40 ha there were 11,654 agricultural land users using 132,888.41 ha. In 2016, there were 120 fewer land users in size group 0–<2 ha using 813,24 ha less land. In size group 2–<40 ha there were 887 fewer users, they were using 10,928.15 ha less land than in 2011.

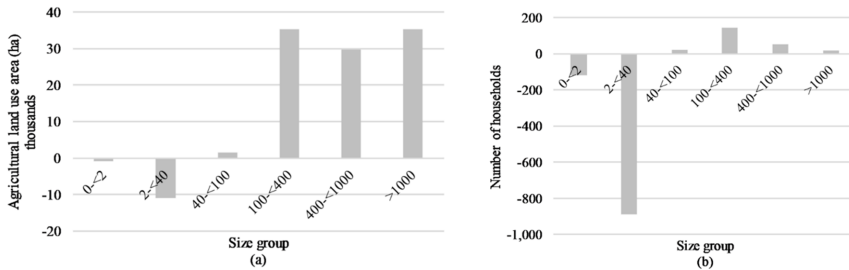


Figure 8. (a) Difference in the area (ha) of agricultural land use, (b) Difference in the number of agricultural households in size groups between 2011 and 2016 (ARIB).

Households in size groups 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 have grown in number. In 2011, there were 337 land users in size group 400–<1000 ha and they were using 207,843.80 ha of agricultural land. In size group >1000 ha, 126 land users were using 216,892.61 ha. By the year 2016, there were 53 more users in size group 400–<1000 ha and 20 more in size group >1000 ha. Agricultural land-use area had grown 29,826.53 ha in size group 400–<1000 ha and 35,217.66 ha in size group >1000 ha.

In 2016, there were 257 corporate bodies and 1098 self-employed workers in size group 0–<2 ha (Figure 9). In size group 2–<40 ha there were 4,319 corporate bodies and 6,448 self-employed workers. In these two size groups, self-employed workers form the majority. In size groups 400–<1000 ha and >1000 ha there are no self-employed workers. In size group 400–<1000 ha there are 390 corporate bodies in size group >1000 ha there are 146 corporate bodies.

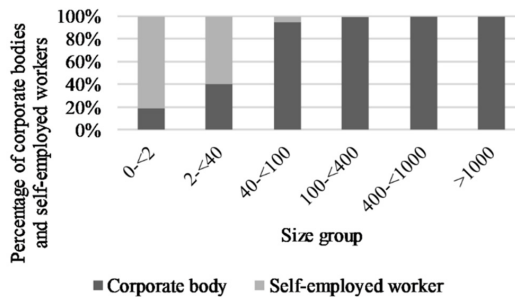


Figure 9. Percentage of corporate bodies and self-employed workers in size groups in 2016 (ARIB).

In 2016 the number of users in size group 0–<2 ha forms 8.8% of the total number of agricultural land users in Estonia (Figure 10a) using 0.2% of the total land use (Figure 10b). The number of land users in size group 2–<40 ha amounts to 69.7% of the total number of land users in Estonia using 12.6% of total land use. Concurrently, the number of agricultural land users in size group 400–<1000 ha accounts for 2.5% of the total number, using 24.6% of total land use in Estonia. The number of agricultural land users in size group >1000 ha accounts for 0.9% of the total households, using land 26% of total land use in Estonia.

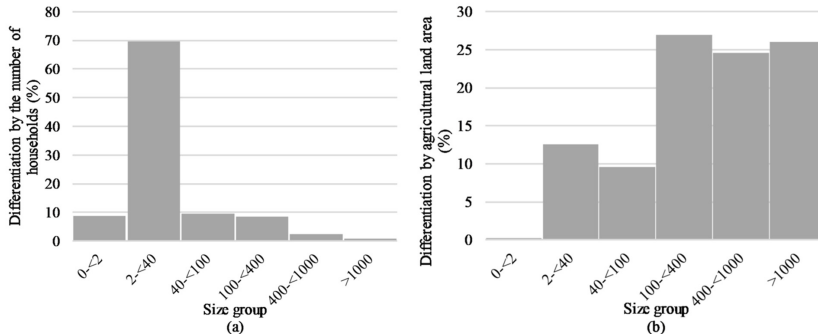


Figure 10. (a) Differentiation of size groups by the number of households, (b) Differentiation of size groups by agricultural land area in 2016 (ARIB).

4. Discussion

The resulting changes in the utilized agricultural area in Europe (Figure 2) are diverse, increasing as well as decreasing in many European countries. A possible direction for this indicator needs future studies. However, it is to be expected that in some countries, agricultural land use has been transformed into other uses. For example, the Czech Republic and Poland have decreased the utilized agricultural land area and the studies [38,39] confirm that changes of agricultural land use to another use, for example for urban needs (dwellings, infrastructure objects, businesses, commercial and retail areas) is problematical. The number of farms in Europe has decreased in all countries (Figure 3) except for Ireland. The average utilized agricultural land area (ha) per farm increased in almost all countries except Italy and Cyprus (Figure 4). That means that despite a decrease in a utilized agricultural area in some countries (Czech Republic, Germany, Poland) there was an even greater decrease in the number of farms, so that average utilized agricultural land area (ha) per farm has actually increased.

The Estonian case presented here that the area of utilized agricultural land has remained almost the same or has increased slightly (Figure 5). The number of landholdings decreased nearly 3 times within 15 years (Figure 5) while the area of agricultural land use per household increased almost 4 times (Figure 6). While average land use per agricultural household in Estonia has increased, the agricultural land in Estonia has become increasingly concentrated into the hands of corporate bodies (Figure 7). Corporate owners held approximately two times more hectares of land in 2016 compared with the year 2001. At the same time, agricultural land used by self-employed workers is decreasing. It suggests that corporate bodies are growing at the expense of agricultural land used by self-employed workers, the reasons for that need further studies.

The deeper case study with the Estonian AIRB data affirms the previous data that the total number of land users has decreased while the utilized agricultural area increased. The total number of agricultural households in Estonia has dropped (Figure 5) and households that have closed their businesses are mostly in size groups 0-2 ha and 2-40 ha (Figure 8b). The biggest growth in the number of households between 2011 and 2016 appears in size group 100-400 ha. The number of self-employed workers in Estonian agriculture has decreased while there has been a growth in corporate bodies (Figure 7). At the same time, there has also been a growth in agricultural household number in size groups over 40 ha (Figure 8). In 2016, most of the self-employed workers are using land in size groups 0-2 ha and 2-40 ha while corporate bodies form the majority in size groups over 40 ha (Figure 9). There are also some self-employed workers that use agricultural land in size group 40-100 ha and a few in 100-400 ha. Land users in size groups over 400 ha are mostly corporate bodies.

The data presents the changes that happened in the agricultural land use and land users sector in Estonia. These changes have taken place within a short time period, only fifteen years (2011–2016). The agricultural land has steadily been concentrated and, at the same time, more land users are corporate bodies. Additionally, it can be firmly stated, according to this study, that while the number of small land users has decreased, the number of larger land users has increased.

Scientists and official documents [6,8–13] have presented the case for smaller vs. larger agricultural producers: smaller farms perform essential tasks in rural society. However, it is also shown that smaller producers are under greater economic pressure. They often need support from the state [3,8]. If this issue is developed only under free-market rules, then the small agricultural producers will shut down their activity. The people who were engaged in small production remain without income and the state must pay the subsistence allowance. The other alternative is for farm labourers to move to find work—normally to the city or towns.

It is important to think beyond the land-use issue to the ownership issue as well. Will the changes in land use pattern bring together changes in the land ownership pattern? This paper addresses the changes in agricultural land use looking at the size of landholdings. It did not distinguish between land that is owned or leased by agricultural producers. It could be that bigger landholdings bring together a concentration of land ownership as well. Agricultural land users get subsidies from the EU. Land users which have bigger holdings receive larger subsidies that enable them to acquire land plots, as is pointed out in documents compiled by the European Economic and Social Committee [8] and requested by the European Parliament's Committee on Agriculture and Rural Development [7].

The question is, is there a need for regulations about land use and/or ownership? Some countries limit land ownership. For example, it is possible to own 500 ha of land in Lithuania and 300 hectares in Hungary [34,40]. Limits for land ownership or use are absent in Estonia. It is theoretically possible for a person with enough money to acquire as much land as is available on the market. The largest land user in Estonia consists of more than 5000 ha of agricultural land, while 146 owners use more than 1000 ha in 2016. The number of such large land users is increasing—it was 126 in 2011, their number in five to ten years is not predictable.

The instructions issued during the Soviet period assigned the optimal agricultural land area for kolkhozes and sovkhoses: 4500–6500 ha agricultural land for kolkhozes or sovkhoses [23,24]. The larger land user in Estonia used the optimal amount of agricultural land (5523 ha) according to these instructions. However, compared to previous use, the kolkhozes or sovkhoses land use in the Soviet period was more compact compared to the current agricultural producers' landholdings. The land reform implementation resulted in land fragmentation, as the previous kolkhozes and sovkhoses were divided among many private owners [25]. Recent agricultural producers must acquire land plots from the land market, thus land holdings are scattered [33]. The area of landholding is comparable or even higher than in the eastern EU member states that, after land reform, became corporate farms [9,30] but the landholdings are more scattered. It means that current land users need more agricultural land for affordable production to compensate for the costs of plot fragmentation. As a result, landholdings will exceed the area that had been used previously by kolhozes and sovkhoses.

Questions about the scale and equitable arrangement of future agricultural land ownership remain. There were two major land reforms in Estonia (1918 and 1991) the purpose of which was to share land holdings between farm owners (mostly German in 1918) and those Estonians who worked the land. Similar examples can be found elsewhere. Now, however, the advent of much larger-scale production, though economically more efficient, also means the concentration of ownership into fewer hands at the expense of small landholders. The resulting imbalance and related societal disruption to rural life and development raise issues that may need to be addressed.

A recent example is from Scotland, where the Government declares: "We are improving Scotland's system of land ownership, use, rights and responsibilities, so that our land may contribute to a fair and just society while balancing public and private interests." [41]. They are undertaking land reform,

as land ownership is in the hands of a very small number of persons, not the best circumstances for society and rural development.

Estonia needs policy direction and regulations for the agricultural land market that help to mitigate the impact of land concentration in rural areas in the long run, similar to several other European countries [34]. The direction of the policy and extent of the area of land use or ownership is a matter for further research and even debate, to determine appropriate regulations and possible limitations to land areas, e.g. to 300, 500, 1000 or even more hectares.

5. Conclusions

The study presents the changes – both increase and decrease - in the utilized agricultural land use in Europe and Estonia. The number of farms decreased while the average utilized agricultural land area (ha) per farm increased in almost all countries in Europe. The decreasing number of agricultural households and almost constant agricultural land area in Estonia shows that average land use per agricultural household has increased. Deeper analyses show that agricultural land in Estonia has become increasingly concentrated into the hands of corporate bodies, that growth has come at the expense of agricultural land used by self-employed workers. These changes have taken place within a short time period and may have been a result of notable change in land relations, after implementation of the post-Soviet land reform. Accordingly, conditions in the agricultural sector should stabilize and such extensive changes should not be the norm in the future.

This paper's aim is to discuss changes in the agricultural sector from the aspect of land use and encourage scientific discussion about the effect of the resulting changes in rural areas. For the discussion to be productive, it needs additional data about the situation in EU countries. As demonstrated, the statistical databases Eurostat and FAOSTAT can provide a range of relevant information in various countries. As the ongoing process of land concentration continues, these changes must be studied more, as there are diverse drivers causing changes in the agricultural sector. Further study must focus on the need for the policy direction and regulations that can mitigate the potential threats that can occur with the land concentration threatening the rural areas. For broad-based statements, input from researchers in different fields is essential. The land holdings should be suitable for necessary and sufficient agricultural production at affordable costs, acceptable to local societies, while also supporting sustainable development. Definitely, the issue is complex. Appropriate solutions cannot arise without further attention.

Author Contributions: Conceptualization, E.J. and M.R.; methodology, E.J. and M.R.; formal analysis, M.R.; investigation, E.J. and M.R.; resources, E.J.; data curation, M.R.; writing—original draft preparation, E.J. and M.R.; writing—review and editing, E.J.; visualization, M.R.; supervision, E.J.; project administration, E.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: We would like to thank four reviewers for their helpful comments.

Conflicts of Interest: The authors declare no conflict of interest.

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Rasva, M., Jürgenson, E. (2020). Changes of agricultural producers in Estonia according to the size of land use. *Agronomy Research*. DOI: 10.15159/AR.20.139.

Changes of agricultural producers in Estonia according to the size of land use

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Abstract. The purpose of this paper is to give an overview of the changes in Estonian agricultural producers according to the size of the land use. Data from the Estonian Agricultural Registers and Information Board (ARIB) data from 2011 and 2016 is used. This data shows that agricultural land use area per producer has increased and most of the agricultural land is used by agricultural producers in size groups 400–< 1,000 ha and > 1,000 ha. This means that a small number of agricultural producers are using a large area of agricultural land. For example, in 2016, the largest agricultural producer was using 27% of agricultural land located in Türi municipality. The outcome of the study shows a trend of farm size growth in Estonia; there is a need to find out if this model of agricultural production guarantees us food and a future of sustainability.

Key words: agricultural producer, Estonia, land use, sustainable agriculture.

INTRODUCTION

Motivation

It is estimated that by 2050 another 2.5 billion people will be added to the current population of 7 billion (United Nations, n.d.; GIZ, 2012). This means that there is also a growing need for food and feed, which puts more pressure on agricultural production (Pöldaru et al., 2018). Hence there has been a long ongoing debate on the effect of farm size on productivity. Are the family farms the ones that will lead us to a future of sustainable agriculture while feeding the population, or should we rely on large corporate agricultural businesses or mega-farms? What kind of balance should there be between them?

Agriculture is a significant user of natural resources (Bruinsma, 2003), although in different ways and to different extents depending on the farming system. Farming is also a major source of greenhouse gases, and as the world's greenhouse gas levels continue to rise, climate change is occurring much faster than anticipated (United Nations, 2019).

