

Influence of the legal regulation concerning reforestation

on the reforestation success

**(A case-study of Germany, Latvia, Lithuania, Poland,
Russia, Sweden and Ukraine)**



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Abstract

Nowadays, the question of improving the reforestation success increases in importance in most European countries, especially in those with a large share of privately owned forests. Legal regulations in such countries provide much more opportunities for decision-taking opportunities to the forest owner. The more decision taking opportunities are given directly to the forest owners – the higher is flexibility of the legal regulation in the certain country.

The aim of the research was to investigate the correlation between flexibility of the legal regulation concerning reforestation and reforestation success. The main criteria for selecting the research countries were similar conditions for the forest growth (dominating of the boreal, hemiboreal, nemoral coniferous and mixed broadleaved-coniferous forests). The legislation of the research countries (Germany, Latvia, Lithuania, Poland, Russia, Sweden and Ukraine) was collected and analyzed, discussed with the forestry and silviculture experts, politicians, scientists and private owners. For this research, the method of the flexibility evaluation was developed. It was based on ranking of the different criteria's that can influence the flexibility of legal regulation concerning reforestation. The flexibility of the legal regulation was estimated and compared between the above mentioned countries. The data concerning reforestation success (the percentage of satisfactory regenerated forest area) of the countries was collected from the annual forest inventories.

As the result, the correlation between flexibility of the legal regulation concerning reforestation and reforestation success was found, that proved the research hypothesis.

The analyses of the results gave the evidence that there are 3 main types of forestry legislation in European countries: with the strict regulations, with the limiting character and with result orienting. If the legal regulations are too flexible, then the government has to use the educational and economical tools to ensure a good reforestation success. But if the flexibility of legislation is too low, then the local site conditions and aims of the forest management have to be taken into consideration when developing the recommendations and regulations.

This research is important first of all as a comparison of the legal regulation in different countries with more or less similar forest growth conditions. The work proves that flexibility of legislation is one of the factors that can influence the regeneration success. The methods used in this research can be used for estimating other qualitative characteristics of the forests in different regions.

Keywords: reforestation, forest policy, flexibility of the legal regulation, reforestation success.

Реферат

Нині питання покращення успішності лісовідновлення стає дедалі важливішим у більшості країн Європи, особливо у країнах зі значною часткою приватних лісів, де надається більше можливостей для прийняття рішень безпосередньо лісовласникам. Чим більше таких можливостей надається лісовласникові, тим більшою є гнучкість нормативного регулювання у певній країні.

Завданням роботи було дослідити залежність між гнучкістю законодавства щодо лісовідновлення та успішності лісовідновлення. Головним критерієм для вибору досліджуваних країн була однорідність лісорослинних умов (домінування бореальних, напівбореальних, неморальних хвойних та мішаних листяно-хвойних лісів). Законодавство досліджуваних країн (Німеччина, Латвія, Литва, Польща, Росія, Швеція та Україна) було зібране та проаналізоване, обговорене з експертами лісового господарства, політиками, вченими та приватними лісовласниками. Для цього дослідження був розроблений метод оцінювання гнучкості нормативного регулювання. Він оснований на рангуванні різних критеріїв, які можуть в різній мірі впливати на гнучкість нормативного регулювання щодо лісовідновлення. Гнучкість нормативного регулювання була оцінена та порівняна між вищезгаданими країнами. Також були зібрані показники успішності лісовідновлення (процент задовільно відновлених лісокультурних площ) у досліджуваних країнах за даними щорічних статистичних звітностей.

У результаті було встановлено зв'язок між гнучкістю нормативного регулювання щодо лісовідновлення та успішністю лісовідновлення, що підтвердило робочу гіпотезу.

Аналіз результатів показав, що існує три основних типи лісового законодавства у країнах Європи: з чіткими регулюваннями, з обмежуючим характером регулювань та з орієнтацією на кінцевий результат. При високій гнучкості законодавчого регулювання урядові слід приділяти особливу увагу освітнім та економічним інструментам досягнення бажаної успішності лісовідновлення. Але при низькій гнучкості законодавства потрібно якнайточніше враховувати місцеві лісорослинні умови та мету ведення господарства.

Важливістю даного дослідження є перш за все порівняння нормативного регулювання у країнах з більш-менш однаковими лісорослинними умовами. Робота доводить, що гнучкість законодавства є одним з факторів, які впливають на якість лісовідновлення. Методи, описані та застосовані у даному дослідженні, можуть бути використані для оцінки інших якісних характеристик лісів різних регіонів.

Ключові слова: лісовідновлення, лісова політика, гнучкість нормативного регулювання, успішність лісовідновлення.

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1. Introduction

1.1. Forest regeneration and its influence upon silviculture

In recent decades sustainable forest management (SFM) has come to the forefront of forestry in each European country. As a result forest area is increasing in most countries, and the positive trends exceed the negative (*State of the World's Forests, 2007*). Activities connected with forest regeneration are a key factor in the expansion of forest area. The importance of reforestation and afforestation for achieving the goals of SFM cannot be overestimated, as stand establishment is a first step for the silviculture of any country, and of any orientation (economy, ecology or social) of the forest sector. In this way the good forest legislation, monitoring and control measures conducted by the state are equally important for ensuring good forest regeneration based on scientific researches and experience background.

There are 2 main ways of forest regeneration: afforestation and reforestation. To draw the boundaries around the main terms, definitions of these terms are given in the United Nations Food and Agriculture Organization (FAO) Global Forest Resources Assessment Program (2004):

- Afforestation is establishment of forest stands on land that, until then, was not classified as forest. It implies a transformation from non-forest to forest.
- Reforestation is establishment of forest stands on temporarily unstocked lands that are considered as forest. Nowadays many countries consider reforestation as: forest stand regeneration itself, supplementation of natural regeneration, care and protection of young stand.

In modern times recognition for the variety of forest functions (as well as forest regeneration functions) has become wider and wider. As exemplified by the Kyoto Protocol and Marrakech Accords of the United Nations Framework Convention on Climate Change (UNFCCC) which lists afforestation and reforestation activities among the possible ways for contributing to climate change mitigation (*MCPFE, 2007*).

1.2. Legal regulation and its influence on reforestation

Legal regulation in forestry includes complex measures with the aim to balance the regeneration of all the forest resources and other values of the forests required by civilization today and in the future. The necessary condition for successful realization of the regulations is the existence of the management system for forests and the forestry sector at the national and international levels (*Regulations of reforestation and afforestation, 2006*).

At the core of forest legislation in every European country there is a main law (code or act) regulating forestry affairs at the national level. The process of the lawmaking is permanent. Even the developed countries periodically make changes and corrections to the forestry legislation according to the tendencies of the development or the requirements of the international agreements. The majority of the former Union of Soviet Socialist Republics (USSR) countries during the last 10-15 years have made several (2-3) cardinal reforms of the forest legislation (*Popkov et al., 2002*).

Forest legislation is one of the main policy tools that can be used by governments to influence the forest sector. The main advantage of these tools is their obligatory character that makes them the easiest instrument for the government to effect the situation in a certain sector. If any changes in the priority list of the forest sector appear – government (usually with the help of parliament)

can develop the new (or adapt the existing) legal act considering the changes; and this regulation becomes mandatory for all forests in the region immediately.

The fundamental principles that were developed on the international or global level are always implemented through legal regulations at the state level. There are many examples of such regulations concerning reforestation and afforestation in Europe. For example, a lot of national forestry programs were developed, new institutions appeared, and changes were made in the Forestry laws and codes of the countries after UNCED 1992 in Rio de Janeiro (Earth Summit) (Maurer, 2008), Kyoto-Protocol 1997 and many other global agreements (MCPFE, 2007).

1.3. Quality of forest regeneration and flexibility of the legal regulation

There is no clear definition of the quality of forest regeneration. Each country has to develop its own rules and requirements of regeneration quality. However, the majority of European countries have the common understanding of this term. After analyzing the forest legislation and legal requirements of some countries the general trend is easily visible: the quality of forest regeneration is some level of plants quantity per hectare that a certain site has to fulfill at a certain time after the final felling was done. This time (as well as site classification) is different for each country*.

Forest legislation of different countries has a differing focus for the main principles of reforestation and different ways of quality control measurements. Some legal acts have more requirements, more strict regulations, more applications for the reforestation activities; but some countries provide more freedom for the forest managers in their activities with minimum amount of the requirements, restrictions and applications. Control measures provided by several countries are purely result oriented without controlling the way how you achieve it; but the governments of some countries also control the processes and human activities connected with reforestation.

Therefore the term “flexibility of the legal regulation” was designed. The main meaning of this term is how strict and precise the legal regulation is in the context of how much decision making opportunities are given to the forest owner or the forest manager. The more decisions which are taken by the owner or manager – the more flexible is the regulation and vice versa.

The main categories for flexibility of the legal regulations about reforestation activities are connected with abilities of the owner:

- 1) to choose the species for reforestation;
- 2) to choose number of seedlings per hectare;
- 3) to satisfy the governmental quality control system;
- 4) to choose the regeneration method (attitude to natural regeneration);
- 5) to choose the main felling type;
- 6) to choose the soil scarification method.

* - Sources:

Germany	<i>The Forestry Law for Federal State of Saxonia, 2007</i>	Latvia	<i>Reforestation Rules, 2001</i>
Lithuania	<i>Lithuanian State news, 2004</i>	Poland	<i>Rules of silviculture, 2003</i>
Russian Federation	<i>Regulations of reforestation, 2007</i>	Sweden	<i>The Swedish forestry act, 2007</i>
Ukraine	<i>Regulations of reforestation and afforestation, 2006</i>		

1.4. Aims of research and hypothesis

The aim of the research was to answer the following questions:

- What are the main legal requirements and limitations for reforestation in Germany, Latvia, Lithuania, Poland, Russia, Sweden and Ukraine?
- How flexible is the forest legislation concerning reforestation activities in these countries? How much decision taking abilities are given to the forest owner?
- What is the regeneration success in the countries (how many per cents of the reforested area were accepted as satisfactory according to the laws)?
- Is there any correlation between the flexibility of legal regulation of reforestation and regeneration success?

All of these questions should be answered basing upon the investigation of legal regulations, recent forest statistics of the aforementioned countries.

The main hypothesis of the research is that there is a correlation between flexibility of legal regulation concerning reforestation and reforestation success; and this correlation is assumed to be negative – success becomes worse if more decision taking power is given to the forest owner (i. e. if flexibility is higher).

2. Overview of the research countries

2.1. Geographical location of the research region. Countries that were taken into research

The work is based on the research in the region of Northern, Central and Eastern Europe. For an objective investigation countries with similar conditions were selected, as reforestation is much dependant the climate, soil and other growth conditions. All conditions that influence the forests and can be objectively measured were taken into account for development of the European forest type classes (*European Environmental Agency, 2007*). It includes 14 categories and 76 types of European forests.

Of course the countries, which were taken for the research, include different forest types within their territories. But the main criterion for the selection was prevailing of 2 forest categories in the country:

- boreal forest which includes forest types:
 - Spruce and spruce-birch boreal forest;
 - Pine and pine-birch boreal forest;
- hemiboreal forest and nemoral coniferous and mixed broadleaved-coniferous forest which includes forest types:
 - Hemiboreal forest;
 - Nemoral Scots pine forest;
 - Nemoral spruce forest;
 - Nemoral Black pine forest;
 - Mixed Scots pine-birch forest;
 - Mixed Scots pine-pedunculate oak forest.

