

# Importance of Discount Rate in Latvian Forest Valuation

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## *Abstract*

Many forest scientists around the world have been spending a lot of time on forest value determination. One of the most widely used methods is the net present value method where asset's value is calculated as the present value of future cash flow. The challenge of this method is the determination of an appropriate discount rate. A high discount rate reduces the present forest value. Therefore, the authors of the paper have analyzed available materials about discount rates in forestry, evaluating discount rate approaches, as well as inspection of specific cash flow subject to different discount rates with income from 1 ha spruce stand, which required an identical start-up capital. Research literature showed that the discounting involves decreasing a future value to its present value while compounding is the reverse. It was demonstrated clearly with the chart that high rates of compound interest cause a very rapid and unrealistic future value increase, while low rates cause slow value increase for a very long period represented by a common forest rotation; for that reason high discount rates used in forest investments are not rational. The factors – roundwood price, costs, increment and cutting age – are important for appropriate discount rate determination in forest valuation because these factors determine what can be earned. Forest risks may be incorporated by potential investors through application of a higher discount rate in case future incomes are endangered.

**Key words:** compound interest, discount rate, discount rate approaches, forestry risks, investment in forestry.

## **Introduction**

Forestry often has a relatively long production cycle, and operations of a forest business require a large amount of capital. Investors want return from capital because the value of future money is completely different compared to money which is received today; therefore, capital investment returns should be evaluated and the rate of interest should be defined as a reward for waiting. The interest rate, which is used for determining the present value of future cash flows, is called discount rate. The discounting is the present capital value calculation from expected income or cost.

The discount rate is a very important measure in order to calculate the project Net Present Value (NPV), which is a standard method to appraise the profitability of long-term projects or investments, showing the difference between the sum of discounted cash flow which is expected from the investment and the amount which is initially invested. It is one of the factors which the NPV-based valuation is most sensitive to. The lower the discount rate the higher the present value and opposite. Therefore, determination of an appropriate discount rate in the forestry is subject to intense discussion.

Different opinions about determination of the discount rate are found in the literature. Samuelson (1995) is amazed about the low interest rates of 4-5 % mentioned in the forest literature because he considers such long-term investments in forestry to be connected with risks and uncertainties. Klemperer (1996) stated that it is difficult to find a consequent use of the discount rate between forest buyers because one investor may conservatively project no stumpage-price increase and use a low-risk discount rate while another may project optimistically high prices using a large discount rate to reflect the resulting risk. Another approach is to add a 2 or 3 percentage-point risk premium to the average real risk-free long-term government bond interest rate. In New Zealand, Forest Valuation Standard (1996) has argued that a rate of zero should be applied when assessing forestry investments, while rates in excess of 20 % are also found. Forest economic and environmental accounting in Sweden (1998) used a discount rate of 1-2 %. This is thought to be a far too low value but no correction has been made. European Communities (2002) published results of European forest valuation by European Framework for Integrated Environmental and Economic Accounting for Forests (EFIEEAF) in 2000; it is stated that an admissible range for the discount rate when calculating the present value of forest assets

in Europe is between 0.5 and 3.5 % with a note that even a zero rate of discount is admissible. Although, in the previous year EFIEEAF published that the discount may be equal to the value growth rate of standing timber (European Commission 1999). Brukas et al. (2001) in their scientific paper note that adoption of a discount rate above 5 % makes forestry an unprofitable venture in the region to the east of the Baltic Sea. For that reason it is advised to use a discount rate less than or equal to 2 % for forest economic evaluations in East European State forestry, also it is possible to apply the same rate to private forestry. Meanwhile, the country and project specifics may require shifting this rate downward to 0 % or upward to 4 % for private forest investment analyses in Eastern Europe. Bright (2001) values forestry as a long-term investment and suggests that when choosing a discount rate in forestry the long-term yield from company shares or government securities should be taken into consideration. In Britain, for instance, the average real rates of return over the period of 1963-1993 were between 6 and 7 %. Whereas in Norway the discount rate size changes due to forest valuation, for example, the 12.5 % discount rate is adopted for the property tax rate calculation, but a 4 % discount rate is used in private deals (Bergseng and Solberg 2007). Colin Price (2002; 2005) has studied the topic during the two last decades, mainly discount rate and time impacts on investment projects in context with problems of sustainability, including the forestry. It is stated that the regime of lower discount rate is more suitable to forestry than to other investments. The high discount rates are typical of short-term projects, but the discount rates in the long-term projects gradually decrease.