The number of people suffering from hunger has been on the rise since 2014 (Bruinsma, 2003; United Nations, 2019). To ensure that future agricultural production guarantees food security for the world's growing population, we need productive yet sustainable agriculture. Which agricultural model is best for sustainable growth in agricultural production? Opinions differ; some sources (Sheng & Chancellor, 2018; Rada & Fuglie, 2019; Ren et al., 2019) support intensive, industry-based production

models; others (Monbiot et al., 2018; Ricciardi et al., 2018; Glenn et al., 2019) are in favour of farming based on smallholders. Some studies show that small family farms are more diversified than large ones, but they are also less likely to conserve structural elements, they leave a higher share of their soils bare during winter, and use more of their fields for monoculture (Wuepper et al., 2020). The Sustainable Development Goals report (United Nations, 2019) states that small-scale food producers are a big part of the solution to world hunger. For example, in the European Union, 50% of farms are smaller than 2 hectares but operate on only about 2.4% of agricultural land (Graeub et al., 2016; Lowder et al., 2016). The share of agricultural land controlled by larger farms is higher in countries with larger average incomes (Lowder et al., 2016).

In many parts of the world, there is an ongoing process of farm size growth (Viira, 2014; Pöder, 2017; Hubert, 2018; Sheng & Chancellor, 2018). While the number of farms is decreasing, the average area of agricultural land use per farm is growing (Sheng & Chancellor, 2018; Wuepper et al., 2020). Mega-farms of up to 500,000 hectares appear in the countries of the former Soviet Union, Latin America, North America, Australia, and even Central Europe (IAMO, 2017). Large-scale agricultural producers are evolving because of the abundance of land resources in some parts of the world. Improved access to outside capital is one reason why large size farms attract investors that do not have experience in primary agriculture (Constantin et al., 2017). It is also believed that given the introduction of modern production technologies, large farms can achieve the expected returns much faster than small ones. Some studies (Ren et al., 2019) show that large-scale farming has no direct negative impact on the environment and lead to a positive environmental impact.

However, the question of whether large-scale farming is more efficient and profitable than the small or medium-size farms, remains. It is believed that small ones are diversified and contribute more to environmental sustainability, preservation of traditional values, and economic resilience than large farms (Graeub et al., 2016; van der Sluis et al., 2016; Rada & Fuglie, 2019). It is known that the smallest two farm size classes (0–1 ha and 1–2 ha) are the most significant contributors to global food production compared to all other classes (Graeub et al., 2016). Farms less than 2 ha produce 28–31% of total crop production and 30–34% of the global food supply (Ricciardi et al., 2018).

In the case of small farms, much of the labour comes from the household: family members are self-supervising, motivated to work with care, and flexible to accommodate the unpredictable timing of some farm operations (Llambí, 2010; Graeub et al., 2016). Large farms, on the other hand, often depend heavily on hired labour that needs to be recruited and supervised, thereby raising transaction costs and, thus, the implicit cost of labour (Llambí, 2010). Agriculture is the single largest employer in the world, providing livelihoods for 40% of today's global population (United Nations, n.d.) and small farms typically apply more labour per land unit than larger farms (Llambí, 2010; Rada & Fuglie, 2019). Thus, it is essential to maintain small farms (Constantin et al., 2017; Dell'Angelo et al., 2017) to support the livelihoods of rural populations.

By number, there are more than 570 million farms in the world; more than 475 million farms are smaller than 2 ha, and more than 500 million are family farms (Lowder et al., 2016). Accordingly, investing in small farms is a crucial way to increase food security and nutrition for the poorest, as well as food production for local and global markets.

The ongoing debate on the effect of farm size on productivity remains; however, the structural adjustment has seen resources shift from smaller and less productive farms to the larger ones. This, in turn, raises the question: is the large-scale model for agricultural production sustainable?

In 2015, countries adopted the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals. Of these 17 goals, three are linked directly to agriculture and its sustainability. Goal 2 leads our attention to people suffering from hunger; this number has been on the rise since 2014. The purpose of this goal is to end hunger, achieve security and improved nutrition, and to promote sustainable agriculture. The United Nations, 2019 report on sustainable development goals states that special attention needs to be given to increasing the agricultural productivity and incomes of small-scale food producers. Small-scale food producers are a big part of the solution to world hunger.

The purpose of goal 13 is to take urgent action to combat climate change and its impacts. The purpose of goal 15 is to protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and to halt and reverse land degradation and halt biodiversity loss. One of the primary drivers of biodiversity loss is habitat loss from unsustainable agriculture.

Therefore, it is essential to determine what is sustainable agriculture. Does this model include small-scale or large-scale farms or both, and in what proportions? To do so, there is a need to map the present situation. Therefore the purpose of this paper is to give an overview of the changes in Estonian agricultural producers according to the size of the land use. The paper is organized as follows: first, to clarify the changes that have taken place in Estonian agriculture, we present a historical overview based on literature and document analysis; second, an introduction of data and method used; third, presentation of the results of the case study of Estonia according to data from ARIB; fourth, discussion of the results and conclusions are given.

Historical overview of changes in Estonian agriculture

Agriculture in Estonia has been through significant structural changes. From 1919 till today, there have been five major land reforms, each influencing Estonian agriculture. After the independence of Estonia in 1918, an extensive area of agricultural land was owned and used by large farms (owned mostly by Baltic Germans) (Grubbström, 2011; Grubbström & Sooväli-Sepping, 2012; Jürgenson, 2017). At the same time, the peasants had a strong desire for land ownership. These circumstances created a suitable environment for the 1919 land reform, the purpose of which was to create more landowners (Grubbström, 2011; Jürgenson, 2016). As a result, there evolved more than 40,000 landowners, while more than 20,000 land users were in the process of acquiring land (Rosenberg, 2019). The average area of one farm was 23 ha (Rosenberg, 2019). The number of small farms rose more than two times; however, the reform also created some bottlenecks. For example, there emerged many tiny and economically not-profit farms, and there were no longer enough workers in large farms (Jürgenson, 2017; Rosenberg, 2019).

In 1940 the Soviet Union occupied Estonia and started new land reform. Private ownership was abolished, and the land was included in state property (Grubbström, 2011; Jürgenson, 2016, 2017). The previous landowner became a land user, and the ceiling of the land-use area was supposed to be 30 ha (Jürgenson, 2017; Rosenberg,

2019). The area of state land fund was over 758,000 ha (Rosenberg, 2019). The outcome was that successful farms were weakened, and lots of small, economically not efficient farms were created. These were steps towards later agricultural collectivization.

In 1941 Germany occupied Estonia, and reform made by the Soviet Union was cancelled. The land was partly returned to the use of its earlier/rightful owners; however, the state still owned the land. Three years later, the Soviet Union occupied Estonia again and picked up with its land reform where it left off. All changes made during the German occupation were cancelled (Jürgenson, 2017). This time land reform comprised 42,274 landowners and equitable owners and 972,000 ha of land (Rosenberg, 2019). By this time, there were only 136,000 farms left in ESSR and living conditions in rural areas were getting worse (Rosenberg, 2019). The next step was compulsory collectivization, resulting in the creation of large collective farms and the disappearance of small farms.

In the Soviet Union planned economy, there was only one suitable form of agriculture: state farms - kolkhozes and sovkhozes (Jürgenson, 2017; Pöder, 2017). Because of that, the number of people living in rural areas and working in agriculture shrank quickly. A further result was the shrinking number of villages and peripheries that arose.

There was a large shortage in the peoples' food supply and it didn't get any better. In the middle of 1980, the Soviet regime decided to allow family farms, small co-operatives and by the year 1986, there were 206 collective farms in Estonia (Jürgenson, 2017; Rosenberg, 2019). Socialistic agriculture was in a jam, and one way to snap out of it was seen in establishing rental farms in the peripheries. A bit later, talk about proper farms and self-sufficiency were put on the table. By the end of 1988, there were about 100 farms in Estonia; only a year later, at the end of 1989, there were over 1,000 farms (Rosenberg, 2019).

The demise of the large socialistic farms had started already in December 1989. A single farm of up to 50 ha was permitted (Rosenberg, 2019). After the regaining of Estonian independence in 1991, restitution of farmlands based on the pre-Second World War ownership and privatisation of collective farms took place (Grubbström, 2011; Grubbström & Sooväli-Sepping, 2012; Viira, 2014; Jürgenson, 2017; Pöder, 2017). The land reform law and then the agriculture reform law both favoured agriculture based on small farms (Kasepalu, 1991; Lillak, 2003; van Dijk, 2007; Pöder, 2017). In the first ten years of regaining independence, the number of farms in Estonia increased from 7.4 thousand in 1991 to 55.7 thousand in 2001 (Viira, 2014). Many small agricultural users arose (Viira, 2014; Pöder, 2017) but in the following years this number decreased (Grubbström & Sooväli-Sepping, 2012; OECD, 2018; Jürgenson & Rasva, 2020).

Today, small-scale farms are family farms that were established due to the restitution of land, the disintegration of former collective farms, or the expansion of household plots (Viira, 2014; Jürgenson, 2017). Large-scale producers are mostly corporate or co-operative farms, with a few exceptions in individual farms that have grown and will continue to expand (Viira, 2014). Although the number of agricultural holdings has decreased, the number of final consumers of their production is steadily increasing – there are 7.5 billion inhabitants in the world, and they all need food (Viira, 2014).

DATA AND METHODS

To introduce a more detailed overview of the recent changes in the pattern of agricultural landholdings in Estonia, ARIB² Field Register data from 2011 and 2016 is used. The Field Register is one of three registers in charge of ARIB, and area support is one of the subsidies that ARIB delivers. The digitalised database of agricultural plots is required for payment of area supports from the budget of the EU. In the process of delivering national and EU subsidies, ARIB collects information about the applicant (every applicant receives an ID number) and land that is filed for area support.

ARIB data about the agricultural land area and the number of producers were analysed to get an overview of changes in Estonian agricultural land users' land holdings in 2011 and 2016. Agricultural land users and land area per producer were summarized using GIS software ArcGIS for Desktop 10.4. As information about the producers' location was also included, it gave us information seen in Figs 2 and 3.

Using GIS software, producers were divided into six groups according to the size of their landholdings: 0–< 2 ha, 2–< 40 ha, 40–< 100 ha, 100–< 400 ha, 400–< 1,000 ha and >1,000 ha; data was taken on the basis of these size groups. The basis for this division comes from Farm Accountancy Data Network³ (FADN), where the agricultural land area is divided into four size groups (0–< 40 ha, 40–< 100 ha, 100–< 400 ha, > 400 ha). To get a closer look at the smallest agricultural land users, FADN size group 0–< 40 ha was divided into size groups 0–< 2 ha and 2–< 40 ha. FADN size group > 400 ha was divided into size groups 400–< 1,000 ha and > 1,000 ha to characterise the largest agricultural land users. These size groups are presented in Tables 2 and 3. More detailed information about three producers are presented in Figs 4 and 5.



Figure 1. Location of Estonia (study area) in Europe and its administrative division (Jürgenson & Rasva, 2020).

There are currently 15 counties in Estonia, according to its administrative division (Fig. 1). This study is based on the division that existed before 01.01.2018. After administrative-territorial reform, the division was revised, and with it, the borders of counties also altered to some extent. The administrative division that existed before

² ARIB is responsible for the delivery of national and EU subsidies for agricultural activities.

³ <https://maainfo.ee/index.php?page=9&>

01.01.2018 is used because the data from other sources precede the administrative-territorial reform as well.

Information about those 15 counties with their name, area (ha), agricultural land use area (ha) in 2016 and 2011 and the number of land users in 2011 and 2016 is presented in Table 1.

Table 1. Data concerning area (ha), agricultural land use area and the number of agricultural land users of the 15 counties in Estonia

County	Area (ha) ¹	Agricultural land use area (ha)		The number of agricultural land users	
		2016	2011	2016	2011
Harjumaa	432,669	71,098	61,417	1,232	1,023
Hiiumaa	103,244	13,957	12,188	364	352
Ida-Virumaa	297,158	36,384	31,028	570	606
Jõgevamaa	254,486	74,817	69,268	1,029	1,117
Järvamaa	267,415	80,544	76,776	785	785
Läänemaa	181,558	52,117	43,052	852	809
Lääne-Virumaa	369,572	109,356	101,711	1,129	1,133
Põlvamaa	182,335	53,310	48,377	1,102	1,212
Pärnumaa	541,873	85,783	78,622	1,535	1,556
Raplamaa	276,506	69,520	64,911	1,129	1,204
Saaremaa	293,765	53,637	46,822	1,200	1,116
Tartumaa	334,931	84,071	75,921	1,248	1,380
Valgamaa	191,709	45,265	41,333	1,144	1,220
Viljandimaa	342,003	85,601	77,829	1,156	1,254
Võrumaa	277,314	52,358	47,781	1,794	2,038
Estonia	4,346,538	967,816	877,036	15,456	16,226

¹ County area (ha) before 01.01.2018.

This study concentrates on agricultural land users' land holdings that cover all plots which are used for agricultural production in Estonia. No distinction is made between land in ownership and leasehold land. Also, no differentiation was made between different production groups.

RESULTS

According to ARIB data, agricultural land use area in Estonia has grown 11% between 2011 and 2016; the growth has taken place in all counties (Fig. 2). The largest growth of agricultural land use is in Läänemaa county (21%) and the smallest in the county of Järvamaa (5%).

The number of land users between 2011 and 2016 (Fig. 3) has dropped in nine counties (Ida-Viru, Jõgeva, Põlva, Pärnu, Rapla, Tartu, Valga, Viljandi, and Võru), representing a 5% drop. The number of land users has increased in four counties (Harju, Hiiu, Lääne, and Saare) and it is almost same in two counties (Järva and Lääne-Viru). The most significant drop in the number of agricultural land users took place in the county of Võrumaa (-12%); the largest increase in the number of agricultural land users took place in the county of Harjumaa (17%).