The following countries were taken to research (*Figure 1*):

- Germany (51% *);
- Latvia (78%);
- Lithuania (81%);
- Poland (75%);
- Russian Federation (95% of Karelian federal republic);
- Sweden (89%);
- Ukraine (62% of Forest and Forest-Steppe zones).

There also is a big share of other forest categories in the aforementioned countries, for example beech forest, broadleaved deciduous and mixed coniferous-broadleaved forest, acidophilus oak and oak-birch forest are widely spread in Germany, Poland and Ukraine. But the ability for the regeneration in these forest categories are not much different comparing to boreal, hemiboreal and nemoral ones (*European Environmental Agency, 2007*).

Ukraine and Russia due to their big variety of climatic, soil and forest growth conditions were partly taken into research. Forest conditions of Ukraine are usually described considering three

* - Rough estimate of the relative frequency of boreal, hemiboreal and nemoral forest categories according to the European forest types classification (*European Environmental Agency, 2007*).



Figure 1. Geographical situation of the countries taken for the research (*State of the World's Forests. Europe, 2007*)

main natural zones (the Polissia – Forest zone, the Forest-Steppe, the Steppe zone) and two mountain areas (the Carpathians and the Crimean) (*Law of Ukraine, 2006, Regulations of reforestation and afforestation, 1996, Interview with Magda A., 2008*). The conditions with prevailing of the boreal, hemiboreal and nemoral forest categories are mostly concentrated in the Polissia and the Forest-Steppe zones of the country. For the same reasons Russia was represented in this research by the federal republic Karelia.

2.2. Forest growth conditions in the research region

According to the European forest type classification (*European Environmental Agency, 2007*) there are 2 dominating forest categories in the area that was taken into research: boreal; hemiboreal and nemoral.

1. *Boreal forest.* The temperature and length of the growing season are the main climatic variables which determine forest productivity in the boreal climate zone. The harsh climatic conditions affect forest composition, dominated by two conifers species (*Picea abies*, *Pinus*

sylvestris) in the late stages of the forest succession; their relative distribution in the boreal climate zone is driven mainly by edaphic conditions. Deciduous trees including birches (*Betula spp.*), aspen (*Populus tremula*), rowan (*Sorbus aucuparia*) and willows (*Salix spp.*) tend to occur as early colonisers of bare ground or in the early stages of forest succession (*European Environmental Agency, 2007*).

Most of the boreal forest is managed as even-aged forest for commercial forestry; forestry has further increased, during the 20th century, the natural range of conifers in the boreal zone, by favouring conifers over deciduous tree species.

2. Hemiboreal forest and nemoral coniferous and mixed broadleaved-coniferous forest. The category has a dual origin: it includes the latitudinal mixed forests located in between the boreal and nemoral forest zones (hemiboreal forest or forest of the boreo-nemoral zone) and anthropogenic coniferous forest in the nemoral zone.

The light regime and length of the growing season are the main climatic variables controlling forest productivity; these factors differ considerably from the northern to the southern part of the hemiboreal zone. Anthropogenic impact has greatly reduced the extent of hemiboreal forest and altered its original tree species composition. The hemiboreal forest is featured by the coexistence of boreal coniferous species with temperate broadleaved tree species (*Quercus robur*, *Fraxinus excelsior*, *Ulmus glabra*, *Tilia cordata*). The structure and composition of hemiboreal forest but also of the nemoral coniferous forests is affected by a complex interplay of natural and anthropogenic influences (*European Environmental Agency, 2007*).

Of course, each of the research countries contains some other forest categories, but they have less importance in the forest conditions of the region.

2.3. Characteristic of the forest sector in the research countries

In **the Federal Republic of Germany** forests cover 11.1 million hectares, or 31% of the national territory (*see table 2.1*). Because of the high population density in the country German forests have a large social value.

In these forests coniferous tree species predominate. They account for 57.5% of the total forest area, while deciduous forest tree species cover 42.5% (*Forest Research Institute of Poland, 2006*). Norway spruce (*Picea abies*) is the most important tree species in German forests. The most common deciduous tree species is the European beech (*Fagus sylvatica*).

Germany is a federal state. According to its Constitution, forestry is mainly the responsibility of individual States (Bundeslaender). For this reason, no comprehensive annual surveys on forestry data are issued in Germany at federal level.

Latvia is a heavily forested country with 45% of its territory covered by forest – a total of 2.9 million hectares. Of this 87.4% of forests is of economic value.

In most of Latvia, forests are dominated by three tree species: pine, spruce and birch, together constituting 87% of the forest area and as much as 92% of the growing stock. Coniferous stands (59% of the total in terms of stock volume) are the most typical forests in Latvian conditions. In state-owned forests, coniferous trees constitute 69% of all stands, a contrast with those under other forms of ownership, where pine and spruce account for only 43% of the total area (*Forest Research Institute of Poland, 2006*).

Lithuania is currently made up of 32% of forest - 2.1 million hectares in total (*Forest Research Institute of Poland, 2006*). The ownership structure in this country, as well as in Latvia, has been

changing since the disintegration of the Union of Soviet Socialist Republics. At the time of regaining the independence (1991) all forests in Lithuania and Latvia were owned by the state, nowadays the share of the privately owned forests in these countries is 31% and 42% respectively, and these figures continuously increase.

There are eight main tree species forming stands in Lithuanian forests: Scots pine (36.4% by area), spruce (22.4%), birch (20.2%), black alder (6.4%), grey alder (6.2%), aspen (3.0%), ash (2.6%) and oak (1.9%). Combined, all other tree species account for only 0.9% of the forest area.

At present, the total area of forestland in **Poland** is 9.2 million hectares, which is equivalent to 29% of the national territory. The forest area managed by the State Forests National Forest Holding (SF NFH) is 7.58 million hectares. Poland's forest area per capita is estimated at 0.23 hectares (*Forest Research Institute of Poland, 2006*).

In terms of spatial structure by species, coniferous species dominate in Polish forests, occupying 5.4 million hectares (77% of the total forest area). Among coniferous species, pine covers the largest area – 70% (4.8 million ha). Broadleaved forests cover an area of 1.6 million hectares, which represents 23% of the total forest area. Among the broadleaved species, oak and birch, constituting 67% (0.5 million ha), occupy the largest area (*Forest Research Institute of Poland, 2006*).

Russian Federation stretches across a large extent of the north of the super-continent of Eurasia. Because of its size, Russia displays both monotony and diversity (*Wikipedia, 2008*). Forests cover 47% of its territory, this makes up 808.8 million hectares of the forests in total.

The dominant part of the Forest Fund is under management of Russian Federal Forest Service (Rosleskhoz). However, some parts of the Forest Fund are managed by other structures and agencies (*Forest club, 2008*).

The major part of Russian forests is coniferous - 76% of the total forest area, with prevailing of larch (30%), pine (20%), spruce (13%), cedar (10%) and fir (3%). Birch forest stands take 14% of the total forest area in Russia. Rest species make up 10% of the forest area (*Russian State Statistics, 2008*). Is there a difference between east and west? Where are most of each of these species. As you said, this is a big country, would be of use for me, as a non-euro reader to know where each of the forests types are.

According to international definitions, the total forest area in **Sweden** is 27.5 million hectares, which is approximately 61% of the national land area. Despite its small population of nine million and its large territory, Sweden is a technologically advanced country with a good infrastructure, including an efficient transportation and communications system. (*Forest Research Institute of Poland, 2006*).

Approximately 85% of the total standing volume consists of conifers. Norway spruce and Scots pine are the most common conifers. Among deciduous trees, birch is the most common species (11%).

The territory of **Ukraine** is mostly a level, treeless plain, calls "steppe". The total area of forestland in the country is 9.5 million hectares, which makes up just 16% of the national territory (*Welcome to Ukraine, 2008*).

Ukrainian forests compose of over 30 tree species. The prevailing species are: pine (*Pinus silvestris*), oak (*Quercus robur*), beech (*Fagus silvatica*), spruce (*Picea abies*), birch (*Betula pendula*), alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*), hornbeam (*Carpinus betulus*), fir (*Abies alba*). Coniferous forests occupy 42% of the total territory including 33% of pine. 43% is

covered by hardwood forests, 32% of which constitute oak and beech forests (*State Forest Committee of Ukraine, 2008*).

Comparison. The main statistics of the countries taken for the research, their forest characteristics are given in *table 2.1*. Density of population as one of the important figures for forestry sector was included in this table: the highest density is in Germany and Poland, the lowest – in Sweden and Russia. From this table we can see that the highest amount of forests is in Russia, but their productivity is low. The highest productivity is observed in German forests. There is no private ownership in Russia, private forests in Ukraine do not play an important role in forest sector.

The general trends of the reforestation and afforestation activities in these countries are given in *table 2.2*.

2.4. Historical background of the forestry legislation in the research region

Forestry traditions in Germany and Sweden are different; their ideas about forest management are guided by timber volume and profitability, respectively (*Brukas and Weber, 2008*). Due to the relatively early appearance of these ideas (second part of 19th – beginning of the 20th century) the great traditions and scientific basis was formed in both countries considering those goals. Until now both profit and volume oriented ways of forest management have been developing and adapting to the new climate and environmental conditions, modern economies, technical possibilities, political trends etc. But the basic concept has remained the same.

In the past Latvia, Lithuania, Poland, Russia and Ukraine have had many important similarities. For example, they have all been socialistic and all of them made a transition to market based economy in two last decades. Moreover all of aforementioned countries, with the exception of Poland, were republics of the USSR resulting in similar forest legislation and forest management. This legislation and management was based on German theories of normal forests and even timber flow and enriched by Russian forest typology and large-scale biogeocenotic landscape concepts (*Meidinger, 2006*). In the early 1990^s the former socialistic countries started to develop their economy (including forest sector) with the requirements of a market based economy. At this point the countries had to develop their own forest legislation, strategies, regulation methods etc.

The Baltic countries (Latvia, Lithuania and Estonia), which have had a long and important connections with the Scandinavian countries, started to integrate their forest sector according to Scandinavian models. Latvia made this change rapidly with the development of industry combined with the reforming the silviculture programs, system of top management and institutions, legislation and control system. The changes in Lithuania were not as rapid, nor radical, selecting a position between Scandinavian and German models (*Brukas and Weber, 2008*).

Table 2.1. Comparative characteristics of the countries chosen for the research

Country	Area, million ha	Population, million people	Density of population, people/100 ha	Forest area, million ha	Forest cover, % of total area	Mean annual increment (m ³ /ha*year)	Forest growing stock		Share of privately owned forestlands, %
							Per hectare, m ³ /ha	Total, million m ³	
Germany ¹⁹⁹⁰	35.7	82.2	233	11.1	31.1	12	320	3 552	44
*Latvia ²⁰⁰⁴	6.5	2.4	37	2.9	44.9	6.3	203.7	591	42
*Lithuania ²⁰⁰⁴	6.5	3.6	55	2.1	32.2	6.4	190.6	400	31
Poland ²⁰⁰⁴	31.3	38.6	124	9.2	29.4	6.7	202.8	1 866	17
*Russia ¹⁹⁹⁵	1707.5	142.0	8.4	808.8	47.4	1.2	99.5	80 476	-
Sweden ¹⁹⁹⁵	45.0	9.1	20	27.5	61.1	4.3	114.6	3 151	51
Ukraine []	60.4	46.4	76	9.5	15.7	5.0	221.3	2 102	≈0.3

* - former USSR countries;
1990 – year of joining the EU.