In Latvia, it is impossible to find common methodology for forest valuation despite the fact that more than half of the total territory of the state is covered by forests. Besides, there are problems with discount rate determination in the state forests as well as in the private forests. In their calculations, the state and private forest owners use the discount rate that is appropriate for a particular case and can vary from 4 % to 12 %. It should be pointed out that such rate selection has no justification.

Based on the information above, a universally applicable discount rate cannot be recommended; therefore, it is important to recognize the distinction in various discount rate approaches as well as to examine how different discount rates influence forest stand valuation and determine the main factors affecting the size of the discount rate.

The aim of the study was to analyze various discount rate approaches as well as to examine how different discount rates influence forest stands valuation

and to determine the main factors affecting the value of the discount rate, taking Latvia as a case.

## Materials and methods

The research is based on the data obtained from different literature sources and the Internet, and also pertaining to the present situation in Latvia. The current discount rate approaches have been characterized and systematized.

Afterwards, an analysis of compound interest and determination of appropriate discount rate was carried out, taking a spruce stand in Latvia as an example. The capital return from the spruce forest stand establishment was compared with a deposit in a bank. Calculations of the investment repayment in this stand have been made using a rotation length of 81 years according to the cutting regulations in Latvia. Investments in a 1 ha of spruce stand were estimated according to non-published data of Forestry Company *Hansa Silvesters* Ltd regarding forestry surveys for services – soil preparation, plants and planting costs, new stands tending. The spruce stand productivity was determined for Latvia's conditions according to P. Zālītis (2006). For the cash flow calculations the average real prices of wood assortments from Forestry Company *Hansa Silvesters* Ltd data base were used. The theoretical stand's price was calculated by multiplying the stand volume with the price for each year. A simplified cash flow was carried out considering only the initial costs for planting and revenue in the first rotation neglecting intermediate costs and revenues (e.g. from thinning) and future rotations to make a rough estimation of profitability. Such approach was chosen to make easier comparison between the return from forestry and the return from the initial sum invested in the bank.

Finally, Latvian forest risk analysis was carried out through recognition of the factors that influence determination of the discount rate using the State Forest Service public report data, which were systematized and analyzed.

Analysis methods such as comparisons and abstract logics were used.

## Results and discussion

### *Discount rate approaches*

Forest investments are generally considered to be fairly secure, but the investment period often extends well beyond the lifespan of individual investors. Nearly all investment capital in Latvian forestry comes internally from the landowners, forest product corporations, and the government. Lately, pension funds, insurance companies and limited partnerships' invest-

ments in timberland tend to be growing. The interest rate varies depending on each investor. For state institutions the interest rate will be lower than for companies. Lawrence et al. (2001) have stated that the interest rate consists of three elements:

- pure rate – the risk-free cost of using money over the time. In the market, these are government treasury notes in case of a full-employment economy with no inflation;
- expected inflation rate – the money paid back in the future will not buy as much as it does today;
- risk rate – an amount depending on the particular venture.

Whereas in the New Zealand Forest Valuation Standard (1996) the following discount rate approaches are stated:

- government-estimated or externally specified hurdle rates;
- discount rates employed in asset reporting;
- transaction evidence discount rates;
- Internal Rate of Return (IRR);
- Weighted Average Cost of Capital (WACC);
- Capital Asset Pricing Model (CAPM).