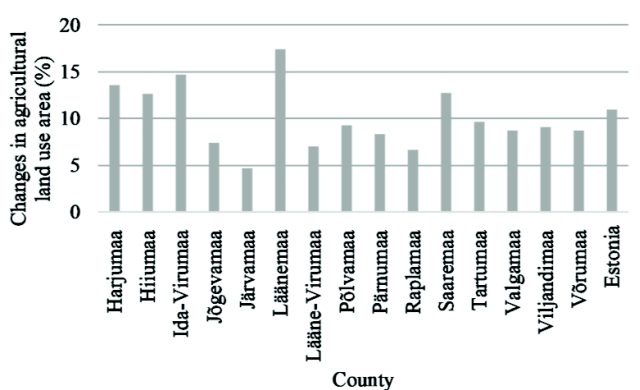


Figure 2. Changes (%) in agricultural land use area in counties between 2011 and 2016 (ARIB).

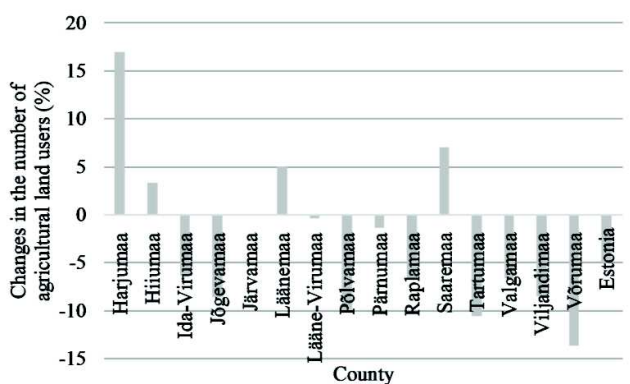


Figure 3. Changes (%) in the number of agricultural land users in counties between 2011 and 2016 (ARIB).

The majority of the producers in counties are in size group 2–< 40 ha (Table 2). The number of producers in size group 2–< 40 ha is the largest (1,338) in Võru county and smallest (249) in Hiiu county. The number of producers using land in size group >1,000 ha is the smallest in every county. The largest number (25) of producers in size group >1,000 ha is in Järva county. In Hiiu county, there are no producers using land over 1,000 ha. There are also very few producers in counties in size group 400–< 1,000 ha (in total 546). Producers division into size groups 0–< 2 ha, 40–< 100 ha and 100–< 400 ha is quite similar all over Estonia.

Table 2. Division of the agricultural users according to size groups in counties in 2016 (ARIB)

County	Number of agricultural land users in size groups					
	0-< 2	2-< 40	40-< 100	100-< 400	400-< 1,000	> 1,000
Harjumaa	79	845	119	129	47	14
Hiiumaa	33	249	43	32	7	0
Ida-Virumaa	52	375	52	63	21	8
Järvamaa	63	486	88	93	38	25
Jõgevamaa	92	691	93	97	39	23
Lääne-Virumaa	72	684	130	153	65	22
Läänemaa	48	568	91	105	34	8
Pärnumaa	115	1,058	152	152	44	13
Põlvamaa	153	691	104	111	44	11
Raplamaa	69	747	144	115	39	13
Saaremaa	110	850	121	93	18	8
Tartumaa	126	821	113	115	51	23
Valgamaa	81	831	104	87	30	11
Viljandimaa	80	766	125	124	43	19
Võrumaa	187	1,338	116	121	26	7
Estonia	1,360	11,000	1,595	1,590	546	205

The largest area of agricultural land is used by land users in size groups 400-< 1,000 ha (in total 237,671 ha) and 100-< 400 ha (in total 260,957 ha) (Table 3). In counties like Järva, Jõgeva, Viljandi, Lääne-Viru and Tartu, land users in size groups 400-< 1,000 ha and >1,000 ha are using over 50% of the agricultural land. Most of the agricultural land in Estonia is used by size groups 100-< 400 ha, 400-< 1,000 ha, and > 1,000 ha (in total 750,739 ha). A small part of the agricultural land in counties is used by those in size group 0-< 2 ha, 2-< 40 ha and 40-< 100 ha (in total 217,077 ha).

Table 3. Division of agricultural land use between the land users in different size groups in counties in 2016 (ARIB)

County	Agricultural land use area in size groups (ha)					
	0-< 2	2-< 40	40-< 100	100-< 400	400-< 1,000	> 1,000
Harjumaa	112	9,790	6,403	21,507	22,745	10,540
Hiiumaa	51	2,696	2,662	5,652	2,896	0
Ida-Virumaa	77	3,741	3,133	9,859	9,257	10,334
Järvamaa	93	6,343	4,766	15,127	11,727	43,377
Jõgevamaa	135	7,511	5,083	16,158	14,551	31,471
Lääne-Virumaa	106	8,115	8,143	27,074	32,361	32,827
Läänemaa	71	6,787	5,196	18,040	14,402	7,832
Pärnumaa	175	12,286	9,136	25,180	20,362	18,380
Põlvamaa	228	6,884	5,600	13,470	16,773	10,649
Raplamaa	103	9,433	9,069	19,201	15,938	15,658
Saaremaa	166	9,491	7,353	16,172	11,001	9,454
Tartumaa	185	8,397	6,616	19,331	25,488	23,995
Valgamaa	125	8,886	5,565	12,689	10,563	7,170
Viljandimaa	120	9,331	7,696	23,333	19,478	25,646
Võrumaa	279	12,266	6,671	18,165	10,131	4,783
Estonia	2,026	121,959	93,092	260,957	237,671	252,111

The area of land holdings varies a lot. For example, there were land holdings from 0.1 ha up to 5,756 ha in the year 2011. In 2011 the largest agricultural landholding was in the county of Järvamaa; it used 5,756 ha of land. The smallest was in the county of Harjumaa, and it used 0.1 ha of land. In 2016 the largest landholding was still the same as in 2011 and it used 5,523 ha land in the county of Järvamaa. In Tartumaa county, the smallest agricultural landholding was 0.3 ha in 2016; a different land holder used 0.1 ha of land in 2011. Land users with the smallest landholdings in 2011, and 2016 are self-employed workers, and the largest user is the corporate body.

The largest agricultural landholding area was 5,523 ha in 2016, situated in the county of Järvamaa (Fig. 4). The land plots were scattered over the Türi municipality. The area of these land plots formed 27% of the Türi municipality total land-use area registered in ARIB.

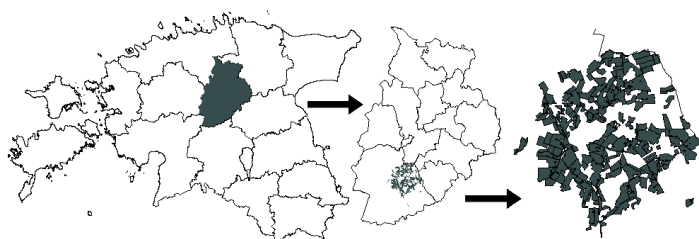


Figure 4. The location of the largest agricultural land user land plots in 2016 (ARIB).

While the largest land user in Estonia used land in only one municipality in 2016, some big producers used land throughout Estonia (Fig. 5). For example, land user ID 141094 used 1,341.37 ha of land, which was scattered over 147 plots. This user farmed land in eight different counties (Ida-Viru, Valga, Võru, Tartu, Viljandi, Põlva, Harju, and Lääne-Viru).

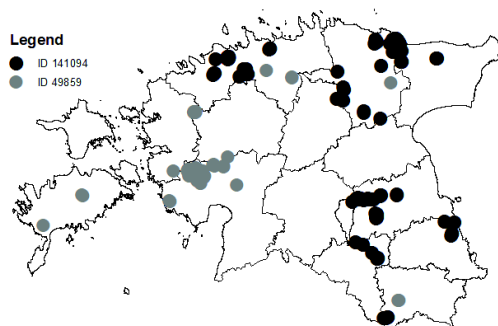


Figure 5. The location of two agricultural land user (ID 141094 and ID 49859) land plots in 2016 (ARIB).

Land user ID 49859 farmed 1,149.9 ha of land that was scattered over 90 plots. This user farmed land in six different counties (Pärnu, Saare, Võru, Harju, Lääne, and Lääne-Viru) and had land both on the island of Saaremaa and on continental Estonia.

DISCUSSION AND CONCLUSIONS

While our population is growing, there is also a growing need for food and feed, which puts more pressure on agricultural production. At the same time, agriculture is a significant user of natural resources and greenhouse gas producers (Bruinsma, 2003). As the world's greenhouse gas level continues to rise, it has brought up questions about sustainability in agriculture and its production. The long ongoing debate on which farm structure could lead us to a future of sustainable agriculture and feeds our growing population remains. Some studies (Ren et al., 2019) show that farm size has a substantial influence on agricultural sustainability and supports the idea that large-scale farming has no direct negative impact on the environment. Are family farms the ones that lead us to the future of sustainable agriculture and feed the population, or should we rely on large corporate agricultural businesses or mega-farms? Additional and broader research is needed to formulate a direct answer to this question. In this paper, we aimed to provide ground for further discussions and studies.

As in many parts of the world, Estonia is in an ongoing process of farm size growth. The number of agricultural producers is decreasing, while the average area of agricultural land use per producer is increasing in size (Jürgenson & Rasva, 2020). The increasing competition among farmers has resulted in small and uncompetitive farmers being forced to end their activities; some are not able to find a successor after retirement (Beckers et al., 2018). According to ARIB data, agricultural land area in Estonia has grown 11% between 2011 and 2016, but the number of agricultural producers has dropped 5% in the same period. It shows that agricultural land use area per user has increased. According to OECD 2018 report, one reason is that CAP single area payments encouraged people to reclaim abandoned agricultural land.

From its history, we can see that Estonia has been through significant structural changes that have influenced the country's agriculture. Through different occupation periods and simultaneous reforms, Estonia has come to independence once again and has undertaken the most recent, still unfinished land reform. The land reform law and also the agriculture reform law both favoured agriculture based on small farms. At first, the number of farms in Estonia increased, and many small agricultural producers arose; however, as the years went by, this number has decreased and is still decreasing. According to ARIB data, the largest increase between 2011 and 2016 in the number of agricultural producers took place in Harjumaa (17%). At the same time, the land-use area grew there by 14%.

While the number of agricultural land users in Estonia has dropped, changes at the county level have been in different directions. As the number of land users dropped in nine counties, it increased in four counties and remained almost the same in two counties. The most significant drop in the number of agricultural land users took place in the county of Võrumaa (-12%), where the land area grew 10% at the same time. One possible reason for the change is Võrumaa's location in the southern part of Estonia, far from the capital.

Some studies (Beckers et al., 2018) indicate that farm size will continue to increase, with small farms disappearing. That structural shift to large, more effective agricultural producers is also seen in Estonia. The OECD report (2018) cited that farm consolidation in Estonia in the 2000s led to increase in average farm size and in the number of larger farms. However, analyses presented in this paper show that most producers in Estonian counties are in smaller size groups; most of the agricultural land is indeed used by agricultural producers in size groups 400–< 1,000 ha and >1,000 ha. In counties like Järva, Jõgeva, Viljandi, Lääne-Viru, and Tartu, these land users are using over 50% of the agricultural land. At the same time, the number of producers using land in these size groups is the smallest in every county. This indicates that a small group of agricultural producers is using a large area of agricultural land in Estonia. At the same time a small part of the agricultural land in counties is used by those in size group 0–< 2 ha, 2–< 40 ha and 40–< 100 ha; the number of agricultural land users in those small size groups is the biggest.

Some studies show that small agricultural producers are diversified and contribute more to environmental sustainability, preservation of traditional values, and economic resilience than large ones (Wuepper et al., 2020). It is also essential for rural livelihoods to maintain small farms because agriculture is the largest employer in the world, and small farms typically apply more labour per land unit than larger farms. However, still, today's structural adjustment in agriculture has seen resources shift from smaller and less productive farms to larger ones. This growth for survival will lead to larger farms, sometimes creating larger parcels, and this upscaling may lead to a decrease in landscape diversity and ecological value (Beckers et al., 2018). As in the case of Estonia, the largest agricultural producer in 2016 was using 27% of agricultural land located in the Türi municipality. While this user was using agricultural land within one municipality, some large agricultural producers are using land plots scattered throughout Estonia (some plots even on the island of Saaremaa).

History has shown us that from one point forward; large farms are no longer sustainable. As large state farms in the Soviet Union period collapsed, there is a need to think forward about what the future could hold for today's large agricultural producers. Future agricultural production must guarantee food security for the world's growing population. Productive yet sustainable agriculture is essential.

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Rasva, M., Jürgenson, E. (2022). Europe's Large-Scale Land Acquisitions and Bibliometric Analysis. *Agriculture*, 12 (6), 850. DOI: 10.3390/agriculture12060850.

Systematic Review

Europe's Large-Scale Land Acquisitions and Bibliometric Analysis

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Abstract: The agricultural sector in the European Union is largely characterized by a declining number of farms and an increasing size of surviving farms. The land is concentrating under the usage of fewer large agricultural producers. Meanwhile, a broad distribution of land ownership is the basis for the welfare of local economies and rural communities. Land distribution is one important component that guarantees our right to food, human rights, and sustainability in agriculture. The aim of this paper was to compile a systematic review of the existing literature on large-scale land acquisitions in Europe. The results are based on two different search methods. Firstly, documents and articles on large-scale land acquisitions were studied and, secondly, keyword research from the SCOPUS database and analysis using VOSviewer where performed. This study shows that large-scale land acquisitions are closely related to food security, human rights, global governance and international law, land tenure, biofuel production, and financialization through European Union common agricultural policy subsidies and foreign direct investments.