Table 2.2. Comparative characteristics of the reforestation and afforestation activities in the countries chosen for the research

Country	Reforestation area, 1000 ha			Afforestation area, 1000 ha	Share of afforestation in forest regeneration activities *, %
	Natural	Artificial	Total		
Germany	not available	not available	not available	3.5	not available
Latvia	23.1	11.7	34.8	2.1	6
Lithuania	3.5	6.4	9.9	1.3	12
Poland	4.4	43.1	47.5	13.2	22
Russia	670.0	202.0	872	not available	not available
Sweden	52.0	110.6	162.6	not available	not available
Ukraine	10.5	18.4	38.9	19.0	33

The data is given for the years 2006-2007.

*Share of afforestation in forest regeneration activities is calculated using the formula: $\frac{\text{Afforestation area}}{\text{Afforestation area} + \text{Reforestation area}} * 100\%$.

Sources:

FMFACP, 2007
State Forest Committee of Ukraine, 2008
Swedish forest agency, 2008

Lithuanian State Forests, 2008
State of the World's Forests, 2007
State forest service of Latvia, 2008

SFN FH, 2008
Maurer, 2008
Russian State Statistics, 2007

Reform of the forest sector in Poland was done inline with German concepts and volume orientation (*Brukas and Weber, 2008*). Russia and Ukraine developed their own system of management, which is still similar to the old Soviet forestry system, originally based on the German theories. Consequential to the Russian market and forest foreign affairs the market became oriented towards both Europe and Asia (*Meidinger, 2006*), but the Ukrainian market in this way is purely Europe oriented. For this reason Ukrainian legislation has to be in accordance with European requirements, but Russia operates independently on a more global stage (*Meidinger, 2006*).

Latvia, Poland and Sweden had tended to reorganize the state forest management agencies to function as a quasi-private company. Where by commercial objectives and more flexibility forest manage forests is allowed, without following strict bureaucratic rules (*State of the World's Forests. Europe, 2007*).

Important changes in the legal framework for forestry in Europe have taken place in Eastern Europe, where a majority of countries have reported an increase in private ownership of forests. Latvia, Lithuania and Poland have made changes considering private ownership (*table 2.1*). However, forest ownership in the Russian Federation and Ukraine remains almost 100 percent public (*State of the World's Forests. Europe, 2007*).

Some aspects of forestry policy in European countries have remained stable in the recent years are:

- commitment to ensuring that forest area should not decline; highly regulated forest harvesting;
- the requirement to replant forests after harvesting;
- widespread acceptance of multiple-purpose forestry practices;
- tax and payment incentives that favour retention of forests and conversion of agricultural land to forest;
- forest policies are also changing in some respects, including a strong trend towards public involvement in policy-making (*State of the World's Forests. Europe, 2007*).

Nowadays the goals of European policies, laws and institutions are remarkably similar: to promote sustainable forest management and conservation. Every country in Europe has laws and policies in place that make it difficult to convert forests to other uses. This is true in countries where virtually all forests are owned by the state, and it is equally true in countries (mainly in Western Europe) with a large number of private forest owners (*State of the World's Forests. Europe, 2007*).

In **Germany** the most important forest Act at federal level, the 1975 Federal Forest Act, is based on these two different constitutional principles. This means it contains both draft provisions that are to be specified by the States and also directly applicable provisions by way of concurrent legislation (*FMFACP, 2007, Federal Forest Act, 1975*). The constitutional basis for the most important regulations of the Federal Forest Act is complicated (*Forest Research Institute of Poland, 2006*).

Since regaining independence, **Latvia** has assigned key-sector status to forest-related industries, which have recorded successful growth under the conditions of market economy (*Forest sector in Latvia, 2007*). The factors favouring development are: high-quality and readily-accessible forest resources serving as a basis for production; long-standing traditions in forestry and wood processing; a high level of expertise and the determination of the authorities and forest-sector shareholders (*Forest Research Institute of Poland, 2006*). The forest sector's long-term

developmental goals and the basic principles under which to achieve them, as set out in the Latvian Forestry Law – a document approved by the Cabinet of Ministers on 28 April, 1998 (*Forestry Law of Latvia, 2000*). The major goal of Forestry Law is sustainable management of forests and forestlands (*Forest Research Institute of Poland, 2006*).

The forest policy document Forestry and Wood Industry Development Programme was approved by the government of **Lithuania** in 1994 and was subsequently updated in 1996. It was the first government-approved document dealing solely with the forestry sector since the restoration of Lithuania's independence in 1990 (*Forest Research Institute of Poland, 2006*).

The Forest Act of **Poland** of 28 September 1991 had the idea that sustainable forest management must be performed with due consideration for the following objectives: forest sustainability and the provision of multifunctional purposes for forests, the factors determining forest management policy in Europe since the 1991 Rio de Janeiro Conference, which promoted a new model for European forest management (*The Forestry Law of Poland, 1991*).

According to the Government of **Russian Federation**, development and adoption of the new version of the Forest Code of the Russian Federation were dictated by necessity to reflect in the forest legislation the changes in social and economic situation that happens in the country in the early 1990th. The new Forest Code was needed to ensure coordinated and effective state management of forest use, preservation and reproduction, to develop a positive climate for rational use of forest resources under conditions of economic growth. Until recently, the founding legal act for forest legal relations regulation was the Forest Code of the Russian Federation (1997). The basis of the new Forest Code (adopted in 2006) is regulation of legal land relations, on allocation of land areas (referred at the Code as 'forest areas') for practicing forest resource uses, determined by the Forest Code (*Forest Code of Russian Federation, 2006*).

Ever since 1903 **Sweden** has had its Forestry Act. Under the revised Swedish Forestry Act of 1994, production and conservation goals are both assigned equal importance (*The Swedish forestry act, 2007*). Forest owners are held responsible for the fulfilment of these goals (*Forest Research Institute of Poland, 2006*). The SFA has been given the mandate of breaking down the two overall forest policy goals into more detailed sub-goals, or forest sector goals. The four main forest policy tools are: advise and information, legislation, financial support and inventory, follow up and evaluation (*Interview with Alexandersson M., 2008*).

In 1994 the State Committee of Forestry of **Ukraine** in cooperation with other ministries, departments and research organizations developed the Forest Code which was later approved by Verkhovna Rada (the Parliament of Ukraine). The main objective of the Code is to provide environmentally-sound forest management, to mitigate negative consequences of natural hazards, to improve water protective, climate-regulating, sanitary-hygienic and other beneficial forest functions, health protection and aesthetic education of population (*Popkov et al., 2002*). The Code restricts some felling methods, introduces environmentally-friendly technologies in harvesting activities, e.g. restricts clear-cutting, enhances application of gradual, selective and narrow-strip felling methods (*Law of Ukraine, 2006*).

3. Materials and methods

3.1. Collecting the data from the legal acts and their analysis

The initial data was collected from the Forestry Acts and Codes that are the frameworks for all the Forestry Laws in every country and regulate the national forest sector. This was done by asking Master forestry students, lecturers and experts (practical foresters) and achieved through the formation and dissemination of a short survey among students of the “Euroforester” master program (Swedish University of Agricultural Sciences, Sweden), lecturers and foresters from each of the represented countries, with the exception of Ukraine (i.e. Germany, Lithuania, Latvia, Poland, Russia and Sweden).

The survey (*appendix 1*) was developed for collecting the main laws and normative acts of the aforementioned countries, and also for understanding the processes connected with reforestation. The main criterion in the formation of the questions in the survey was objectivity. Consequently almost all answers needed to be based on the laws or the normative acts of the countries. Only one question was made to find out the subjective opinion. All the categories of respondents were asked this question. It was thought to be useful when there are few respondents from one country, then the opinions of different people categories (forestry students, scientists and practical foresters) can be compared and some common trends can be found and taken into account.

The survey was spread via e-mail to 31 students of the Euroforester MSc program (representing Germany, Latvia, Lithuania, Poland, Russia and Sweden), 3 forestry scientists (Lithuania, Latvia, Poland) and 2 practical foresters (Sweden). There were 21 replies received from the respondents. As there were several replies from each country the information was compiled into country based archives and the legal acts were analysed for each country.

The legal acts connected with reforestation for Ukraine were collected and analysed via using internet and printed publications of the laws and normative acts.

3.2. Interviews design and implementation

Following the analysis of the legal acts, their practical application was assessed. For this, interviews were conducted with the forest sector workers of various levels from Sweden and Ukraine. The interviews sort qualitative information, than quantitative. The interview was connected with the development and differentiation of the categories of the research and the appropriate answers would make more significant contribution of knowledge than number of the observations. As surveying a single person can confuse objective and subjective expressions (*Gillham, 2000*) multiple experts were questioned to combat subjective answers and identify an objective overview.

The design of the interviews was based on the categories selected earlier for the flexibility and quality of the regeneration. Some questions contained the possibility for the interviewee to extend these categories or to suggest the new ones. The final interviews consisted of 10 questions (see *appendix 2*). There were also supplementary questions asked during the conversation to find out any problems in more detail and to look at the questions from different perspectives. There were also some questions developed specially for the experts connected with their activities or activities of the companies they represent.

Interviewees were selected in both countries from the different categories of workers in the forestry sector, different ownership categories, companies and location. The interviews were

carried out in May-July 2008. There were 5 interviews taken in Sweden and another 5 - in Ukraine.

3.3. Methodology of evaluation of flexibility and the quality of reforestation

To compare the quality of regeneration and the flexibility of the legal acts considering forest regeneration some common principles and grading system had to be developed for all the countries taken in the research.

The quality of the reforestation in all of the countries was characterized by the percentage of the satisfactory reforestation areas out of all reforestation areas. The principles for decision of a satisfactory reforestation are developed in all of the research countries and they are common for all of these countries: the regeneration area has to include not less than some minimum acceptable number of seedlings of the main species per hectare. These species depend on a certain site, its productivity, the aims of creating a forest stand on the site, climatic conditions etc. The minimum acceptable number of seedlings, the term of the observation after the reforestation activities and the methods of the reforestation are indicated in the normative acts in all of the research countries. And these figures differ from country to country depending on the conditions for the reforestation within a certain country. Nevertheless these figures are scientifically based and they can be a basis for the evaluation of the successfulness of the reforestation. So the percentage of the satisfactory reforestation areas out of all reforestation areas served in this research as a common indicator for the quality of the reforestation.

To estimate the flexibility of the legal acts considering the reforestation activities criterion was developed to identify the flexibility and to form the grades for measuring and comparing these criterion between the countries. The main factors that can influence the opportunity for the forest owner to decide about the regeneration activities, to choose the initial features and future forest stand characteristics were taken as these criterias. The developed criterion received the different categories and the points of flexibility for each category. This grading system (*table 3.1*) was taken as a basis for the evaluation of the legal acts flexibility considering the reforestation in all the research countries.

According to the grading system every country received points for each criteria of the flexibility according to the legal acts and the practical forestry procedures. Than the points were summed up, this number assumed to be the common indicator for the flexibility of the legal acts considering reforestation. The higher this number – the more flexible is the legislation of a certain country considering reforestation.