These approaches are subsequently inspected in detail in the following. In a global perspective, a fixed discount rate is applied in Great Britain through application of the official state discount rate destined for costs of capital for low risk purposes in the private sector. In Australia, a discount rate of 4-5 % is defined. However, in government projects with huge social importance it is accepted to apply a lower discount rate than the rate being used in the market. The discount rates are applicable for forestry companies' public reports where discount rates are declared for valuation of forest assets. As an example, Bergvik Skog AB, Sweden's second-largest forest owner, in its annual report used the discounted cash-flow method for measuring the value of standing forest. A discount rate of 6.25 % was used, which is assessed as a long-term cost for capital within the forestry business. Valuations of cash flow from standing forest include assessments of expense and income trends over 100 years, indicating the sum which will affect the value of forest if the discount rate increases or decreases by 0.25 percentage units as well as envisaging an increase or decrease in the level of timber prices and felling costs by 1 % in monetary terms.

Calculations of other discount rate approaches depend on the kind of cash flow the valuation is based on. Discount rate estimation of the market transaction should evaluate sale of forests or sale of shares in forest owning companies. A cash flow model of the traded forests is generated using the information available in the market with application of an appropriate

discount rate in order to estimate the NPV equivalent to the transaction value. Average price of forest land in Latvia from the year 2000 till 2007 had grown by 50 %. According to the data of State Land Service of the Republic of Latvia, the price of forest land varied from 80 to 1,689 EUR per ha in the year 2000, but at the end of the year 2007 from 166 to 6,877 EUR per ha. According to experts' estimation, forest land prices had decreased by 30-40 % in 2009, compared with price maximum in 2007. Those forest land prices do not describe the real market situation, but show the price range just for separate deals. The Latvian forest land market is quite new and such a wide price range is connected also with forest characteristics such as value of forest stands (wood value) and with quality of roads and distance to timber industry enterprises and other places for purchase of wood. Unfortunately, the data with characteristics of the transacted forest real estates are not available at the moment in Latvia.

For own capital cash flow, the Internal Rate of Return (IRR) has been used, which is equal to the invested capital return rate needed for an owner or an investor. IRR is also known as a discount rate but, in the authors' opinion, IRR has a different purpose in this case and it could not be defined as a discount rate determination approach. IRR is mostly the owner's or investor's expectation and it could differ from standard discount rate calculations. IRR is generally assessed as an indicator of the quality and efficiency of an investment not as an indicator of the value of an investment. For all invested capital cash flow the discount rate has been estimated within the Weighted Average Cost of Capital approach. The base of this approach is: the cost of equity capital is multiplied by the assumed proportion of equity financing, and the costs of debt are likewise multiplied by the assumed proportion of debt financing. The need to assess the appropriate return on capital has led to the development of the Capital Asset Pricing Model (CAPM). This model is based on the security market information analysis depending on free exchanged shares profitability changes. The general idea behind CAPM is that the discount rate is equal to the total sum of the risk-free profitability and the risk premium. In accordance with the CAPM, the discount rate has to be calculated using the following formula (New Zealand Forest Valuation Standard 1996):

$$R_i = R_f + \bar{a}_e (R_m - R_f), \quad (1)$$

where  $R_i$  – the required rate of return for equity holders in shares of asset I;  $R_m$  – the return to the equity market as a whole;  $R_f$  – the rate that can be obtained

from risk-free investments;  $\bar{a}_c$  – beta factor (industry and specific company sensitivity against average market profitability changes);  $(R_m - R_f)$  – average market risk premium, assuming the risk of a portfolio of equity investments.

The beta factor has been estimated from a particular company's total share profitability fluctuation range compared to the profitability of the security market as a whole. In the stock market annual reports, the names of the companies which deal with forestry should be found and this information should be adapted to local cases. The main disadvantage of this method is that there is a lack of companies with the relevant evidence that the beta factor should be based on.

The methods that were described above lead to different discount rate estimating options, but it should be noticed that no single method is perfect and the choice of the discount rate should be justified. The justification for determination of an appropriate discount rate in forestry is elaborated below.