Keywords: land concentration; land grabbing; large-scale land acquisition; food security; EU agriculture; sustainable land use



Citation: Rasva, M.; Jürgenson, E. Europe's Large-Scale Land Acquisitions and Bibliometric Analysis. *Agriculture* **2022**, *12*, 850. <https://doi.org/10.3390/agriculture12060850>

Academic Editors: Hanna Dudek, Joanna Myszkowska-Rycka, Ariun Ishdorj and Marzena Jeżewska-Zychowicz

Received: 25 April 2022
Accepted: 10 June 2022
Published: 13 June 2022

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1. Introduction

Recently, sustainable agricultural production and land use in the agricultural sector have been the subject of discussion for several reasons. The COVID-19 pandemic and Russian invasion of Ukraine are the latest reasons to address this issue. The pandemic situation disrupted the global supply chains, closed the borders between countries (albeit for a short period), and restricted movement inside countries. It indicated the need for domestic agricultural production to use short supply chains (where production occurs close to the consumers). A study by Benedek et al. [1] showed that around 19% of small-scale farmers in Estonia, Hungary, Portugal, and Romania were actually able to boost sales during the first wave of the pandemic. Farm gate sales were one of the most important marketing channels both before and during the first wave [1]. However, our knowledge on how the COVID-19 pandemic affected land-use change is limited. Nolte et al. investigated the impact of the COVID-19 pandemic on the livelihoods of agricultural households and their land-use decisions [2]. The outcome of the study showed that smallholders' risk-coping capacities are weak and have been further weakened by the pandemic.

The COVID-19 pandemic provided the needed push for the European Green Deal. As a result, the EU is moving towards a more sustainable society and accelerating its transition to climate neutrality. The European Green Deal [3] strives for a climate-neutral economy by 2050, and its ambition is to apply more climate-friendly land use. The aim is to achieve emissions reductions of at least 55% by 2030 compared to 1990 levels. It has been recognized that the land-use sector has a critical role in reaching long-term climate mitigation objectives. The land use, land-use change, and forestry (LULUCF) sector can provide long-term climate benefits [4]. Nevertheless, there is a need to find a coherent strategy that will achieve both the Union's food security and climate change objectives.

The Russian invasion of Ukraine and the sanctions that were applied with the aim of crippling the Russian economy are already affecting the agricultural sector and our food supply. In this situation, a country's self-sufficiency in food is becoming increasingly important.

Europe, and especially its eastern region, is undergoing creeping agricultural land concentration. The concentration of agricultural land has an adverse effect on the availability of food supplies. It is distorting production and market processes.

The issue of land concentration in the EU and many parts of the world remains basic and is one of the most serious land issues in the district today [5,6]. Over the years, many review papers have been published in the large-scale land acquisition (LSLA) literature [7–18]. The aim of this paper is to compile a systematic analysis of the existing literature on land grabbing and concentration in Europe. It is important for mapping the cumulative scientific knowledge on the topic of LSLA and its relations to other subjects. This study included document and article analyses, keyword research from the SCOPUS database, and analysis via VOSviewer (Version 1.6.17, Nees Jan van Eck and Ludo Waltman, Centre for Science and Technology Studies Leiden University, Leiden, The Netherlands).

2. Materials and Methods

Different documents and scientific articles (30 materials in total) on the topic of LSLA were studied for Section 3.1. The aim of this section is to give a general review on Europe's large scale land acquisitions.

The SCOPUS database was used for Section 3.2. The aim of this section is to present a bibliometric analysis on land concentration and land grabbing. Firstly, some previously studied articles (used in Section 3.1) were used to determine popular keywords that could be used to search SCOPUS for articles on the topic. Keywords were chosen for this work assuming that the selected works were provided with keywords that successfully connect their research with their target audience.

The keywords identified were "agricultural land use", "land concentration", "land grabbing", "family farms", "large-scale farming", "smallholder farms", "smallholder agriculture", "farm size", "farm ownership", "smallholder", and "small family farming". Some of those keywords yielded results that were too broad and had to be excluded.

The first search from the database was performed with four keywords ("land concentration" OR "land grabbing" OR "large scale farming" OR "small family farming") and yielded 390 records. After screening those results, the search had to be narrowed down to only English written articles for which the content was restricted to within Europe, and to which we had free access through our institution or which were open access journals. This search yielded 112 results, of which 45 articles were not accessible (no free access, not digitized, etc.), and 15 were outside the current scope. Finally, there were 40 articles, published from 1982 to 2020, included in the study. A detailed description of the query made in the SCOPUS database is shown in Figure 1. The methodological approach for this study is presented in Figure 2.

The VOSviewer software was used to provide an overview of the terms used in the LSLA literature. The keywords from the last SCOPUS database search results (112 articles) were entered into VOSviewer, and the keywords represented at least three times were visualized.

KEY("land grabbing") OR KEY ("land concentration") OR KEY ("large-scale farming") OR KEY ("small family farming") AND NOT KEY ("Asia") AND NOT KEY ("Africa") AND NOT TITLE("Brazilian") AND NOT TITLE("Amazonian") AND NOT TITLE("Laos") AND NOT TITLE("India") AND NOT TITLE("China") AND NOT TITLE("Indonesia") AND NOT TITLE("Brazil") AND NOT TITLE("Thailand") AND NOT TITLE("America") AND NOT TITLE("Rwanda") AND NOT TITLE("Mapuche HUILICHE") AND NOT TITLE("Ethiopia") AND NOT TITLE("Malawi") AND NOT TITLE("Uganda") AND NOT TITLE("Egypt") AND NOT TITLE("Sudan") AND NOT TITLE("Africa") AND NOT TITLE("Argentina") AND NOT TITLE("forest") AND NOT TITLE("medicine") AND NOT TITLE("Sierra Leone") AND NOT TITLE("Colombia") AND NOT TITLE("Sumba") AND NOT TITLE("Colombian") AND NOT TITLE("Iraq") AND NOT TITLE("Mozambique") AND NOT TITLE("Pakistan") AND NOT TITLE("Cameroon") AND NOT TITLE("Uruguay") AND NOT TITLE("Cambodia") AND NOT TITLE("Sri Lanka") AND NOT KEY("Kaiowa") AND NOT TITLE("ASEAN") AND NOT TITLE("Tanzania") AND NOT TITLE("Honduras") AND NOT TITLE("Ghana") AND NOT TITLE("Chongqing") AND NOT KEY("Brazil") AND NOT KEY("Laos") AND NOT KEY("Nigerian") AND NOT KEY("Mozambique") AND NOT TITLE("Zimbabwe") AND NOT TITLE("Ethiopian") AND NOT TITLE("Guatemala") AND NOT TITLE("Zambia") AND NOT TITLE("Mali") AND NOT TITLE("Peru") AND NOT TITLE("Guinea") AND NOT TITLE("Kenya") AND NOT TITLE("Ocean") AND NOT TITLE("Water") AND NOT KEY("Myanmar") AND NOT TITLE("Mexico") AND NOT TITLE("Bolivia") AND NOT TITLE("Algeria") AND NOT TITLE("Japan") AND NOT TITLE("Alabama") AND NOT TITLE("Bengal") AND NOT TITLE("Costa Rica") AND (LIMIT-TO (PUBSTAGE,"final")) AND (LIMIT-TO (LANGUAGE,"English"))

Figure 1. Search of the SCOPUS database.

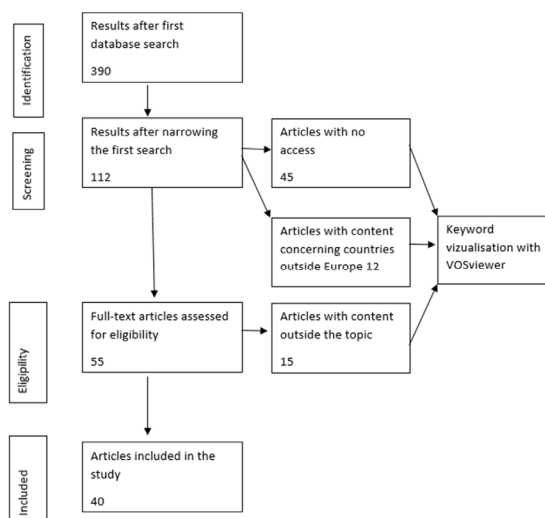


Figure 2. Methodological approach used for analyzing the literature.

3. Results

3.1. Europe’s Large Scale Land-Acquisitions

The ever-growing world population and increasing consumption puts high pressure on the EU’s agricultural land through competition for agricultural land use. For instance, agricultural land is used to grow products for biofuel production, and rapid urbanization also needs space [19].

Agriculture is a serious user of natural resources [20,21], although in diverse ways and to diverse extents depending on the operating system. This raises a question: are family farms the ones that will lead us to the future of sustainable agriculture and feed the population, or should we depend on large corporate agricultural businesses or mega-farms? Either way, there is a need to take actions towards greener agriculture. In the move towards sustainability, the European Green Deal and Sustainable Development Goals (SDGs) [22] set out necessary goals. Some of the objectives in the SDGs are directly linked with agriculture and its sustainability. Their aims include ending world hunger and ensuring sustainability in agriculture. In the 2019 United Nations Decade of Family Farming 2019–2028 [23] report, it is stated that family farming supports the SDGs by:

- Making food systems more sustainable;
- Creating income generation opportunities in rural areas;
- Implementing resilient and highly productive agricultural practices;
- Delivering inclusive rural services and contributing to territorial development;
- Promoting food systems that are more resilient to climate change;
- Preserving biodiversity;
- Strengthening sustainable integration between urban and rural areas.

From the beginning of the 2007–2008 financial crisis, land was acquired not only by investors keen in agriculture of food crops but also by financial institutions that awaited an increase in its value [24–27]. Suddenly, many influential economic actors started to invest in farmlands by buying them up or renting as much farmland as possible. International and domestic large-scale land deals became a growing global phenomenon. Today's structural arrangement in agriculture has seen resources transfer from smaller and less productive farms to larger ones. This increase, driven by a need for survival, will lead to larger farms, sometimes creating larger parcels, and this upscaling can lead to a decrease in landscape diversity and ecological value [28].

Structural change in the agricultural sector in the EU is also largely characterized by a dropping number of farms and a growing size of surviving farms [4,29–31]. In consequence, the critical choice of farms can be summarized as “grow or go”. Therefore, the EU faces land concentration, but there are no reliable data about its scope [32–34]. Different studies showed that, in recent years, the number of agricultural producers has dropped in the EU, while the size of farms has increased [31,32,35]. These qualitative case studies on the effect of land concentration, pushed by further investments in rural societies, can rather be found in post-socialist EU countries [32]. For example, in 2001, there were 55,748 agricultural producers in Estonia; this number decreased each subsequent year to 18,755 in 2013 and 16,696 in 2016, while, concurrently, the area of utilized agricultural land remained almost stable [31,32,35]. This decrease took place largely at the expense of small producers [35].

In Romania, small-scale farms have been vanishing quickly, and between 2002 and 2010, 150,000 small-scale farms disappeared, while large-scale farming increased by 3% [6]. In 2020, the average monocultural land parcel situated in Slovakia reached a size of 12 hectares [13]. In 2010, the number of farms in Hungary was 351,000, which dropped to 235,000 by 2020 [14]. Meanwhile, these numbers do not show how much land the agricultural producers own and how much they rent.

LSLA transforms land use and food systems in their targeted regions worldwide [15]. It is found that LSLA threatens socio-economic loss, including income generation and food access [16]. The European farming model is built on the recognition of the multifunctionality and diversity of European agricultural systems [17]. It is estimated that, by 2040, an additional 6.4 million farms may disappear in Europe [17]. Toma, Redman, Czekaj et. al. found that the programming of the EU's Common Agricultural Policy at national and regional level does not respond to small farms' needs [18]. At the FAO regional conference for Europe 2022 it was suggested that member states strengthen their resilience by investing in smallholders and family farms, and updating agrifood systems to be better prepared, adaptable and autonomous [36].

Different studies are searching for the answer to the question of which farming model (large-scale agriculture or small farms) is most suitable for the environment and will ensure food security in the future. Ren et al. [37] found that farm size has a large influence on agricultural sustainability from the aspects of economy, environment, and society. Some studies have found that environmental harm resulting from large-scale industrial farming practices includes the loss of soil fertility, pollution of water sources, loss of biodiversity, and draining of wetlands, and large-scale landowners in the agricultural labor market depress labor income in the primary sector [33,38,39]. Wuepper, Wimmer, and Sauer [40] found, on the contrary, that small-scale farming does not lead to more sustainable farming practices. The result of this study was that small-scale farms are less likely to conserve structural elements, leave a higher share of their soils bare during winter, and use more of their fields for monoculture.

Therefore, land policy is severely important in shaping who farms, how farming is done, and the future of rural communities. For example, there are congruous land policy tools with direct intervention in the land market in Estonia. Restrictions on the acquisition of immovables used as profit-yielding land were enacted through the Restrictions on Acquisition of Immovables Act under Chapter 2. There are limitations for legal persons of the Contracting States and persons of third countries. In Poland, there are strict rules maintained for potential buyers, in order to scare the mass buy-out of land after the regulations restricting land purchases by foreigners were eased [41]. Restrictions on agricultural land acquisitions are necessary to avoid large tracts of land ending up in the ownership of a few large companies.

Nevertheless, even if there are restrictions against companies acquiring large tracts of land, the links between companies can be very complicated, and through complex relationships between different companies, agricultural land can still end up in foreign companies' portfolios. It also makes it challenging to track down how much land different companies (foreign or domestic ones) really use (own or rent).

The problem of the complexities of evaluating land use concentration regarding closely related companies was addressed by Rea [42]. The study's outcome showed the complexity of the relationships between companies in Estonia, and the result was that it is hardly possible to estimate the land use concentration based on simple and easy inquiry. Schemes based on extracts included simple systems containing one company and more complicated ones [42]. Finally, the thesis pointed out that it is essential to develop a methodology that would allow us to determine the scope of land use concentration concerning connections between companies. Visser, Mamonova, and Spoor [43] also described these complex relations between companies. A broad distribution of land ownership is the basis for the welfare of local economies and rural communities [13]. An increase in the area of agricultural land farmed by large agricultural producers raises concerns that agricultural development may not be favoring small-scale farming and has an important environmental footprint [44]. Farming should provide livelihoods for farmers, while retaining natural ecosystems and services [45].

3.2. Bibliometric Analysis

According to the 40 articles that were included in this study, the number of publications written about LSLA has increased over the years (Figure 3). Between 1991 and 2011, there was one article written on the topic, but between 2019 and 2020, there were 16 publications on LSLA.