After the quality and the flexibility of reforestation were estimated for each of the research countries these figures were analysed to find some correlation, analogies or tendencies.

This for the statistical investigation was done and the correlation index was calculated and analysed for two aforementioned characteristics. The graph of this correlation was built to give the evidence of the possible correlation.

Table 3.1. System for evaluation of the legal acts flexibility considering the reforestation

№	Criteria	Categories	Points of flexibility
1.	Choice of the species for reforestation	Independently by the owner	5
		Independently by the owner with some advices	4
		Independently by the owner with some restrictions	3
		Choice from the recommendation list	2
		Small ability to choose, following the recommendations	1
2.	Number of seedlings per hectare	Independently by the owner with some advice	4
		Independently by the owner with advice and few restrictions	3
		Independently by the owner with a lot of restrictions	2
		Small ability to choose, not less than in recommendations	1
3.	Control system	Not exist	4
		Does not disturb the forest owner, result orientation	3
		Control is made once, with the help of the forest owner	2
		Control is made more than once	1
4.	Choice of the regeneration method (attitude to natural regeneration)	Voluntary natural regeneration	3
		Natural regeneration is recommended by state	2
		Natural regeneration is promoted by state in all suitable sites	1
5.	Choice of the main felling type	The owner is free to choose the type of the main felling	3
		The owner chooses the type of the main felling out of the recommended and has to adjust it with a state	2
		The owner has to follow the regulations depending on the certain site conditions	1
6.	Choice of the soil scarification method	Voluntary soil scarification	3
		Soil scarification is recommended by state	2
		Soil scarification is regulated by state according to the site conditions	1

Different grade diapason was given to different criterias. This is connected with not equal influence of the criterias to the flexibility of the legal regulation: the bigger the influence – the wider is the diapason.

4. Results

4.1. Analysis of the legal acts and their implementation in the research countries

4.1.1. Germany

For the regulation of the forestry processes on the state level Germany has its Federal Forestry Act (Bundeswaldgesetz). The recommendations and general features of the the Forestry Act and other normative documents outline the different administrative areas (lands) (*Federal Forest Act, 1975*). According to the Federal Forestry Act the forest owners must regenerate and supplement in the rational terms which are described more in detail in the laws of the Federal lands (*Bauer et al., 2004*). This can only be achieved with close cooperation between the Federal government and the lands (*FMFACP, 2007*).

The advantage of such a legal structure is that it is more flexible and corresponds with the conditions of the particular region, both climatic and forest conditions. The more detailed recommendations, normatives and regulations are described in the administrative acts (Verwaltungsakt). This takes into account the growth conditions, the success of the natural regeneration, the species composition in the existing forest stands etc. In these acts the methods of reforestation and afforestation, and certain schemes are noted. There are also regulations and recommendations for reforestation and afforestation, which are based on the Forest acts. The regulations and recommendations form the framework of the forest regeneration process in all federal lands; they are flexible enough to adapt to the properties of the regions, and in general that makes the legal regulation system of the forest regeneration flexible and adaptable to the different growth conditions.

Reforestation in Germany has to be done no more than in 3 years after the final felling or forest fire. The forest manager needs to report the forestry structures on the regeneration activities on the sites larger than 1,5 hectares.

The remaining regulations concerning regeneration activities and control methods are described on the level of the federal lands.

Reforestation (both natural and artificial) is almost always done under the forest cover. The reason for this is mostly selective character of the final fellings in Germany. Of course the compound fellings have many advantages in the social and ecological aspects. But at the same time for reforestation it causes some difficulties – during the preparing to the final fellings the way of regeneration, its methods have to be considered much (the number of the trees left per hectare, the size of the windows left, the density of the existing and the potential successfulness of the future natural regeneration, its species composition and so on).

That's why in the most of cases natural regeneration is the best reforestation method from not only ecological but also economical point of view. It is favored in the Federal Forestry Act (*Federal Forest Act, 1975*) and in the Forestry Laws on the level of the lands (*Forestry Law for Federal State of Saxonia, 1992*).

The large number of restrictions regarding reforestation are connected with the nature protection and preserving the biodiversity. For example only the species that are characteristic for the certain growth conditions can be planted in the site with these conditions. Although at the same time the exotic tree species are also allowed to plant in Germany. The large number of restrictions regarding reforestation are connected with the nature protection and preserving the

biodiversity. For example only the species that are characteristic for the certain growth conditions can be planted in the site with these conditions. Although at the same time the exotic tree species are also allowed to plant in Germany.

The main criterion for successful forest regeneration is the percentage of the survived seedlings on the site 5 years after it was regenerated (*Forestry Law for Federal State of Saxonia, 1992*).

There are many goals and principles for the German forestry; almost all of them are reflected to a different extent in the regulations and recommendations for reforestation and afforestation. The aim is to implement close-to-nature forest management throughout Germany (*FMFACP, 2007*). Here, trees of different age classes stand side by side. Regeneration takes place here on a continuous basis, more or less. Selective cutting use or group-selection cutting are carried out in the forests. Natural regeneration can develop or already existing regeneration can be used in the spaces opened up by cutting (*FMFACP, 2007*).

4.1.2. Latvia

The forest must be both highly productive and sustainable if the national economy is to be provided with the necessary timber resources while preserving ecological balance in the forest environment and improving the forest recreational and aesthetic characteristics. This is a primary aim of forest regeneration and afforestation in Latvia (*FAO, 2001*). These can be artificial processes (planting seeds or seedlings) and natural. One element is making sure that each area of forest has the trees which are appropriate for local growth conditions. Forest regeneration is ensured by national regulations in this area and by decisions which forest owners take about the kinds of trees they prefer (*Forest sector in Latvia, 2007*).

The optimal tree species for the future forest stand is in some way limited by the Rules of reforestation. Depending on the soil conditions (humidity and richness) and the composition of the previous forest stand there is a list of species recommended to plant. In general these recommendations are flexible. For the extreme soil conditions (e.g. dry and poor or too moist) there is just one species recommended for reforestation (e.g. pine or black alder). But for the most common soil conditions there always are several species recommended for the reforestation. After the final fellings of black alder the reforestation must be done with the same species.

Forest managers or any other legal owner must inform the State forest service about the reforestation activities on his land before the 1 of February of the next year (*Forestry Law of Latvia, 2000*).

The Forestry Law of Latvia (2000) indicates three methods of reforestation: natural, artificial and combined. But none of them is favored anyhow by this Law and other normative acts of the country. It gives more opportunities for the foresters in their way of silviculture management.

The regulations of reforestation activities indicate the terms for the regeneration on the clear felled area, forest fire etc. In general the term for these activities is 5 years, but for the sites with the ditch-water the term wide up to 10 years.

The criteria for the successful reforestation are also mentioned here. The reforestation control measurements are done by State forest organization after 3 years (in the period from the 1 of July to the 1 of November). The main criteria in these measures are the minimum height of the seedlings, evenness of their spreading around the area and the number of the main species plants on the area per hectare (*Reforestation Rules, 2001*):

- The minimum acceptable height for the artificially planted seedlings of coniferous species at the time of control is 0,1 m, for the deciduous – 0,2 m, on the sites with the rich soil conditions – 0,5 m for both coniferous and deciduous.
- The acceptable number of the seedlings of main species is:
 - pine – 3000 plants/ha;
 - spruce – 2000 plants/ha;
 - oak, elm, maple, beech, hornbeam – 1500 plants/ha;
 - aspen, birch, alder and lime – 2000 plants/ha (if black aspen regenerates by coppice – not more than 4 suckers from one mother plant).
- Grass vegetation and the secondary plants in the distance 30-40 cm around every seedling of the main tree species has to be more than $\frac{3}{4}$ of the main tree species seedlings height.

In case of the unsatisfactory or late regeneration forest owner must pay the penalty fee. This rule is also applied to the state enterprises as the controlling company is a separate organization from the State forest organization. In this way the control of both state and private forests becomes more effective and objective.

There is the prohibition of further final felling on the forest owner's land before the proper measures considering the reforestation on the previous clearcuts are done. This makes the owners stimulated regenerate their forests.

One of the features of the Latvian legal regulations is that approaches the “Scandinavian forestry” model with result oriented silvicultural measurements. For this reason quality control of the regeneration is done just once, after 3 years. Forest regeneration in Latvia is ensured by the national legal acts and the decisions about the future stand composition and other features of reforestation, which are taken by the forest owners.

4.1.3. Lithuania

The main documents for forest owners in Lithuania concerning forest regeneration are the Law on Forests, Regulations on Management and Use of Private Forests, Regulations of Reforestation and other legal acts. Also, the obligatory forest management project parts must be implemented, including reforestation. Regulations of Reforestation are obligatory for forest managers and advisable for forest owners (*Lithuanian State news*, 2004).

According to the Forestry Law of Lithuania regeneration has to be done on ecological basis and it must fulfill the requirements of the Regulations of reforestation and afforestation (*Forestry Law of the Republic of Lithuania*, 2001). Forest managers, owners, and users are obliged to regenerate clear fell area in time and in a proper manner. Terms and methods of regeneration after final fellings are strictly regulated. The areas after final fellings and forest fires have to be artificially regenerated within 3 years or naturally regenerated within 4 years (*Lithuanian State news*, 2004).

The method of forest regeneration is defined before forest harvesting. Preliminary, it is made by a specialist of forest inventory who prepares forest management project. Next, in case of state forests, the project is further detailed by a specialist who prepares forest regeneration project. In private forests it is done by state forests officer who issues the permission to cut forest (*Lithuanian State news*, 2004).

Forest management project is a document, according to which forestry in given territory is planned and organised. It specifies how forests should be managed, used, regenerated etc.

Forests shall be managed, used and regenerated according to forest management projects (*Forestry Law of the Republic of Lithuania, 2001*).

Felled and burned areas have to be reforested by sowing or planting tree species suitable for the site. The main species are chosen by site conditions and functional purposes of stands. Priority is given to species that suit the management goals best (*Forestry Law of the Republic of Lithuania, 2001*). A certain site is considered to be reforested if a year after defined reforestation time it is covered by certain number of seedlings of the future tree species (*table 4.1*).

Table 4.1. The minimum acceptable number of main tree species seedlings on the regenerated site a year after reforestation time in Lithuania

Tree species	Number of seedlings, plants/ha	
	artificial regeneration	natural regeneration
Oak	3000	5000
Ash	4000	7000
Spruce	3000	6000
Pine	4000 (in sphagnum 6000)	5000 (in sphagnum, bilberry pinewood 7000)
Black alder	3000	4000
Larch	2000	-
Birch	-	5000
Aspen and white alder	-	1000

Nowadays, the way of regeneration is to some extent limited, depending on the group of forests (*Lithuanian State news, 2004*):

- In forest reserves only natural regeneration is possible (group I). Rehabilitation of forest biocenosis is possible according to special projects.
- In forest of ecosystem protection (group II A) priority is given to natural regeneration. Planting material should be of local origin (preferably from the same stand).
- In recreational forests (group II B) all reforestation methods are allowed, so that their recreational functions are fulfilled in the best possible way.
- In protective forests (group III), priority is given to natural regeneration. Only material of local origin (preferably the same stand) is allowed in protective zones of forest reserves.
- In commercial forests (group IV) all methods are allowed.

Administrations of forest enterprises and national parks provide information on available seedlings and help forest owners (first of all, local ones) to purchase them (*Regulations on Private Forest Management and Use, 1997*).

The forest manager has to provide statistical data about fellings and regeneration activities (*Regulations on Private Forest Management and Use, 1997*).

The Lithuanian Regulations on Private Forest Management and Use, control private forest use, reforestation and protection by public forest officers. This control includes checking the terms of regeneration activities, stand composition, quality of the works etc (*Regulations on Private Forest Management and Use, 1997*). Unsuccessful forest plantations shall be reforested not later

than within two years (*Bauer et al., 2004*). Private forest owners who fail to comply with control requirements are subject to the prescribed fines (*FAO, 2001*).

The state officials may forbid further final forest cuttings until the cut over forest has been regenerated. Exceptions from reforestation obligations may be made for large forest areas which have been destroyed by natural calamities (*Bauer et al., 2004*).

4.1.4. Poland

The main legal requirements concerning reforestation and afforestation in Poland are described in the instructive document The Rules of Silviculture, which is a general guideline in the questions of forest regeneration, thinnings, final fellings etc. This document was developed according to the Forest Act, which is a conceptual framework for forest sector in the country.

The forest manager has to follow the normative schemes of stand composition when establishing a new forest stand. The projects for forest regeneration are made in accordance to the types of forests. For each forest type there is the guiding stand composition in the age of maturity and the main felling method described. These guidelines for each forest type are collected in the annex to The Rules of Silviculture (*Rules of silviculture, 2003*) under a title “The types of forest stands and the guiding stand composition of the forest sites”. The specific technical issues about forest regeneration are solved by forest managers, basing on their own knowledge and experience (*Forest research centre, 2003*).

The number of seedlings for establishing a new forest stand depends on many factors: main tree species, type of regeneration site, soil preparation method, the age of seedlings and management goals for the future stand. General recommendations for the initial density of forest stands are collected in The Rules of Silviculture (*Rules of silviculture, 2003*) (table 4.2):

Table 4.2. The approximate initial density of the forest stands in Poland

Tree species	Approximate number of seedlings, thous. plants/ha	Tree species	Approximate number of seedlings, thous. plants/ha
Pine	8-10	Oak	6-10
Spruce	3-5	Beech	6-8
Larch	1,5-2	Other deciduous	4-6
Fir	3-4		

In case of using containerized seedlings their number per hectare, for the majority of species, can be reduced up to 40% (*Rules of silviculture, 2003*). Artificial reforestation has to be done not later than in 2 years after final fellings, preferably in spring. However, for some deciduous tree species (mostly oak) the autumn planting is also acceptable (*Forests in Poland, 2007*). Sowing is also practiced in Poland. This method is recommended for the regeneration of pine, spruce, beech, oak and fir in the past years (*Forest research centre, 2003*).

When possible, the already existing natural regeneration of the valuable species is used first of all. Natural regeneration is especially of high importance in mountain region, highlands, dense or virgin forests, sites with degraded soils and with local ecotypes of given forest tree species.

It is prohibited to use natural regeneration in forest stands (*Forest research centre, 2003*):

- of unknown origin, which are to be liquidated;
- which grow in unsuitable conditions, except of the stands of species, which regenerate spontaneously and according to the direction of stand reconstruction;

- which are infected or seared;
- surrounded by the secondary forest stands established artificially;
- in conditions of strong grass vegetation competition or dense cover of coppice understory.

The time of preparation activities is determined by systematical researches about the mast cycles. The mast years are registered in “The informational system of the state forests”.

The main silviculture system for the production forests dominated by pine is clear felling followed by artificial reforestation. However, if possible, it is recommended to leave the seed and shelter trees or to use consecutive fellings to promote natural regeneration. Also, natural and artificial regeneration could be combined (*Forest research centre, 2003*).

It is prohibited to use exotic tree species for reforestation in Poland (*Forestry Law of Poland, 1991*), however, this restriction is not that strict when it comes to afforestation (e.g. for the forest melioration).

All forests have to be inventoried and their quality has to be controlled (*Forestry Law of Poland, 1991*). Artificial regeneration is controlled twice, in second (primary control) and fifth year (final control) after planting. If regeneration was done under canopy the first control is in second year and next controls are done in one year after each removal cutting.

According to The rules of silviculture (*Rules of silviculture, 2003*) there are 2 criteria of such a control: percentage of covering the site and their health, correspondence with the site conditions (*table 4.3*).

Table 4.3. Classification symbols for the control of forest regeneration in Poland

Coverage		Health and correspondence with site conditions	
%	Classific. symbol	%	Classification symbol
More than 90	1	Good health and correspondence with the project and site conditions, single defects up to 10%	1
71-90	2	Up to 20% of defects	2
51-70	3	Up to 30% of defects	3
up to 50	4	More than 30% of defects	4

The quality of each controlled regeneration site is characterized with the two-digit classification symbols. First figure stands for the coverage, second for health and correspondence with site conditions (*table 4.4*).

Table 4.4. Grade system for the quality of reforestation in Poland

Classification symbol	Grade
1-1, 1-2	very good plantations
1-3, 2-1, 2-2,	good plantations
2-3, 3-1, 3-2, 3-3, 1-4, 2-4, 3-4	satisfactory plantations
4-1, 4-2, 4-3, 4-4	bad plantations

4.1.5. Russia

The framework for reforestation in Russia is article 62 of The Forest Code of Russian Federation, which includes three basic statements for regeneration of all forest sites (*Forest Code of Russian Federation, 2006*). Referring to this article, the Ministry of Natural Resources of Russian Federation adopted Regulations of forest regeneration, which include “the requirements for forest regeneration in all forest regions of Russian Federation” (*Regulations of reforestation, 2007*).

The recommended time for reforestation is early spring, before the budbreak. There are some exceptions, however, when it is recommended to plant the seedlings in autumn (*Regulations of reforestation, 2007*). The reforestation and afforestation activities on each regeneration site are to be done in correspondence with the forest regeneration project. These projects are elaborated centrally, not locally or by the forest owners themselves. The method for regeneration is developed in correspondance to the existing regulations and schemes. It depends on the growth conditions of a certain site, its location and ability for natural regeneration. The main species has to be chosen from the local forest tree species and has to meet the goals of forest management and natural-climatic conditions of the site (*Regulations of reforestation, 2007*); accompanying species has to be chosen considering their influence to the main tree species. In this way, the use of introduced tree species is limited.

The regeneration objects are planned annually for all the executive authorities of Russian Federation, which are responsible for the forest affairs, reasoning from the existed areas of the reforestation and afforestation funds (*Forest Code of Russian Federation, 2006*).

A big importance in Russian Regulations of forest regeneration is given to ecological and silviculture aspects of reforestation. The effort to mimic natural processes in forest management is emphasized in the attitude of legal acts to natural regeneration. The existing underbrush and young trees of the valuable species have to be preserved during fellings in the stand, which have to be done in winter using the underbrush friendly technologies. According to the Regulations of forest regeneration (*Regulations of reforestation, 2007*), artificial or combined reforestation has to be done if it's impossible to establish a proper forest stand using natural methods.

For the growing of the planting stock and establishing of forest stands the seed zoning was introduced in the country (*Collection of the legislation of Russian Federation, 1997*). This measure ensures the genetically correspondence of the future stand trees with climatic and soil conditions of a certain site and region.

The first control of regeneration is done after completing the planting. It includes the examination of the planting scheme and accuracy of the work itself. The first quality control is done at the same time; the second is done two years after planting (*Regulations of reforestation, 2007*).

Almost all reforestation measures are regulated with the normative acts and recommendations depending on the relief, climate, soil and other conditions. Many processes (e.g. sowing) are regulated only within the climate zones. However, taking into account the size of the country, regulation of some regeneration processes, normatives and schemes, which are used for it, should be developed according to certain growth conditions, shifting the scale of regulation from the country level to local levels.

The aforesaid analysis shows that in general the legal regulations of reforestation in Russian Federation are oriented towards ecological values and natural processes. However, at the same time, significant emphasis is put on exploitative forest management. The normative acts are strict

as far as selection of the tree species, methods of soil scarification, species composition, and tending measures are concerned. Natural conditions of the regeneration site seem to be neglected. This strictness in regulations leaves little freedom to forest owners and limits them the ability to take into account economical possibilities of his future stands, i.e. it makes the forest management less flexible.

4.1.6. Sweden

The Swedish Forestry Act is the main and one of few legal acts that regulate the processes of reforestation and afforestation in the country. Almost all the basic recommendations, limitations and normatives are pointed in this document.

Characteristic feature of regulation in forest regeneration in Sweden is the accent on a final aim, and not on the process of achieving it. There are some restrictions for choosing methods and ways of regeneration (*The Swedish forestry act, 2007*):

- forest regeneration has to be done not later than 3 years after the main fellings;
- it is allowed to use only regeneration methods that are experienced/tested in practice or/and scientifically proven on a big scale with a sufficient result;
- when choosing the species for the future stand it is not allowed to regenerate with the species, that do not give satisfactory productivity in the particular growth conditions (<60% comparing to the maximum productivity on this site);
- depending on the growth conditions and the geographical location of the site The Forestry Act appoints territories, where it is allowed to use planting material from ;

The Forestry Act is precise when it comes to the goal fulfillments for number of seedlings after the latest time for help planting: 3 years for planting and 5 years for natural regeneration in southern Sweden.

The establishment of new forest stands shall be carried out using methods that are necessary to assure a satisfactory stand density and composition (*The Swedish forestry act, 2007*). There are always some regulations governing the methods of regeneration, scarification, sowing, planting, tending of young stands, and other measures to meet general aims. These regulations are issued by the Government or public authority designated by the Government. The Swedish Forest Board develops these regulations about regeneration method to help the forest owners to make a decision, however, it is only a recommendation (*Interview with Philipsson A., 2008*). They are based on both practical experience and forest regeneration research in certain part of the country. In this way, specific local climate, soil and growth conditions are taken into account. Mainly, it is connected with the north-south length of the Swedish territory (nearly 2000 km), which influences a wide diversity of the aforesaid conditions.

In practice, the decisions about methods and species for reforestation are affected mostly by tradition, experience and general trends described in scientific researches or articles. Undoubtedly, site conditions, landscape, already growing tree species are also considered. However, different economical calculations are seldom prepared, at least in case of private forest owners (*Interview with Philipsson A., 2008*).

There are always some rules and policies for choosing tree species for regeneration within the companies. These policies are built on environmental standards, forest certification rules and frameworks, ambition to maintain high production in the individual forest stand (*Interview with Pedersen S., 2008*). However, the law is the same for all the kinds of ownership.

Natural regeneration in general is an accepted method, as long as the result is satisfactory according to the regulations in the Forest Act, but there is no special favoring of this method in

the Forestry Laws, rules and regulations. Natural regeneration is often connected with mixed stands. To create such a stand, forest owner plants one tree species (mostly Norway spruce) and uses natural regeneration from the shelter- or seed-trees (mostly Scotts pine or birch) (*Interview with Persson L., 2008*).

The attitude to the exotic tree species in the laws and the legal acts are liberal. There are few regulations and restrictions about using them. If there is a scientifically proved growing of a certain species or there is a positive experience of using this species in forestry the owner is free to plant this kind of trees on his site.