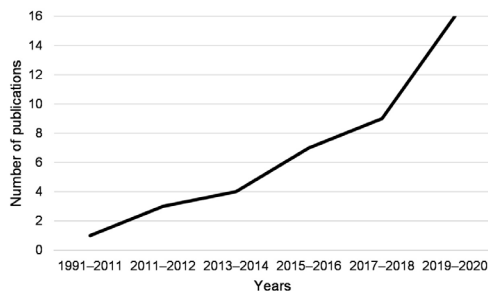


Figure 3. Number of publications written about LSLA between 1991 and 2020.

VOSviewer visualized 20 keywords, of which the earliest, most-used keywords emerged before 2013 and between 2013 and 2014 (Figure 4). The most-used keywords at that time were “land concentration”, “land tenure”, “global governance”, and “governance”. From 2013, the number of publications written on the topic started to increase more quickly (Figure 3). Between 2014 and 2015, the keywords “land”, “biofuels”, and “food sovereignty” started to emerge as the most-used keywords.

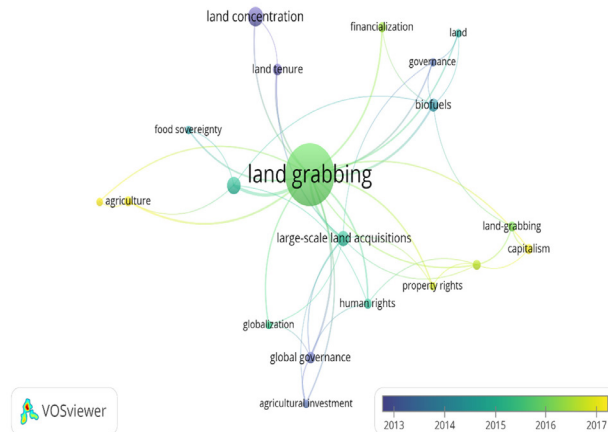


Figure 4. Keyword overlay visualization through VOSviewer.

Between 2015 and 2016, the keywords “food security”, “large-scale land acquisitions” “human rights”, and “globalization” were the most used in the publications. Between 2016 and 2017, the keywords “land grabbing”, “financialization”, “international law”, and “land-grabbing” started to emerge strongly in publications. After 2017, the keywords “property rights”, “capitalism”, “agriculture”, and “land fragmentation” started to emerge as the most-used keywords.

The majority (85 + 4) of the literature studies included the keywords “land grabbing” or “land-grabbing”, which are linked with the other 19 keywords visualized in Figure 4.

The term “land grabbing” started to emerge strongly in the literature after 2016. Before that, the term “land concentration” was primarily used in these studies.

4. Discussion

There is no commonly accepted definition for the concept of “land grabbing”; nevertheless, since 2000, it has become a crucial concern for the academic community, civil society, governments, corporations, and financial institutions [46–49]. Land grabbing is frequently associated with the disempowerment and loss of local farmers, involving violence in some cases [11,50–54]. Nonetheless, land grabbing is not illegal or immoral in all cases [46,53].

In the EU, land grabbing takes place mainly in the Eastern and Central countries, but there are no reliable data about its scope. The Land Matrix Global Observatory includes only transactions that involve over 200 ha and are made in severe economic situations [32]. The EU’s directives, including the common agricultural policy (CAP), fuel land grabbing and concentration [46,55]. Currently, 80% of direct payments are concentrated only in the hands of 20% of the EU’s farmers [56]. This means that the principles on which the EU has been established require appropriate changes within the CAP. The CAP has a series of precise objectives, both economic and social, which basically pursue the protection of producer and consumer interests [57]. The post-2020 CAP reform has promised to deliver a fairer CAP and to change the abovementioned distribution [56].

As the CAP is closely related to land grabbing and land concentration in Europe, it is interesting that it did not come up as a keyword in Figure 4. After undertaking a new analysis (to find out if there was at least one CAP keyword) with VOSviewer and entering all keywords that had even one occurrence, the keyword CAP came up (it occurred once). There was only one article containing the keyword CAP, from 112 articles and 419 keywords.

The term “land concentration” was used as a keyword in 12 articles (Table 1), and it has been used in the LSLA literature since 1984. This keyword is linked with the terms “land tenure” and “land grabbing” (Figure 2). Land concentration is a process in which large agricultural corporations increasingly buy up or lease land from other agricultural producers [31]. The concentration of agricultural land makes it really challenging for the younger generations to buy or lease agricultural land, and the aging of the population employed in agriculture threatens the viability of rural communities [46]. Land should be regarded not as a commodity, but rather as a crucial resource for food security and safety. Therefore, land is fundamental to existence for the generations of today and tomorrow.

Various factors drive land concentration. As a result of the present form of the EU subsidy scheme CAP, where a subsidy is paid for each hectare of land, small-scale farms become weaker, and large-scale farms grow stronger [5,55]. Large agricultural enterprises are increasingly flooding our markets with low-cost food and agricultural commodities, and through this, small farms become less capable of competing in the market. This means that growing numbers of farms are likely to go out of business and have to sell their lands. Large and rapidly expanding farms are more likely to go bankrupt because their high debt-to-asset ratios make them more sensitive to market volatility [5]. This, in turn, may result in huge tracts of land coming on the market at a time when other farmers will find it difficult to buy additional land [5]. To avoid this, a relationship between large agricultural enterprises and small-scale farms must be enabled so that both farming types can stay in fair market competition [58]. This means that LSLA can be, to some extent, good for the local population [59].

“Food security” was used as a keyword in 10 studies and “food sovereignty” was used in three studies. These keywords are directly linked with the keyword “land grabbing”. The Food and Agriculture Organization of the United Nations (FAO) defines food security as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” [60]. Movement toward global food security is strongly related to agriculture, as most of the poor depend on agriculture and related activities for a significant part of their livelihoods. Food security is compromised by “land

grabbing” and “land concentration”. Local food security and food sovereignty, especially in developing countries, can be undermined by the export of agricultural products [61]. Moreover, the outbreak of COVID-19 and the restrictions that followed it have shown us that it is imperative that countries have their own food supply [62,63]. This means that relying only on food imports from other countries can threaten a country’s food security. It has also been noted that several mechanisms accompanying LSLA may contribute to the emergence of zoonotic diseases [64].

Table 1. Keyword occurrences in the examined studies.

Keyword	Occurrences
Land grabbing	85
Land concentration	12
Food security	10
Large-scale land acquisitions	8
Biofuels	6
Global governance	5
Land tenure	5
International law	4
Human rights	4
Agriculture	4
Capitalism	4
Financialization	4
Land-grabbing	4
Agricultural investment	3
Governance	3
Globalization	3
Land	3
Property rights	3
Food sovereignty	3
Land fragmentation	3

“Large-scale land acquisitions” occurred as a keyword in eight studies (Table 1) and is linked with eight keywords (“land grabbing”, “land tenure”, “governance”, “globalization”, “agricultural investment”, “global governance”, “property rights”, and “international law”) (Figure 4). In general, terms like “land grabbing”, “land concentration”, and “large-scale land acquisition” are used to mark the takeover of large land areas; nevertheless, these terms are not synonymous. LSLAs have been promoted as a mechanism to support rural development through the increased input of financial capital, job creation, agricultural technology transfers, and gains in agricultural productivity [65]. However, these developments may come at the expense of reducing water access for local farmers and their future ability to irrigate [65,66].

LSLAs have been widely reported during the last two decades across Africa, Asia, Latin America, and even Eastern Europe. The Land Matrix reported that, since 2019, EU-based companies have been engaged in 909 land deals globally, involving a total of 29 million hectares of land [34]. The results of research by Burja et al. [46] showed that land concentration and land grabbing pose a serious threat to the sustainable development of agricultural holdings and rural areas due to their inimical social effects.

“Biofuels” was used as a keyword in six studies, and it is linked with six other keywords (“land”, “governance”, “financialization”, “land-grabbing”, “land grabbing”, and “food security”). Biofuel production may harm food security [67]. Its production influences the food supply by increasing greenhouse gas emissions and food prices [67]. As the EU biofuel directive requires that 10% of all transport fuel should come from biofuel by 2050, its production has tripled in the last decade [61]. This directive does not help relieve hunger and may increase both the rate of land grabbing and food prices [61,67].

“Global governance” was used as a keyword in five studies, and it is linked with five other keywords (“land grabbing”, “agricultural investment”, “large-scale land acquisitions”, “human rights”, and “globalization”). Global governance as an academic notion arose in the 1990s in response to new global-scale problems (HIV, climate change, international migration, etc.). As land grabbing and land concentration is a global-scale phenomenon that is taking place in all regions and parts of the world, and has become a matter of public concern, it has provided the political sense of urgency to move forward on global land governance [68,69]. There has been criticism of the lack of a binding and consistent regulatory regime for LSLA [47].

Growing concentration has shaped governmental agricultural policies, including the different modalities of the CAP subsidy scheme, which has favored long time large-scale holdings, marginalized small-scale farms, and blocked the entry of possible future farmers [5]. The voluntary nature of different regulatory instruments is seen as being weak for protecting against human rights violations caused by LSLA and poor for facilitating sustainable development [47].

“Land tenure” was used as a keyword in five studies, and it is linked with the keywords “land concentration”, “land grabbing”, and “large-scale land acquisitions”. There is no international definition of land within the context of tenure [70]. The meaning of the word may be defined within the national context. This keyword mostly arose in studies where FAO’s voluntary guidelines on the responsible governance of tenure of land, fisheries, and forests in the context of national food security (VGGT) were discussed. For instance, Margulis et al. [68] wrote that the VGGT are the most concrete element of emergent global governance related to LSLA. Their overarching goals are to achieve food security for all and support the progressive realization of the right to adequate food in the context of national food security [70].

“International law”, “human rights”, “agriculture”, “capitalism”, “financialization”, and “land-grabbing” were used as keywords in four studies. All these keywords are linked with “land grabbing” or “land-grabbing”. In particular, “human rights” as a keyword is linked with “international law”, “land grabbing”, “food security”, and “global governance”. Throughout the world, human rights are pivotal in human development [71]. Secure tenure is an internationally recognized human right, and this right includes the human right to livelihood and land [72]. In the past few decades, several countries have adopted forceful land reforms to deal with poverty, equity, restitution for past expropriation, investment, and innovation in agriculture or sustainability [73]. For example, Scotland’s unusually concentrated pattern of land ownership is a matter of longstanding concern. In Scotland, 432 families (0.008% of the population) own 50% of the private rural land, and if only a small fraction of society owns the land, inequality will rise [74]. Scotland has made some progress on land reform, and the Scottish government, in consultation with a wide range of stakeholders and experts, is in the progress of specifying the maximum amount of land that any individual is permitted to hold. Nevertheless, this kind of land reform is complex and has already left behind exhausted communities and enriched landowners [74]. This means that it might be better for society to control land concentration before it reaches an extent (as has happened in Scotland) where there is a need for complex land reform.

“International law” as a keyword is linked with “capitalism”, “land grabbing”, “land-grabbing”, “human rights”, “property rights”, and “large-scale land acquisitions”. “Agriculture” as a keyword is linked with “land fragmentation”, “land grabbing”, and “food security”. “Capitalism” is linked with “land grabbing”, “land-grabbing”, and “international

law". "Financialization" is linked with "biofuels" and "land grabbing". "Land-grabbing" is linked with "biofuels", "capitalism", and "international law". "Agricultural investment", "governance", "globalization", "land", "property rights", "food sovereignty", and "land fragmentation" were used as keywords in three studies, and keywords that had linkages with them are aforementioned.

5. Conclusions

As the COVID-19 pandemic closed the world, and Russia invaded Ukraine at the beginning of 2022, domestic agricultural production to ensure short supply chains began to look more and more essential. Closed borders between countries, disrupted global food supply chains, and restricted movement inside countries showed that it is essential to keep food production as close to the consumers as possible from the viewpoint of food security.

As land concentration remains basic and is one of the most serious land issues today, the aim of this paper was to compile a systematic literature analysis literature on land grabbing and concentration. To fulfil this task, different documents and articles were first studied (Section 3.1), and, in Section 3.2, literature from the SCOPUS database was analyzed. In Section 3.1, the phenomenon of Europe's LSLA was described. It was found that the agricultural sector needs to change to reach the goals set out in the European Green Deal and SDGs. The trend in today's EU agricultural sector is characterized by a declining number of agricultural producers and an increasing size of farms. An increase in the area of agricultural land farmed by large agricultural producers raises concerns that agricultural development may not be favoring small-scale farming. Increase in the number of agricultural producers is coming at the expense of small farms. Although different studies have sought to determine which farming model is most suitable for the environment and will ensure future food security, there is no single answer to this question.

For Section 3.2, VOSviewer was used to visualize 20 keywords. Results showed that the majority (85 + 4) of the examined studies from the literature included the keywords "land grabbing" or "land-grabbing", which were linked with the other 19 keywords. The term "land grabbing" started to emerge strongly in the literature after 2016, but before that, the term "land concentration" was primarily used in these studies. The study also showed that the number of publications written on LSLA has increased over the years.

The land is a fundamental element for our existence, and, because of that, it is difficult to overstate its strategic importance to our wellbeing and prosperity. The ownership of land can make it available for community and business development, or keep it in the hands of a small number of large agricultural users. Investments in small agricultural producers remains one of the most direct ways to address food security and rural poverty. This study shows that LSLAs are closely related to food security, human rights, global governance and international law, land tenure, biofuel production, and financialization through EU CAP subsidies and foreign direct investments. This means that land distribution is one important component that guarantees our right to food, human rights, and sustainability in agriculture and other related areas. Equitable agricultural land distribution should ensure, in addition to food supply, a range of ecosystem services at prices that sustain a living income for producers of food.

As the topic of LSLA is broad, and different countries in various ways are involved, this topic needs successive studies. One way for developing the study further is by investigating the LSLA phenomenon in different countries and highlighting good practices in the discussed topic.

Author Contributions: Conceptualization, E.J. and M.R.; methodology, M.R.; software, M.R.; validation, M.R., E.J.; formal analysis, M.R.; investigation, M.R.; writing—original draft preparation, M.R.; writing—review and editing, E.J.; visualization, M.R.; supervision, E.J. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the European Union, European Regional Development Fund (Estonian University of Life Sciences ASTRA project „Value-chain based bio-economy“. Funding number: 2014-2020.4.01.16-0036).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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Rasva, M., Jürgenson, E. (2022). Agricultural Land Concentration in Estonia and Its Containment Possibilities. *Land*, 11 (2270), 1–15. DOI: 10.3390/land11122270.