Swedish Forest Agency does the partly control cooperating with the forest owners as total control costs much. It is done with looking of the clear cuts after three years, counting the survived main species plants. Certain minimum amount of the main plants in the certain site conditions (connecting with the site index and geographical position) is considered when making the control in the areas (*table 4.5*).

Table 4.5. Lowest allowable number of future stems/ hectare after the latest time for help planting in Sweden

Site-index H100*		Number of stems / ha.		Site-index H100		Number of stems / ha.	
		In general	In hard regenerated sites in northern Sweden			In general	In hard regenerated sites in northern Sweden
Pine	T28+	2 300	1 800	Spruce	G36+	2 300	-
	T24	2 000	1 600		G32	2 000	1 600
	T20	1 700	1 300		G28	1 800	1 400
	T16	1 300	1 000		G24	1 500	1 200
	T12	1 100	900		G20	1 100	900
Birch	All	2 000	1 500		G16	900	700

* Site index is used for the indication of the growth conditions. It consists of two parts:

- 1) letter – short name of the tree species (T – Tall – pine, G – Gran – spruce, B – Bjork – birch);
- 2) number – number of meters, which shows the height of this species in this growth conditions at the age of 100 years old.

According to the regulations issued by the Government or public authority designated by the Government, a forest owner is obliged to notify the Swedish Forest Agency of planned measures to secure regeneration (*The Swedish forestry act, 2007*).

It means that when the forest owner plans to make final felling on the site which is bigger than 0,5 ha, the method of regeneration and the future tree species chosen for the regeneration should be mentioned in the special application (*Interview with Alexandersson M., 2008*). The reason for having this application is to monitor forest area, control the biotopes, key habitat territories, natural and other values of the areas that are going to be reforested. The owner mentions there specific conditions of the site including the old ruins, culture objects, big rocks etc. In this document there is no need to specify the type and methods of regeneration, or number of seedlings per hectare (*Interview with Philipsson A., 2008*). After the regeneration is done the owners receive special mail with applications that are voluntary to reply, where they are asked how regeneration was done, what species were planted and in what initial density (*Interview with Persson L., 2008*).

From this table we can see that the regulations have the restricting character, but at the same time these restrictions are not too drastic. This general way of formulating of the normative acts enlarges the possibilities for the forest owner in choosing the way (natural, artificial or combined) of regeneration, its methods, future species composition, the initial density of the stand etc. Of course in many cases forest companies have their own rules and measures concerning control of regeneration on their sites.

4.1.7. Ukraine

All forest affairs in Ukraine are regulated by Ukrainian Constitution, the Forestry Code of Ukraine, the law “About environmental protection”, and other legal acts, normative acts, which were developed on their basis (*Forest Code of Ukraine, 2006*). One of the main documents concerning forest regeneration is the one under the title “Regulations of reforestation and afforestation”. It is a framework for the Instructions of projecting, technical requirements, registration and evaluation of the forest regeneration sites.

According to the Forestry Code (*Forest Code of Ukraine, 2006*), reforestation has to be done on forest sites, which were covered by the forest vegetation (clear cut areas, slash fires etc). These sites have to be regenerated not further than two years after their appearance. Help planting on unsatisfactory regenerated sites is done the next year after the main regeneration. In case of natural calamities (e.g. windfalls, big fires or droughts) time limits for regeneration can be prolonged by the state executing authorities of the certain region.

The scope of reforestation and afforestation is calculated using the materials of forest regulation or special inspection, with consideration of the changes in forest fund of Ukraine and the condition of sites, which have to be regenerated (*Forest Code of Ukraine, 2006*). Forest regulation itself includes the scheme of reforestation, i.e. the organization which develops forest regulations (Ukrderzhlisproekt) chooses methods and species for the regeneration. Of course, forest managers can modify these regulation schemes and methods to some extent, but it happens rarely (*Interview with Gusak A., 2008*). The ability to modify the initial parameters (species composition, density etc) is much wider for afforestation and forest melioration than for reforestation.

Forest manager has to follow special programs and projects to achieve good results of regeneration, a quality high productive forest stand composed of the valuable tree species in the shortest time (*Regulations of reforestation and afforestation, 2006*). The minimum acceptable initial density of the main species is also regulated by the forest industrial standards.

The main principles for developing recommendations for reforestation are:

- correspondence of future forest stands with the geographical location (Forest, Forest-Steppe, Steppe zones or mountainous area);
- climate;
- soil conditions (humidity and fertility).

These recommendations include typical schemes of reforestation considering forest management experience and the composition of local natural forests. Recommendations are the basis to take decisions about the reforestation measures on a site (*Interview with Romanovsky V., 2008*).

In this way, the owner is limited in selection of the regeneration methods, initial density, the future stand composition etc. His part is just to choose a silviculture program and a project out of the list, developed by the State forest committee of Ukraine, which suits the soil, climatic and typological conditions of the reforestation site best.

High importance in the Regulations about reforestation and afforestation is given to natural forest regeneration. All sites with suitable conditions have to be reforested naturally.

One more ecological oriented feature of Ukrainian forest legislation refers to seeds and planting material. In the Instructions of projecting, technical requirements, registration and evaluation of the forest regeneration sites (*Ministry of Forestry of Ukraine, 1996*) it is mentioned that the planting material has to be grown in the soil-climatic conditions that are analogous or close to the ones of regeneration site. Seeds have to be collected on the permanent seed plantations or other objects of forest seed production in the similar forest types.

The attitude to the introduced tree species is not mentioned directly in the Forestry Code and other forest legal acts. However, after analyzing the Instructions of reforestation and afforestation (*Resolution about reforestation and afforestation, 2006*) and the recommended projects of reforestation, forest management and silviculture programs, one may deduce neutral attitude for the introduction of exotic tree species. Namely, some of these species are included in the recommendation list for reforestation in some regions of Ukraine. Often, exotic tree species are given as an alternative to the traditional forest management programs with the native species. However, the use of foreign tree species is always followed by the lack of planting material and great efforts to find it. Another problem is lack of experience and knowledge about the silviculture program for exotic tree species (*Interview with Gusak A., 2008*).

A list of applications that the forest manager has to design for regeneration measures is given in the Instructions (*Ministry of Forestry of Ukraine, 1996*). There are also the examples and blank tables to help the manager. Following documents are designed at the time or after:

1. Final fellings (existing and potential natural regeneration, method of the following reforestation is precised).
2. Project of reforestation (with the plan of the site, soil inspection etc).
3. Technical acceptance of reforested areas (here, the quality of planting and correspondence with a project are evaluated).
4. Inventory of the reforested site in the first and the third year after the regeneration (the percentage of survived seedlings is counted; decisions about help planting are made).
5. The Act about transition the reforested site to the forest covered areas (the quality of regeneration itself is described).

The majority of these documents is designed by an engineer of afforestation and reforestation and is agreed with a forest regeneration inspector (*Interview with Gusak A., 2008*).

All measures connected with reforestation and afforestation are subjects to quality control and registered. General aims for control of reforestation are indicated in the Forestry Code of Ukraine (2006). They can be classified by the categories:

- to ensure the realization of the state policies concerning forest regeneration;
- to ensure that the forest legislation will be followed by the government authorities, local governments, enterprises, organizations and citizens;
- to ensure that all forest owners, permanent and temporary forest managers will follow the legislation concerning reforestation;

- to avoid the violations of the legislation by aforementioned categories, to ensure the reasonable time of their discovering and appropriate measures of their elimination.

State control concerning reforestation is provided by the government of Ukraine, central executive authorities, which deal with environmental protection questions, forest management (*Forest Code of Ukraine, 2006*). So the control is always a big part of regeneration works. There is a list of the punishments and penalties for the persons or enterprises, which are guilty in the violation of the reforestation.

After analyses of the legal regulation in several of European countries, some common trends are easily recognizable. As a rule, legal regulation includes not only the laws, which are adopted by the parliament, but also several by-laws and normative documents, which are adopted by different authorities, and regulate the affairs from the level of the whole country to the local levels (*figure 2*).

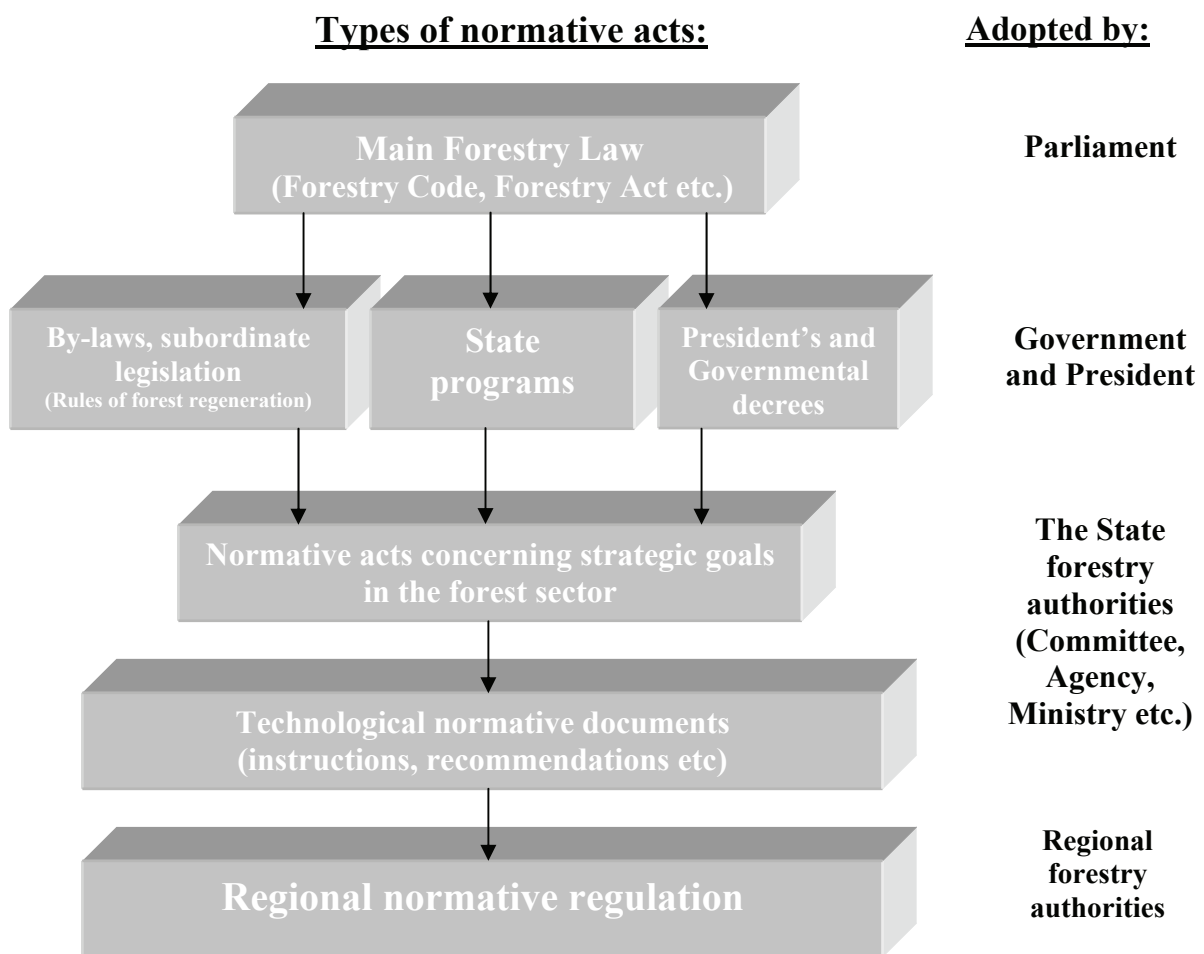


Figure 2. General scheme of forestry legislation in Europe

General legislation system consists of the main Forestry Law, which contains general principles, goals and the main regulations of forestry in a given country, and many other normative acts designed by different authorities to regulate the processes in details; additionally, state programs and decrees adopted by President or Government are issued to answer various problems that have appeared or to help the implementation of new trends and international agreements

4.2. Evaluation of flexibility of the legal acts concerning forest regeneration

The flexibility of the legal acts concerning reforestation was measured using the evaluation system (*table 3.1*) for all seven countries that were taken into research (*appendix 3*). The points of the legal acts flexibility considering reforestation for all criteria and total flexibility grades for all the research countries are given in the *table 4.6*.

Table 4.6. Evaluation of the legal acts flexibility concerning reforestation in the research countries (1 is the lowest flexibility, 4 – the highest)

Country	Criteria of flexibility						
	Choice of species for reforestation	Number of seedlings per hectare	Control system	Choice of regeneration method (attitude to natural regeneration)	Choice of the main felling type	Choice of soil scarification method	Total flexibility grade
Germany	3	2	2	1	1	1	10
Latvia	2	3	3	3	3	2	16
Lithuania	1	1	2	2	3	2	11
Poland	1	2	1	1	2	1	8
Russia	1	1	1	3	2	1	9
Sweden	4	3	3	3	3	3	19
Ukraine	1	1	1	1	2	1	7

4.3. Quality of forest regeneration in the research region and its correlation with flexibility of legal regulations of reforestation

The main indicator for the quality of forest regeneration is reforestation success (the percentage of satisfactory reforested areas compared to the total reforestation area in certain time). The data for reforestation success was provided by the government authorities of the corresponding countries and it was calculated using forest statistics in annual reports. Reforestation success in Germany is a good estimation by the state silviculture expert philosophy doctor Hans Volz. Respective data for Latvia was not available.

The weighted average reforestation success in the period of 2000-2006 for the research countries and regions is given in *table 4.7*. The total flexibility grades for each of the research countries were also put in this table.

Table 4.7. Flexibility of the legal regulation and reforestation success in the research countries (mean data for the period 2000-2006)

Country	Flexibility, points	Reforestation success, %
Germany	10	≈100
Latvia	16	not available
Lithuania	11	83
Poland	8	99,6
Russia (Karelia)	9	93
Sweden	19	80
Ukraine (Polissia and Forest-Steppe zone)	7	97

Basing upon the information given in the *table 4.7*, we can estimate how the flexibility of the legal acts concerning reforestation can influence the reforestation success (*figure 3*).

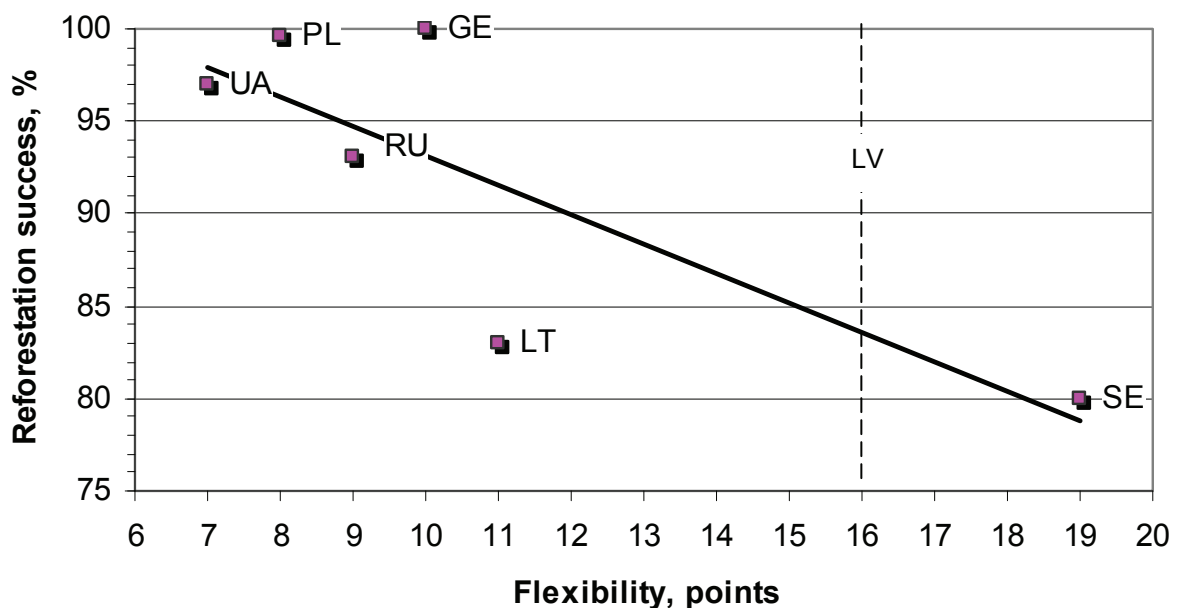


Figure 3. Correlation between the flexibility of legal regulation concerning reforestation and reforestation success in the research countries.

Figure 2 proves that there is a correlation between two examined characteristics. Correlation index in case of the research countries is: $r_{\text{fact}} = -0.797$. Degree of freedom in our case is $\nu = n - 2 = 6 - 2 = 4$ ("n" means number of observations i.e. number of countries; as there is no data concerning reforestation success for Latvia, it equals 6).

For the degree of freedom 4 and significance value $\alpha = 0.05$ (which is mostly used for statistical investigations in forest sector), the critical point of the correlation index is: $r_{\text{crit}} = 0.811$. So, if $|r_{\text{fact}}| < r_{\text{crit}}$, it means, that correlation between the investigated characteristics is insufficient for the existing number of observations (6).

However, for the significance value $\alpha = 0.1$ this correlation is already sufficient. It means, that **we can state with 90% of probability that there is a correlation between the flexibility of legal regulation concerning reforestation and reforestation success.**

5. Discussion

5.1. Analysis of the results and the uncertainties connected with the research

Legal regulation is one of the most effective and the most frequently used policy tools, which is employed by governments to achieve certain results in different sectors of economy. Different approaches to creating the laws and developing the principles of the legislation, as well as methods of implementation and control system, always determine the quality of the regulated processes. Reforestation, as one of the elements of forest sector, also depends much on legal regulation; in this way precision of the laws and legal acts formulation has a great impact on the quality of the works, and as a result on the success of reforestation in general.

As we can see from figure 2, the correlation between the reforestation success and flexibility of the legal regulation has an invert character: the more flexible the legislation, the worse final result of reforestation, and vice versa. Therefore, the hypothesis which was put forward has been confirmed.

Obviously, one should consider also some uncertainties and factors that can directly or indirectly influence the result, but were not considered in the research. Some factors are connected with measuring of the flexibility, while others – with evaluation of the reforestation quality in the research countries. Main uncertainties of the research are:

- method of flexibility evaluation is connected with the ranking of some qualitative characteristics by the forestry experts, so it is connected with subjectivity.

- natural and climatic – in spite of the detailed analyses of the climatic and soil conditions of the region, international zoning of the forest growth conditions, actual and potential forest stand compositions in different areas of Europe, the research region has similar forest growth conditions only in scale of Europe, but there is a diversity in the local growth conditions within the region. This heterogeneity can influence the general result of the research.

- each country has its own system of the reforestation inventory; time of inventories, quality control measures also vary from country to country. Although the main goals of these inventories are the same in general, the measures for their implementation and the principles at their basis are a bit different in each country. This could influence the objectivity in the evaluation of reforestation success.

- other policy tools could also to some extent influence reforestation processes and their final results. These tools can be divided on economical (incentive fees, penalties, taxes, subsidies etc.) and educational, or advice services (informational brochures, periodicals, consulting centers, centers of raising the level of forest managers' skills etc).

- moral factor, which signifies different mentality of the nations. This factor influences the implementation of the legal acts in a given country, the compliance of the forest workers and managers activities with the requirements of the legislation.

- small number of the research countries, which is caused by the requirement to contain two forest categories on more than 50% of the countries territory. Two forest categories dominate in all of the research countries (boreal forests; hemiboreal and nemoral coniferous and mixed deciduous-coniferous forests), which was the main selection criterion of the research countries.

These uncertainties influence the evaluation of the legislation flexibility and the reforestation quality. That is why, its use in other studies can be limited, and depends on the aims of studies. Nevertheless, for this study the methods can be considered as reliable. With a high probability we can state, that general trends described in the results of the research are constant and objective.

5.2. Practical importance of the results

The main result of this research is demonstration of the correlation between flexibility of the legal regulation and reforestation success, which proves the research hypothesis (*see chapter 1.4*). However, some visible deviation from general trends is observed in case of Germany and Lithuania (*figure 3*).

The most probable reason in case of the first country could be mentality of the Germans and long forestry traditions which were formed in Germany for centuries. As a rule, when establishing a new forest stand, the initial density is much bigger than minimum acceptable value (required by the law). In addition, the prohibition on the clear fellings increases natural regeneration potential much. These factors help to ensure the success of reforestation in every single regeneration site, and in a whole country in general.

On the contrary, reforestation quality in Lithuania differs from the general trend in the research countries. It can be caused by the rapid change in the forest ownership system: during last 15 years almost half of the Lithuanian forests have been restituted to private ownership. But at this period advisory services and educational information for the private forest owners have been developing slower.

As the result of analyses of the legal regulations concerning reforestation, all research countries were divided into three groups: with the strict regulation of the reforestation processes, with the legislation, which has limiting character, and with the result oriented legislation (*table. 5.1*). Countries with the first type of legislation have the lowest flexibility (6-9 points), second type – medium (10-13 points), third – the highest (15 points and more).

Table 5.1. Analyses of the legal regulation in the research countries

Type of legislation	With a strict legal regulation of the reforestation processes	With the legislation, which has limiting character	With result oriented legislation
Representative countries	Poland, Russia, Ukraine	Lithuania, Germany	Latvia, Sweden
Ownership	Forests are mostly state owned	Big share of privately owned forests	Big share of privately owned forests
Ability of the forest owner to make decisions	Low, the recommendations are developed centrally	Limited (everything, that is not forbidden, is allowed)	High, except of few limitations
Control system	Control is done several times. Processes of reforestation are controlled as well as the final result	Control measures are done once, only the final result is controlled	Control measures are done once, only the final result is controlled
Flexibility of the legal regulation	Low (6-9 points)	Medium (10-14)	High (15 and more)

This table also shows that the countries with the small share of the privately owned forests (*see table 2.1*) have the strict type of legal regulation (i.e. have the low flexibility). However the

countries with big share of the privately owned forests have either limiting or result oriented type of legislation (i.e. have medium or high flexibility). So the forest ownership structure also can influence the principles that are set up in the basement of the legislation of the certain country. It could serve as a topic for an independent research.

Reforestation success also depends on the ownership type. But mostly forest statistics, provided for the research countries, were given without division on privately or state owned forests. So it was not possible to investigate the influence of the ownership type on the reforestation quality.