Article

Agricultural Land Concentration in Estonia and Its Containment Possibilities

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Abstract: Land is essential to livelihoods, so it is hard to overstate its strategic significance for well-being and prosperity. It has been detected that farm size greatly influences agricultural sustainability from the viewpoints of the economy, environment, and society. Land concentration is negatively affecting the development of rural communities. Similar to other European countries, Estonia is undergoing agricultural land concentration. One way to stop the further concentration of agricultural land is to set an upper limit to land acquisition (similar to that in Latvia and Lithuania). This paper aimed to determine what kind of regulations concerning agricultural land use and ownership Estonia needs to restrain land concentration. Four sources of data were used for this research: statistical data from Statistics Estonia, the data for the land holdings of agricultural producers from the Estonian Agricultural Registers and Information Board, data from the Land Registry and available literature. The outcome of the study confirmed that Estonia requires policy direction and regulations for the agricultural land market, that would help to lighten the impact of land concentration in rural areas in the long run, similar to several other European countries.

Keywords: land concentration; sustainable land management; policy directions; acquisition of agricultural land



Citation: Rasva, M.; Jürgenson, E. Agricultural Land Concentration in Estonia and Its Containment Possibilities. *Land* **2022**, *11*, 2270. <https://doi.org/10.3390/land11122270>

Academic Editors: Kleomenis Kalogeropoulos, Andreas Tsatsaris, Nikolaos Stathopoulos, Demetrios E. Tssemelis, Nilanchal Patel and Xiao Huang

Received: 18 November 2022
Accepted: 9 December 2022
Published: 12 December 2022

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1. Introduction

Land is fundamental to prosperity and well-being and, due to this, it is hard to overstate its strategic importance for existence. Large-scale land acquisitions transform land use and food systems in targeted districts worldwide [1–6]. The outcome of these large-scale land acquisitions is that agricultural land becomes concentrated. It has been found that large-scale land purchases are causing socio-economic destruction. [7–11].

Agricultural land concentration is a topic of discussion in different countries, but particularly current in post-Soviet countries. Land concentration is an activity by which large agricultural concerns increasingly buy, or lease, land from other agricultural producers [12–15]. Supporting small farmers remains essential for food security and to combat rural poverty. This phenomenon has affected countries like Slovakia [16], Hungary [5], Romania [17], Poland [18] and many other countries. These countries all experienced major land reforms after the Soviet Union collapsed. In the process of land reform, a lot of land came onto the market and it was possible for buyers to purchase as much land as they wanted. The prices of land are still low in these countries, compared with other European Union countries.

The process of agricultural land concentration started decades ago but has recently accelerated. It has been detected that farm size greatly influences agricultural sustainability in economic, environmental, and social aspects [19]. Small agricultural producers are vanishing rapidly, and places of employment in rural areas are decreasing [20–24]. The rural living situation is worsened by job losses, poor social infrastructure, and the fact the younger generation is moving away from rural areas. The process of land concentration is

generally not reversible [25,26]. Land concentration is negatively affecting the development of rural communities. Small agricultural producers are vital for rural communities as they conserve rural cultural heritage and rural life. They enliven rural social life, produce valuable products, use natural resources sustainably and assure a range of landowners in rural regions [25,27–29]. Sustainable land use that ensures a fair and balanced distribution of land, water, biodiversity and other environmental resources between various competing claims, is necessary to secure human needs now and in the future [30].

Division of land ownership to cover a wide range is the foundation of the social market economy and social cohesion [31]. It also ensures job creation in rural areas, adds significant value to agricultural production, and is essential for ensuring peace in society. The future of the agricultural sector depends on a new generation of farmers. The will to innovate and invest in young people is vital for rural areas. The ageing of the agricultural sector can be stopped, and the continuity of rural life can be secured through this.

Estonia has undergone, over its history, considerable structural changes, affecting its agriculture. Through various streaks of occupation and simultaneous reforms, Estonia became independent in 1991 and launched the most recent, still incomplete, land reform. The laws of land reform, and agricultural reform, are inclined towards agriculture based on small farms. In the early years of the reforms, between 1993 and 2001, the number of farms in Estonia grew, and many small farms were involved [32]. However, over the period of 2001–2020, the number of small farms decreased and is continuing its downward trend.

Agricultural development is not favouring small-scale farming. The only choice for small- and medium-sized farms is to grow or go. If farms are not able to grow in size and acquire more land (move to larger sized farming groups), they are not able to survive. Larger and more competitive agricultural producers push small farmers out of business, and agricultural land becomes even further concentrated. Small farms struggle to survive in the existing market situation, where large producers have a clear advantage. Thus, the State should step in and regulate the agricultural land market so that small, medium and large producers can coexist and operate under similar conditions.

The agricultural land market cannot be regulated only by means of market principles because land genesis does not respond to prices in the same way as regular goods [33]. Several EU countries have laws with various objectives, from preserving agricultural land for agricultural use to curbing land concentration. Since 2013, Hungary, Slovakia, Latvia, Lithuania, Bulgaria, Romania and Poland have sanctioned land laws targeting unwanted developments in their land markets [34].

Agricultural land concentration can be a threat to soil use as well. Previous studies have shown that environmental damage from large-scale agricultural production includes the destruction of soil fertility, contamination of water sources, loss of biodiversity, and draining of wetlands [35,36]. Large-scale agricultural producers, whose primary purpose may be to earn as much profit as possible, might be the outcome of further agricultural land concentration. The cost of this kind of behaviour may result in severe and irreversible environmental damage and harm to the soil [17,35]. Industrialised agricultural producers are mainly interested in greater yields, which means soils are often harmed through more intensive agriculture. Healthy soils are vital to reverse biodiversity destruction, assure healthy food and guarantee everyday well-being. The European Union (EU) soil strategy for 2030 has a vision and objectives to achieve healthy soils by 2050 [37]. The EU soil strategy for 2030 supports the goals of the European Green Deal.

Besides the intensive use of agricultural land, there are several other environmental issues. One is the soil sealing that can happen through land use changes. Agricultural areas are replaced with development areas in the ongoing urban sprawl [38,39]. The consequences of this kind of land use change may be that agricultural land use becomes more complicated, as agricultural activities can disturb nearby land owners and users [40,41]. This situation emerges when there are no buffers between expanded urban areas and rural areas, or when people who are not farming move to rural areas [42]. Eventually, only a small number of agricultural producers survive near cities [43].

Agricultural land fragmentation is also not environmentally friendly, as farming is more expensive than it would be with compact land use. Extensive driving to get from one field to another field results in increased pollution [44–48]. Agricultural activity is complex and involves different aspects. Although land use changes and fragmentation are important topics it is not feasible to handle all the involved issues in one paper. Therefore, this study focused on agricultural land concentration and opportunities for restraining land concentration in Estonia. Similar to many other European countries, Estonia requires policy direction and regulations for the agricultural land market so as to relieve the influence of land concentration in rural areas for extended periods. This paper aimed to determine the kind of regulations, concerning agricultural land use and ownership, that Estonia needs to curb land concentration.

2. Materials and Methods

Four types of data sources were required for this research. Statistics Estonia was the resource for statistical data. The data on agricultural producers' land holdings were obtained from the Estonian Agricultural Registers and Information Board (ARIB). Land Registry data was used to analyse changes in land ownership of the 49 largest agricultural producers, according to 2020 ARIB data. Books, scientific papers, reports, acts of law, regulations and documents were researched.

Data from Statistics Estonia (PMS416, PMS422) was used to analyse changes in Estonian agricultural land use, including data on the number of agricultural households and agricultural land use area. This data was for the years 2001, 2003, 2005, 2007, 2010, 2013, 2016 and 2020.

To obtain an overview of changes in Estonian agricultural land users' land holdings, ARIB data for agricultural land area and number of farms in 2011 and 2020 were dissected. GIS software ArcGIS (version 10.4) was applied to summarise land users and land area per farm. Farms were divided into six groups according to the size of their land holdings: 0–<2 ha, 2–<40 ha, 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 ha. This division (into six groups) was based on the method of the Farm Accountancy Data Network (FADN), in which agricultural land area is separated into four size groups (0–<40 ha, 40–<100 ha, 100–<400 ha, >400 ha). To obtain a better understanding of the smallest farmers, we divided the FADN size group 0–<40 ha into size groups of 0–<2 ha and 2–<40 ha. We divided FADN size group >400 ha into size groups of 400–<1000 and >1000 ha to define the largest agricultural producers. This means that two FADN size groups were changed for this study. Figure 1 presents the study area and its position in Europe.

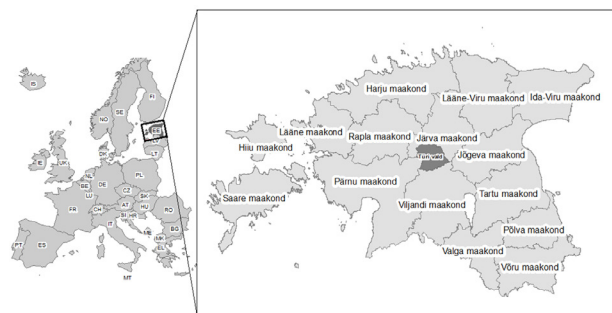


Figure 1. Position of Estonia (study area) in Europe.

Land Registry data were used to get an overview of land ownership changes among 49 land users. Land Registry data covered the years 2001, 2016 and 2021. In order to acquire data from the Land Registry, ARIB 2020 data was used to ascertain the 49 largest producers. After searching the ARIB 2020 data, an inquiry was sent to the Land Registry concerning the 49 largest agricultural producers.

The farmed land areas of the 49 largest agricultural land users were studied to compare land ownership and changes in land use area. Unfortunately, the earliest records from the ARIB concerning land use were only available from the year 2003. ARIB data from 2003, 2016 and 2021 were used to compare land ownership with land use in this study. Farms were grouped into six clusters according to the size of their land holdings: 0 ha, less than 100 ha, 101–200 ha, 201–400 ha, 401–1000 ha and more than 1000 ha. Data was applied based on these group sizes.

Available books, scientific papers, reports, acts of law, regulations and documents were studied to determine the restrictions EU countries have implemented to protect their agricultural land against concentration. Firstly, information from reports and scientific articles was used to find countries where such restrictions are implemented. Secondly, some legal acts (that were available online and in English) from these countries were studied to determine the exact regulations. Figure 2 illustrates the countries' division in the study regarding restrictions on agricultural land acquisitions.

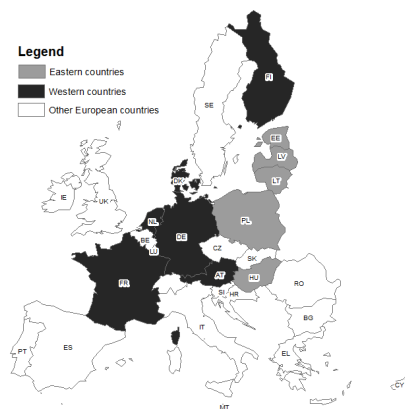


Figure 2. Division of the countries included in the study regarding restrictions on agricultural land acquisitions.

EU countries that were included in the study were divided into two groups. The first group included countries from the western part of the EU (Germany, The Netherlands, Denmark, France, Austria and Finland). The second group included post-Soviet EU countries (Estonia, Hungary, Poland, Latvia and Lithuania).

3. Results

3.1. Agricultural Land Use Changes in Estonia

The number of agricultural households has diminished year-to-year (Figure 3). In 2020, there were 11,369 farms in Estonia, a considerable decrease from that in 2001 when there were 55,748 farms in Estonia. Meanwhile, the agricultural land area has stayed nearly the same. The utilised agricultural land area was 871,213 ha and 975,323 ha in Estonia in 2001 and 2020, respectively (Figure 3).

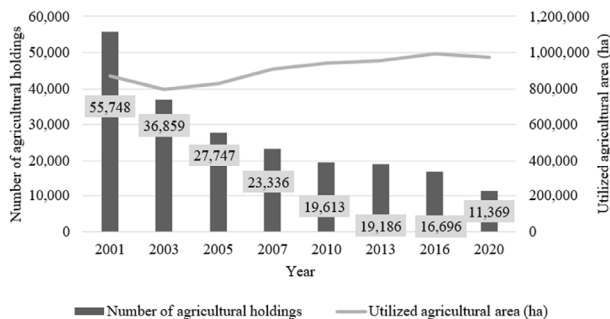


Figure 3. The number of farms and area of agricultural land in Estonia between 2001 and 2020 (Statistics Estonia).

The average land use per farm in Estonia has grown due to the decrease in the number of farms and the almost consistent farming area (Figure 4). In 2001, the area of agricultural land use per farm was 16 ha. It had grown to 86 ha by 2020. The average agricultural land use area per farm grew from 2 to 26 ha per year.

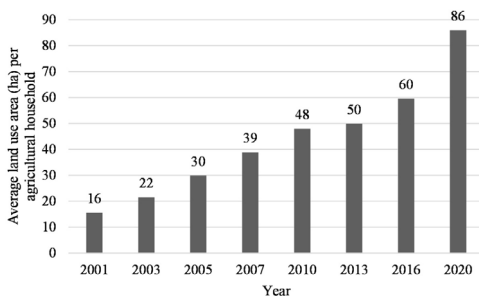


Figure 4. Average utilised land per farm in Estonia between 2001 and 2020 (Statistics Estonia).

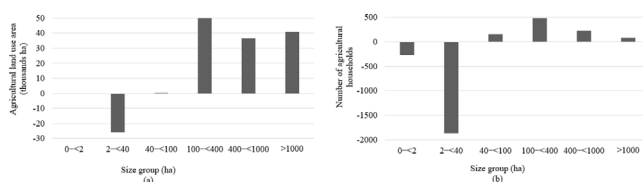
The number of farms in the three smallest land user groups (0–2 ha, 2–<40 ha and 40–<100 ha) diminished over the years 2011 to 2020. The number of farms in the three largest (100–<400 ha, 400–<1000 ha and >1000 ha) groups grew (Table 1).

An analysis of farmers, according to the six farm size groups showed that between 2011 and 2020, area farmed by land users in the size groups 100–<400 ha and >1000 ha increased the most. Meanwhile, the area farmed by land users in the size groups 0–<2 ha and 2–<40 ha diminished. The agricultural land area used by size group 40–<100 ha stayed almost similar for the period considered.

Table 1. Data for land user groups, according to the area of farms for the years 2011 and 2020 (ARIB).

Groups (ha)	2011			2020		
	Number	Area (ha)	Area (%)	Number	Area (ha)	Area (%)
<2	1475	2140	0	1211	1778	0
2–<40	11,654	132,888	15	9785	107,119	11
40–<100	1460	91,563	10	1615	91,578	9
100–<400	1174	225,708	26	1660	275,696	28
400–<1000	337	207,844	24	556	244,574	25
>1000	126	216,893	25	212	257,964	26
Total	16,226	877,036	100	15,039	978,711	100

There were 768 farmers in Estonia, with land holdings above 400 ha in 2020, who utilised 502,539 ha, or 51%, of the agricultural land. In 2011, 463 farmers with land holdings above 400 ha utilised 424,736 ha, or 48%, of the farmed area. The agricultural land area used by larger farms increased, while that used by smaller ones diminished (Figure 5a). The number of farms in size groups 0–<2 ha and 2–<40 ha diminished (Figure 5b).

**Figure 5.** (a) The difference in the area of agricultural land use, and (b) the difference in the number of farms in size groups between 2011 and 2020 (ARIB).

In 2011, 1475 farms in size group 0–<2 ha used 2139.72 ha of agricultural land. In size group 2–<40 ha, 11,654 farms used 132,888.41 ha. In 2020, there were 264 fewer farms in size group 0–<2 ha using 361.57 ha less land. In size group 2–<40 ha, there were 1869 fewer farms, using 25,769.19 ha less land than in 2011.

Farms in size groups 40–<100 ha, 100–<400 ha, 400–<1000 ha and >1000 ha increased in number. In 2011 in size group 400–<1000 ha, 337 farms used 207,843.80 ha of farmed land. In size group >1000 ha, 126 farms used 216,892.61 ha. By 2020, there were 219 more farms in size group 400–<1000 ha and 86 more in size group >1000 ha. The farmed area increased by 36,730.39 ha in size group 400–<1000 ha and by 41,071.78 ha in size group >1000 ha.

In 2020, there were 275 legal persons and 936 self-employed in size group 0–<2 ha (Figure 6). In size group 2–<40 ha there were 4203 legal persons and 5582 self-employed. The self-employed formed the majority in these two size groups. There were no self-employed in size groups 400–<1000 ha and >1000 ha. In size group 400–<1000 ha, there were 556 legal persons, and 212 in size group >1000 ha.

The number of farms in size group 0–<2 ha formed 8.1% of the total number of farms in Estonia (Figure 7a), utilising 0.2% of the total land area (Figure 7b) in 2020. The number of farms in size group 2–<40 ha accounted for 65.1% of all Estonian land users, using 10.9% of all agricultural land areas.



Figure 6. Percentage of legal entities and self-employed in size groups in 2020 (ARIB).

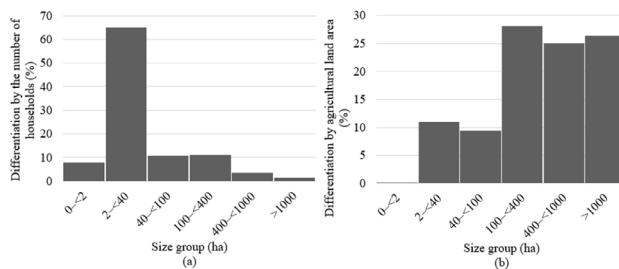


Figure 7. (a) Distribution of size groups by the number of farms, and (b) differentiation of size groups by agricultural land area in 2020 (ARIB).

Simultaneously, the number of farms in size group 400–<1000 ha accounted for 3.7% of the whole number, utilising 25% of all agricultural land in Estonia. The number of farms in size group >1000 ha accounted for 1.4% of the whole, utilising 26.4% of all used agricultural land in Estonia.

3.2. Agricultural Landownership Changes in Estonia in 2001–2021

The area of properties owned by the 47 largest farms increased between 2001 and 2021. Two producers’ land ownership area decreased in the same period but increased between 2001 and 2016. One producer owned 96.04 ha of land in 2001, and 2164.94 ha in 2016. The second producer owned 76.01 ha of land in 2001, and 1116.18 ha in 2016.

In 2001, 41 producers had no land ownership or owned fewer than 100 ha of land (Figure 8 and Table 2). In 2021, all producers were landowners and only four owned less than 100 ha of land. In 2001, 20 producers owned fewer than 100 ha of land, and their average landownership area was 38 ha. In 2021, it was 53 ha.

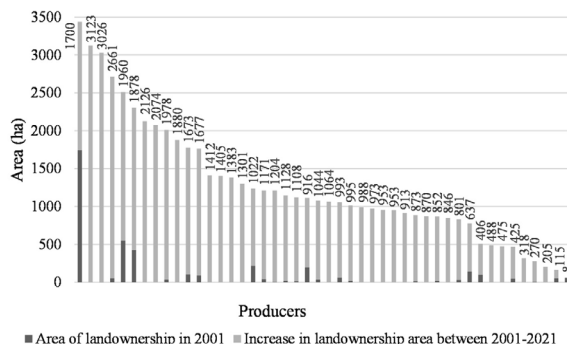


Figure 8. Area of landownership (Land Registry) of 47 agricultural producers in 2001 and 2021 (Land Registry).

Table 2. Changes in the 49 largest producers’ landownership area (Land Registry) between 2001 and 2021 (Land Registry).

Groups (ha)	2001		2021	
	Number	Average Area (ha)	Number	Average Area (ha)
0	21	0	0	0
<100	20	38	4	53
101–200	4	136	1	164
201–400	1	215	3	267
401–1000	2	488	15	787
>1000	1	1741	26	1750
Total	49	2618	49	3021

The larger sized groups grew over the years (Table 2). In 2001, there were two farms in size group 401–1000 ha, and their average landownership area was 488 ha. In 2021, there were 15 producers in this size group, and their average landownership area was 787 ha. Massive changes occurred in size group >1000 ha. In 2001, one producer owned 1741 ha. In 2021, there were 26 producers with landownership larger than 1000 ha, and their average landownership area was 1750 ha.

The average landownership area of these 49 producers was 86.48 ha in 2001. In 2016, this area was 1135.80 ha, and in 2021, it was 1193.62 ha. The average landownership area of the 49 largest producers grew by an average of 1107.17 ha between 2001 and 2021. The most enormous land ownership area was 1700.14 ha, and the smallest was five hectares (Figure 8). The average growth area was 1280.96 ha. Sixteen producers’ landownership area grew by more than the average. Ten producers’ landownership area grew by more than 100,000%, and the most significant growth was 312,347%.

Analysing the changes in the 49 largest producers’ land use area by dividing them into size groups, it was found that the number of farms in the largest size group grew between 2003 and 2021 (Table 3). Most of the producers grew in size and moved into size group >1000 ha. In 2001, there were 40 farms in size group >1000 ha, five farms in size group 401–1000 ha, two producers in size group 201–400 ha, and in size groups 101–200 ha and

<100 ha, there was one producer. In 2021, there was one producer in size group 401–1000 ha and 48 in size group >1000 ha.

Table 3. Changes in the 49 largest producers' land use area between 2003–2021 (ARIB) and proportion of their landownership (2001–2021) area (Land Registry) to land use area (ARIB).

Groups (ha)	2003		Proportion of 2001 Land Ownership Area to 2003 Land Use Area (%)	2021		Proportion of 2021 Land Ownership Area to 2021 Land Use Area (%)
	Number	Average Area (ha)		Number	Average Area (ha)	
0	0	0	0	0	0	0
<100	1	58.51	0	0	0	0
101–200	1	145.54	0	0	0	0
201–400	2	283.48	25	0	0	0
401–1000	5	764.08	0	1	847.44	103
>1000	40	3040.48	3	48	2538.01	47

Producers in size group 201–400 ha utilised the largest share (25%) of owned land in 2001. In 2021, there were no producers in size groups smaller than 401–1000 ha. All these producers had moved into larger size groups. In size group 401–1000 ha, producers had almost no owned land in 2001. In 2021, the share of owned land in this size group had grown to 103% of the total land use. Farms in size group >1000 ha owned 3% of the utilised land area in 2001. In 2021, the share of owned land in this size group was 47% of the utilised land area.

Comparing the increase in land ownership area between 2001–2021 (Land Registry) to the changes taking place in utilised land area (owned land and rented land, from ARIB) of the 49 largest land users, it was found that many producers' land use area had decreased, while the area of land ownership had increased (Figure 9).

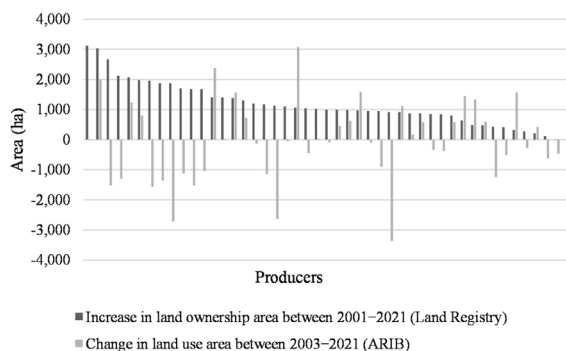


Figure 9. Increase in landownership area between 2001–2021 (Land Registry) and change in land use area between 2003–2021 (ARIB).

In 2001, the average share of landownership area from the utilised land area (2003) was 1.02%. In 2016, the average share of landownership area from utilised land area was 46%, and in 2021 it was 47%. Consequently, the share of owned land increased in the case of the largest land users.

3.3. Restrictions to Agricultural Land Purchase in European Union

The agricultural land market is subject to different regulations in the countries of the world. The importance of a well-functioning agricultural land market is difficult to over-emphasise.

Restrictions on the acquisition of agricultural land vary in different EU countries. The member states decide on adopting and implementing agricultural land market regulations, as certain land market regulations are missing at the EU level. However, EU treaties disallow restrictions on the movement of capital [49].

In Germany, the legislation concerning the ownership of agricultural land favours people engaged in farming. The approach aims to protect agricultural land from being turned into development areas, to protect nature and the environment, and to assure food security [50]. There is a permit obligation before any agricultural land transaction. Local municipalities also possess a pre-emptive right to purchase agricultural land, and the magistrate can appoint inheritable agricultural land to one particular heir in the case of inheritance. In Germany, there is also a minimum area of agricultural land that is subject to permit obligation.

In the Netherlands and Finland, there are no restrictions on acquiring agricultural land based on the buyer's legal form or citizenship [49]. However, there is a permit obligation in Finland for persons from certain third countries. In Denmark, there are no longer any specific restrictions on acquiring agricultural land.

There is a need to apply for a specific permit if persons from third countries wish to acquire land in France. An obligation has to be approved by *Sociétés d'Aménagement Foncier et d'Établissement Rural* to purchase agricultural land [49]. In Austria, there is also an obligation for approval from the *Grundverkehrskommission*. However, in Austria, there are exceptions to this rule.

In Hungary, there is an obligation to qualify as a farmer to purchase more than one hectare of agricultural land [49]. To qualify as a farmer, a person has to be a citizen of Hungary or another EU country [51]. A person who does not have the qualification mentioned earlier must first be able to prove that they have been engaged in agriculture for at least the previous three years. Secondly, this person must prove that they received an income from agriculture over the previous three years.

In Hungary, there is a restriction on third persons using acquired agricultural land. The owner must use this land only for agricultural purposes for at least five years from the purchase [49]. The agricultural land area that one person can purchase in Hungary is limited to 300 ha [20], and a maximum of 1200 ha of agricultural land can be in the ownership of one farmer [49,52]. Corporations have no right to own land in Hungary, but there are exceptions to this rule. It is not easy for a third-world person to obtain a farmer's qualification in Hungary.

In Poland, there is an obligation for a person from Poland or the EU to qualify as a private farmer when purchasing agricultural land. A private farmer is a subject who owns or uses a maximum of 300 ha of agricultural land and is registered to live in the local municipality [49]. Purchasable agricultural land and already-owned land cannot exceed 300 hectares in Poland; although exceptions exist to this rule [49,53]. Persons not qualified as private farmers must acquire approval from the National Support Centre for Agriculture to purchase agricultural land in Poland.

A person from Latvia or another EU country must be registered to conduct business there to acquire agricultural land in Latvia. A self-employed person must confirm in writing that they will start agricultural activity there within one year of purchasing the land [49]. From 2017, a person cannot acquire more than 2000 hectares of land, and related persons cannot acquire more than a further 4000 hectares of land [49,54]. A corporate body must also prove that agricultural activities will commence on the purchased land and indicate the actual profit recipients. Persons from third countries are not permitted to purchase land in Latvia; although exceptions exist.

In Lithuania, there are also restrictions on how much agricultural land can be acquired and by whom. Similar to restrictions in Latvia, these are important to prevent further agricultural land concentration [20]. In Lithuania, in the case of agricultural land purchase, it is mandatory to prove that the person will use the land only for agricultural purposes for at least the next five years [49]. A person cannot own more than 500 hectares of total agricultural land in Lithuania [55]. Persons from third countries cannot acquire land in Lithuania.

Estonia has no specific restrictions on acquiring agricultural land for citizens of Estonia or the EU [56]. Corporate bodies from EU countries must be involved in agriculture in the EU for at least three years prior to purchasing land in Estonia that exceeds 10 ha. Corporate bodies must also be involved in agriculture to purchase agricultural land, and its affiliate has to be registered in Estonia. Persons from third countries have the right to purchase agricultural land in Estonia only with permission from the local government and provided the person has lived in Estonia for at least six months [56].