All the processes of forest management are regulated to a different extent in all types of normative acts (*figure 2*). To understand how flexible the legislation is in a country, it is necessary to find out how precise it is and which type of normative act contains the most detailed regulation about a given question.

If the legislation on “high” levels of this hierarchy is too detailed (contains detailed instructions or recommendations), the ability of the forest owner to use his creative and innovative thinking, own experience and to take decisions on his own decreases.

Without a doubt, high level of flexibility of legal regulation is a great advantage for forest owners, providing them wide range of possibilities to take decisions about forest management and silviculture program independently. However, from the other hand, government has to provide forest owners with all necessary information and motivation to ensure effectiveness of those decisions, which will lead to desirable result. For the high level of flexibility a good education, competence and responsibility of forest owners (which are, in the most cases, forest managers as well) are indispensable. Thus, the state has to always keep dialog with the owners.

The example of the connection between flexibility of the legal regulation and the quality of forest regeneration can be observed in Sweden. Forestry Act, adopted in 1979, was precise (*Interview with Alexandersson M., 2008*): it included the recommended species depending on the site conditions, description of the reforestation methods and methods of the soil scarification. However, after adopting the “new” Forestry Act in 1994, the number of factors, which were strictly regulated by the legislation, was much reduced. The main idea behind developing the amendment, except realizing the ideas of Rio-1992, was to provide forest owners discretion of decision concerning forest management and silviculture program in their forests.

As a result, the problems connected with insufficient pre-commercial thinnings and delays of other thinning types appeared. It has led to economical failures and reduction of stands productivity (*Interview with Alexandersson M., 2008*). The changes in the legislation had also a strong impact upon reforestation. The total area of reforestation sites had increased annually until, 2005), however, the annual area of satisfactory reforested sites had decreased (*Mentor Communications AB, 2008*). For example, the inventory from 2007 shows that 82 % of the regeneration is done according to the legislation; on the other hand, in, 2005) it was 84 %. The goal is to have at least 87 % of well established regenerations in 2010. The plan is to achieve it through information and advice support for forest owners (especially for private ones), as well as through economical tools.

Similar problems and solutions are observed in Latvia and Lithuania.

The situation in Poland, Russia and Ukraine has the opposite character – nowadays, the governments struggle with heterogeneity of the local site conditions that have to be regulated in the legal acts and recommendations. As a rule, the bigger the country, the more diverse growth conditions throughout its territory; and as a result, the more difficult for the government is to develop precise legal regulation.

The example of an effective solution of this problem could be the structure of the forest legislation in Germany. Here, only general principles and norms of forest management are mandatory throughout the country. More detailed recommendations, normatives and rules are regulated in the Federal Forestry Acts. It helps to consider the diversity of natural, economical and social conditions.

6. Conclusions

The practical importance of this work is, first of all, to compare the legislation systems of different European countries, which have similar forest growth conditions (belong to similar forest classification categories). The selected countries for this research were Germany, Latvia, Lithuania, Poland, Russia (Karelia region), Sweden and Ukraine (Polissia and Forest-Steppe zone). Nevertheless, forest growth conditions and the main principles of forest management in all countries are similar (sustainable forest management and multifunctional use of forests) success of reforestation activities varies from country to country.

The researches kept in this work have proven the correlation between methods and principles at the heart of forestry legislation concerning reforestation and general success of reforestation in the country. Particularly, flexibility of the legal regulation is one of the key factors that influence general result of reforestation.

There is practically no form of state policy that can ensure the best results of reforestation in every country, even in those with similar climatic and forest growth conditions. Nevertheless, general recommendations can be made for all countries:

1. Each country should develop and adopt the legislation concerning the main principles and long-term goals of forest management.
2. According to these principles and strategies a certain set of legislative, economical and educational policy tools for their implementation has to be developed. A proper balance between these three tools should be found considering forestry traditions, mentality of the nation, forest growth conditions and ownership structure in a given country.
3. If the flexibility of the legislation concerning reforestation is low, much attention should be paid to the periodic renewing of the normative acts (concerning market dynamics, technical progress, changes in the international requirements etc), scientific ground of the selected methods, and economical potential of the forest regeneration sites. The legislation has to take into account local site conditions and aims of forest management as much as possible.
4. In case if the power to take decision is shifted to a forest owner, some risk can increase – such decisions may be wrong or may not consider all factors that make reforestation and silviculture successful. After all, not all forest owners have sufficient knowledge and skills in forestry. That is why, the state has to participate in the forestry education and provide forest owners with advice services. Additional role as extra motivation measures in the countries with flexible legislation should be given to economical policy tools (penalty fees, subsidies etc).

To ensure the objective result of the research it could be useful to amplify the number of the research countries. For the same analysis countries with domination of the boreal and boreal-nemoral forest categories (e.g. Byelorussia, Estonia and Finland) can be added to the research.

Similar researches with the use of methods described in this work can be carried out for many other topics connected with comparison of the legislation and other qualitative characteristics of forest management or silviculture processes in different countries. However, the researchers

always have to keep in mind that the natural factors should be more or less similar in all research countries. Otherwise, the result can contain too many uncertainties and errors, i.e. can be not objective.

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Appendix 1

Survey developed for collecting the main laws and normative acts concerning reforestation in the research countries

1. Find, please, the English translation of the latest Forestry Law or Act. If you do not find it, send, please, the main issues of it about forest regeneration in English.
 2. How is natural regeneration considered in the Forest Act of your country? Is it favorable? Give some examples from the law.
 3. How should the owner/manager choose the species for the regeneration, according to what schemes? What does it depend on? Is it flexible? Give some examples from the law.
 4. How widely can the forest manager choose:
 - a) species for reforestation?
 - b) initial density?
 - c) methods of reforestation (natural, artificial or combined)?
 - d) methods of soil scarification?
- Give the correct references, please.
5. How precise is the regulation of the forest regeneration in acts and normatives? How flexible is it? What are these acts and normatives (Forest Act, Regeneration rules etc.)? Give the correct references, please.
 6. According to these documents:
 - a) When do you have to regenerate (year after clear felling and season)?
 - b) What are the methods of regeneration (natural, planting etc.)?
 7. What are the criterias of controlling the quality of regeneration (good, satisfactory and unsatisfactory)? How, when and by whom this control has to be made?
 8. Advantages and disadvantages (weak sides) of the situation in your country about the laws considering regeneration (could be subjective).

Appendix 2

The questions for the qualitative interviews about the flexibility of the legal regulation concerning reforestation

1. How widely can the owners choose the species and the methods for the regeneration? What are the restrictions and limitations for these decisions?
2. What is the difference in this question for the private, state and other owners?
3. What is an attitude in the laws and legal regulations for the natural regeneration? What are the pros and cons for using it?
4. What is an attitude in the laws and legal regulations for the exotic tree species? What are the pros and cons for using it?

5. What are the applications that the owners have to fill in when doing regeneration?
6. Is this information enough for ensuring the successful regeneration?
7. What is the control system for the quality of the regeneration? How reliable is it? What are the criterias for quality control?
8. What do you think, is the quality of regeneration good enough in Sweden?
9. There are some critical articles about the success of the forest regeneration. What will you say about it?
10. What are the tools for influence the quality (policies, economical, education etc)?

Appendix 3

Evaluation of the legal acts flexibility concerning reforestation in the research countries

Germany:

- 1) The species for reforestation are chosen by the forest owners but with some limitations and restrictions that are mentioned in the legal acts – 3 points;
- 2) The initial density (number of seedlings per hectare) can be chosen by the owners with advice from the state and with a lot of restrictions – 2 points;
- 3) Control is made once with a help of the forest owner – 2 points;
- 4) Natural regeneration in Germany is almost always promoted by state for reforestation – 1 point;
- 5) The choice of the main felling type is limited in Germany as clear cut system is forbidden (except of few cases) – 1 point;
- 6) Soil scarification is strictly regulated by state according to the site conditions – 1 point.

Latvia:

- 1) The species for reforestation are chosen by the owner out of the recommendation list – 2 points;
- 2) The initial density is chosen independently by the owner with some advices from the state – 3 points;
- 3) Control system is provided by the independent state company – 3 points;
- 4) The attitude to natural regeneration in the legal acts is neutral, the owner can decide on regeneration method himself/herself – 3 points;
- 5) The owner decides himself/herself about the type of fellings – 3 points;
- 6) Soil scarification is recommended by the state in Latvia – 2 points.

Lithuania:

- 1) The species for reforestation are mentioned in the recommendations, which are obligatory to follow – 1 point;
- 2) The minimal initial density of seedlings is also included in the recommendations – 1 point;
- 3) Control of reforestation is done once with the help of the forest owner – 2 points;

- 4) Natural regeneration is promoted by the state only in few categories of forest stands, otherwise the owner is free to choose the regeneration method himself/herself – 2 points;
- 5) In all commercial forests the owner is free to choose the felling type – 3 points;
- 6) Soil scarification is recommended by the state – 2 points.

Poland:

- 1) All reforestation measures are mentioned in legal regulations and recommendations, including species composition – 1 point;
- 2) The manager decides about initial density for reforestation but only in the limits given by the state (table 4.2) – 2 points;
- 3) Control system is also strict and it's done twice – 1 point;
- 4) The use of natural regeneration is strictly regulated in the Rules of silviculture – 1 point;
- 5) When choosing the final felling method, forest owner can decide himself but with some restrictions – 2 points;
- 6) Soil scarification is regulated by the state and controlled directly after reforestation measures – 1 point.

Russia:

- 1) The species composition used for reforestation is mentioned in the regeneration projects, which are obligatory to be followed by the permanent and temporary forest owners – 1 point;
- 2) The decision about the initial density is made by the owner considering the existing regulations that are developed for different site types (depending on soil fertility and humidity) – 1 point;
- 3) Control of regeneration is always done twice (at least) – 1 point;
- 4) Natural regeneration is not promoted by the government, even opposite – planting has to be done almost in all cases and condition – 3 points;
- 5) The final felling method has to fulfil the restrictions to preserve the existing underbrush, and it has to be agreed with the state authorities – 2 points;
- 6) Soil scarification method is strictly regulated by the legal regulations – 1 point.

Sweden:

- 1) Forest owner is free to choose the species for reforestation (with few exceptions) and then to agree them with the local forest authorities; state can influence the owners mainly by advice – 4 points;
- 2) The number of seedlings per hectare is chosen independently by the owner, state only helps by advice – 3 points;

- 3) Control is done only once, to check the results of reforestation without disturbing the owner, the owner can voluntarily report about the results himself/herself – 3 points;
- 4) The method of regeneration is chosen by the owner himself/herself – 3 points;
- 5) The final felling system is chosen by the owner – 3 points;
- 6) The decision about soil scarification is made by the owner – 3 points.

Ukraine:

- 1) Forest owner has limited ability to choose the species for reforestation; species composition for reforestation on all types of sites are mentioned in the regulations of forest regeneration – 1 point;
- 2) The ability to choose the initial density is also limited: not less than in regulations – 1 point;
- 3) Control system is done twice and the forest owner must report about reforestation activities to the local forest authorities – 1 point;
- 4) Natural regeneration has to be used as reforestation method in all suitable sites – 1 point;
- 5) Final felling method is always chosen by the owner and has to be agreed with the authorities – 2 points;
- 6) Soil scarification methods are mentioned in the state reforestation projects for each certain site – 1 point.