4. Discussion

A growing population and an aim to decarbonise the economy mean that agricultural land is in demand for a broader range of uses than ever before [57–59]. Agricultural land is a unique asset exposed to pressure from non-agricultural uses, increasing demand for food, energy and biomass. Agriculture is a significant source of greenhouse gases, and as the world's greenhouse gas levels continue to heighten, climate change is appearing much quicker than foreseen [60,61]. There is a need for productive, yet sustainable, agriculture to ensure future food security for the world's increasing population [32,62]. The European Green Deal and Sustainable Development Goals set some of the goals needed to move towards sustainability [12,39,63,64]. Land is a finite resource, and more cannot be produced. Growth in farm size is connected with a statistically significant decrease in fertilizer and pesticide use per hectare, showing clear gains for environmental conservation [19]. Small agricultural producers are the core of European agriculture, and increasing concentration makes it harder for family farmers to access land.

The phenomenon of land concentration in the EU and many parts of the world is one of the most severe land matters. This phenomenon started to emerge decades ago and has recently accelerated. The ongoing agricultural land concentration affects Europe's small farms and hinterlands. Some EU countries have taken steps to prevent and reverse agricultural land concentration. For example, Hungary, Poland, Latvia, and Lithuania have adopted regulations against excessive land concentration and other undesirable patterns in their land markets.

Utilised agricultural land area in Estonia has remained almost the same over 20 years (871,213 to 975,323 ha) or grown a little. The number of farms diminished by almost five times (from 55,748 to 11,369) within 20 years, while the area of agricultural land use per farm grew five times (from 16 ha to 86 ha). While average land use per farm in Estonia has grown, the agricultural land in Estonia has become progressively concentrated in legal entities' hands.

The whole number of farms in Estonia has diminished, and farms that have shut down their activities are primarily in size groups 0–<2 ha (–264 producers) and 2–<40 ha (–1869 producers). The most extensive increase in the number of farms between 2011 and 2020 appeared in the size group 100–<400 ha (486 producers).

Most of the self-employed were farming in size groups 0–<2 ha (77%) and 2–<40 ha (57%) in 2020. Legal entities dominated in size groups over 40 ha. Some self-employed farmed in size group 40–<100 ha (4%) and a few in 100–<400 ha (1%). Farmers in size groups over 400 ha (100%) were legal entities. The largest portion of agricultural land is concentrated in the usage of large corporate users in Estonia in Lääne-Viru and Järva counties [32,65], in which the most fertile soils in Estonia are located. Therefore, the largest concentration of agricultural land occurs in regions where soils are most fertile. This phenomenon has also been seen elsewhere in the world.

Agricultural development in Estonia is not favouring small-scale farming. Yet small agricultural producers are preferable for environmental sustainability, protection of traditional values and economic flexibility [23]. One reason for the decline of small-scale producers is that the CAP does not cater to the needs of small-scale farmers. Land users with enormous domains receive more significant subsidies, which means they can obtain more land. Secondly, large agricultural businesses are deluging markets with cheap food and agricultural products. A situation has been created wherein small-scale agricultural producers cannot compete in the marketplace.

It is indicated [66–70] that agricultural producers' holdings will grow in the future, with small farms disappearing. If small farms are not able to grow in size and acquire more land (move to larger sized groups), they will not be able to survive. Larger and more compatible agricultural producers will push them out of business, and agricultural land will become even further concentrated. Small farms struggle to survive in the existing market situation where large producers have a clear advantage. Thus, the State should step in and regulate the agricultural land market so that small, medium and large producers can coexist and operate under similar conditions.

The results of this paper indicate that the area of land ownership of large land users is growing alongside the increase in land use area. This conclusion was made by analysing the land ownership of the 49 largest land users. Further research on changes in landownership is needed to make firm conclusions. Nonetheless, this paper indicates that land ownership is concentrated beside land use, and this is a dangerous sign. Control over land is concentrated increasingly in the hands of a small number of large corporations, and there is a need to take action against this development in Estonia.

Like many other European countries, Estonia requires policy direction, strategy and regulations for handling the agricultural land market to relieve the impact of land concentration in remote areas in the long run [20]. Restrictions on acquiring agricultural land in Estonia are necessary to stop further concentration and reverse the current situation, where small and medium farms cannot compete with large corporate bodies. Small and medium farms require more support from the State. The State should also create conditions for newcomers entering the sector. Farmers have pointed out that they need support from the State to acquire agricultural land [71].

An upper limit should be set on how much agricultural land one person, or related persons, can own in Estonia to prevent further agricultural land concentration. To restrain agricultural land from ending up in the possession of large business with no relation to agriculture, a portfolio obligation to have a particular qualification for purchasing agricultural land is also necessary in Estonia. A prior right of purchasing agricultural land should be enacted to guarantee that newcomers and small farms can acquire the necessary land. The possibility of fair market competition for all farming types should be assured.

Before setting restrictions on obtaining agricultural land, there is also a need to create a clear structure of enterprises in Estonia to determine how much land one enterprise owns or rents. Without this, grounds for the circumvention of restrictions are possible.

5. Conclusions

Circumstances regarding agricultural land concentration are similar in Estonia to other post-socialist EU countries. The number of farms has dropped, and the agricultural land area per farm has increased. Surviving farms are growing in size. The size of agricultural holding plays an essential role in the environment, including in agricultural sustainability. Small farms are disappearing, although these producers are believed to contribute more to environmental sustainability, preservation of traditional values, and economic resilience than large ones.

The Estonian case study showed that agricultural land use concentration is happening along with land ownership concentration. A large area of land is already concentrated in the ownership of a small number of large farms. Restrictions on acquiring agricultural land

in Estonia are needed to restrain further concentration and reverse the current situation, where small and medium farms cannot compete with large corporate bodies.

There is a need to regulate how much agricultural land one person or related persons can own in Estonia. Agricultural land should be owned only by those who have a particular qualification. A prior right of purchasing agricultural land should be enacted to guarantee that newcomers and small farms can acquire the necessary land.

The direction of agricultural land use and ownership in Estonia is a topic for studies and disputes over relevant regulations, potential limitations for possession and the usage of pre-emptive rights. Measures concerning agricultural land concentration in Estonia should be implemented in an interplay between agricultural producers and the government to encourage green development. The balance between large agricultural producers and small farms in Estonia must ensure that both farming types remain in fair market competition. There is undoubtedly a need for transparency in the structure of enterprises in Estonia.

Author Contributions: Conceptualization, M.R. and E.J.; methodology, M.R. and E.J.; software, M.R.; validation, M.R. and E.J.; writing—original draft preparation, M.R.; writing—review and editing, E.J.; visualization, M.R.; supervision, E.J. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the European Union, European Regional Development Fund (Estonian University of Life Sciences ASTRA project “Value-chain based bio-economy”. Funding number: 2014-2020.4.01.16-0036) and “Public sector (Estonia)” project P210157MIMP (Governing land take and agricultural land use in Estonia and providing implementation of the European Green Deal).

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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CURRICULUM VITAE

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Education

2000-2009 Orissaare Gymnasium
2009-2012 Saaremaa Joint Gymnasium
2012- 2015 Estonian University of Life Sciences, BSc,
land management
2015-2017 Estonian University of Life Sciences, MSc,
land management and real estate planning
2018-2023 Estonian University of Life Sciences, PhD,
land management

Additional training

09.03.2018 EGÜ Spring conference 2018, 4 hours
05.03.2018-06.03.2018 MapInfo Pro 16 advanced training, 16 hours,
AS Reach-U
20.04.2018 Trainee as an adult learner, 8 hours, University
of Tartu
21.05.2018–30.05.2018 Statistics and data processing for beginners,
26 hours, Estonian University of Life Sciences
22.05.2018–29.05.2018 Development of competences in
communication and cooperation, 0,5 EAP,
Estonian University of Life Sciences
04.06.2018–13.06.2018 Mathematical statistics, statistical modelling, 1
EAP, Estonian University of Life Sciences
19.11.2018–16.12.2018 My e-course worthy of the quality mark

17.01.2022–19.01.2022	ArcGIS Pro: Essential Workflows, 24 hours, AlphaGIS
20.01.2022	Continuing education program From teacher to teacher 2022: what is the core of teaching at the university, 0,25 EAP, University of Tartu
14.04.2022	Land Transaction Data and Regular Valuation Webinar, 3 hours, Estonian Land Board
29.04.2022	Arable land webinar, 3 hours, Estonian Land Board

Professional employment

2016–2017	Estonian Land Board, Chief specialist
2018	Estonian University of Life Sciences, Institute of Forestry and Rural Engineering, Chair of Geomatics, Assistant
2018– present	Estonian University of Life Sciences, Institute of Forestry and Engineering, Chair of Forest and Land Management and Wood Processing Technologies, Assistant (0,50)

Field of research

Natural Sciences and Engineering, Geosciences (land management, land use, land use planning, land administration)

Participation in Research and Development Projects:

27.08.2018–26.08.2022	V180217MIGX „Public Value Capture of Increasing Property Values”, Evelin Jürgenson, Estonian University of Life Sciences, Institute of Forestry and Rural Engineering, Chair of Geomatics.
16.07.2020–30.10.2022	L200044MSMJ „Põllumajandusliku maakasutuse muutuse analüüs sõltuvalt tulevikustsenaariumitest”, Ants-Hannes Viira, Estonian University of Life Sciences.

1.01.2022–31.12.2023 P210157MIMP „Baasfinantseerimise toetus projekti „Euroopa Rohelise Kokkuleppe elluviimise tagamiseks maavõtu (land take) ja põllumajandusmaa kasutuse juhtimine Eestis” taotlusega seotud teadus- ja arendustegevuse toetamiseks”, Evelin Jürgenson, Estonian University of Life Sciences, Institute of Forestry and Engineering, Chair of Forest and Land Management and Wood Processing Technologies.

Dissertations supervised

Pille Toom, Master's degree, 2019, (sup.) Evelin Jürgenson; **Marii Rasva**, Elaborating a methodology for estimating road usage load based on the population register data, Estonian University of Life Sciences.

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Haridustee

2000-2009 Orissaare Gümnaasium
2009-2012 Saaremaa Ühisgümnaasium
2012-2015 Eesti Maaülikool, BSc, maakorraldus
2015-2017 Eesti Maaülikool, MSc, maakorraldus ja
kinnisvara planeerimine
2018-2023 Eesti Maaülikool, PhD, maakorraldus

Täiendõpe

09.03.2018 EGÜ Kevadseminar 2018, 4 tundi
05.03.2018-06.03.2018 Map Info Pro 16 edasijõudnute koolitus, 16
tundi, AS Reach-U
20.04.2018 Praktikant kui täiskasvanud õppija, 8 tundi,
Tartu Ülikool
21.05.2018–30.05.2018 Statistika ja andmetöötlus algajatele, 26 tundi,
Eesti Maaülikool
22.05.2018–29.05.2018 Suhtlemise ja koostöö alaste pädevuste
arendamine, 0,5 EAP, Eesti Maaülikool
04.06.2018–13.06.2018 Matemaatiline statistika, statistiline
modelleerimine, 1 EAP, Eesti Maaülikool
19.11.2018–16.12.2018 Minu e-kursus kvaliteedimärgi vääriliseks
17.01.2022–19.01.2022 ArcGIS Pro: Essential Workflows, 24 tundi,
AlphaGIS

20.01.2022	täiendusõppeprogramm Õppejõult õppejõule 2022: mis on ülikoolis õpetamise tuum, 0,25 EAP, Tartu Ülikool
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2018– present	Eesti Maaülikool, Metsanduse ja inseneeria instituut, Metsa- ja maakorralduse ning metsatööstuse õppetool, assistent

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Loodusteadused ja tehnika, Maateadused (maakorraldus, maakasutus ja selle planeerimine)

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27.08.2018–26.08.2022	V180217MIGX „Public Value Capture of Increasing Property Values”, Evelin Jürgenson, Estonian University of Life Sciences, Institute of Forestry and Rural Engineering, Chair of Geomatics.
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1.01.2022–31.12.2023	P210157MIMP „Baasfinantseerimise toetus projekti „Euroopa Rohelise Kokkuleppe elluviimise tagamiseks maavõtu (land take) ja põllumajandusmaa kasutuse juhtimine Eestis” taotlusega seotud teadus- ja arendustegevuse toetamiseks”, Evelin Jürgenson, Estonian University of Life Sciences, Institute of Forestry and Engineering, Chair of Forest and Land Management and Wood Processing Technologies.

Juhendatud väitekirjad

Pille Toom, magistrikraad, 2019, (juh.) Evelin Jürgenson; **Marii Rasva**, Rahvastikuregistri andmete alusel teede kasutuskooormuse määramise meetodika välja töötamine, Eesti Maaülikool.

LIST OF PUBLICATION

Publications indexed in the Thomson Reuters Web of Science database

Jürgenson, E., **Rasva, M.** (2020). The Changing Structure and Concentration of Agricultural Land Holdings in Estonia and Possible Threat for Rural Areas. *Land*, 9 (41), 1–15. DOI: 10.3390/land9020041.

Rasva, M., Jürgenson, E. (2022). Europe's Large-Scale Land Acquisitions and Bibliometric Analysis. *Agriculture*, 12 (6), 850. DOI: 10.3390/agriculture12060850.

Rasva, M., Jürgenson, E. (2022). Agricultural Land Concentration in Estonia and Its Containment Possibilities. *Land*, 11 (2270), 1–15. DOI: 10.3390/land11122270.

Publications in other peer-reviewed research journals and in proceedings

Arslan, F., Değirmenci, H., **Rasva, M.**, Jürgenson, E. (2019). Finding least fragmented holdings with factor analysis and a new methodology: a case study of kargılı land consolidation project from Turkey. *Agronomy Research*, 17 (3), 683–693. DOI: 10.15159/ar.19.052.

Rasva, M., Jürgenson, E. (2020). Changes of agricultural producers in Estonia according to the size of land use. *Agronomy Research*. DOI: 10.15159/AR.20.139.

Popular scientific publications

Rasva, M. 2022. Põllumajandusmaa koondumine võib jätta noored väiketalunikud maata. *Novaator*.

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10. veebruar 2023

ISSN 2382-7076

ISBN 978-9916-669-91-4 (trükkis)

ISBN 978-9916-669-92-1 (pdf)