**Discounting and compounding**

First of all, it is necessary to concentrate on the specific feature of the compound interest that the discounting is based on. The general formula for compounding (Pearse 1990) is

$$V_n = V_0 (1 + r)^n, \tag{2}$$

where  $V_n$  – sum, which is the return with interest;  $V_0$  – credit sum, which has been invested;  $n$  – credit period in years;  $r$  – per cent in decimal.

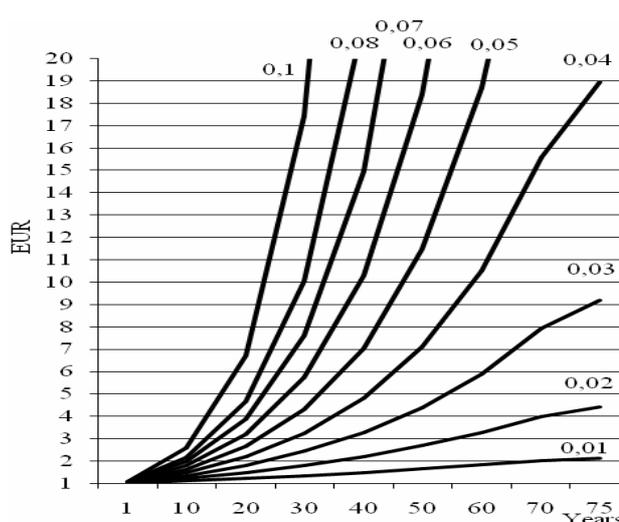
By transposing equation (2) it is possible to estimate the amount of money  $V_0$  invested today in the bank for  $n$  years that will yield in the future at the concrete discount rate. Actually this formula describes the present capital value  $V_0$  for capital  $V_n$  which is expected after  $n$  years at discount rate  $r$ :

$$V_0 = V_n / (1 + r)^n. \tag{3}$$

The discounting involves decreasing a future value to its present value whereas compounding is the reverse. So it allows us to choose any point in time to evaluate the forest at the time the forest is to be harvested or established.

The rate of interest used in evaluating investments in forest is very important in determining the results. Low interest rates cause a very slow increase and may be applied for some reason to the investments that run for a very long period. High rates cause a very rapid increase, which may quickly pass the bounds of possible attainment in practice (Figure 1).

This is the reason why the compound interest



**Figure 1.** Profitability of 1 EUR at different rates of compound interest (adopted from Chapman 1914)

rate in forestry which is more than 7 % is practically impossible, because the fastest gain tree species are aspen from the age of 41 according to cutting regulations in Latvia. All other species should wait their cutting age twice longer than aspen. Let us consider a specific example. If 1 ha of spruce is planted, then the necessary capital will be 705 EUR (soil preparation – 100 EUR, plants – 340 EUR, planting – 120 EUR, new stands tending – 145 EUR), assuming that the stand will be cut at the age of 81, when the standing volume is 365 m<sup>3</sup>ha<sup>-1</sup> according to P.Zālītis' table of forest type productivity (Zālītis 2006), with an average annual growth rate of 4.51 m<sup>3</sup>ha<sup>-1</sup>. Knowing the average price of spruce assortments today, 28.5 EUR, in theory, by investing 705 EUR today, we get an income of 365 m<sup>3</sup> x 28.5 EUR = 10,400 EUR (tax deductions are not taken into account in the calculations) after 81 years.

**Table 1.** Comparison of the results of simple and compound interest on 705 EUR at the end of period of 81 years

Rate of interest	EUR	
	Value of capital and interest at the end of period according to formula (2)	Simple interest to be earned annually and saved to give equal final result
1	2	3
1 %	1,578	19
2 %	3,506	43
3 %	7,727	95
4 %	16,900	208
5 %	36,688	455
6 %	79,061	983
7 %	169,151	2,088
8 %	359,346	4,436
9 %	758,116	9,359
10 %	1,588,534	19,611

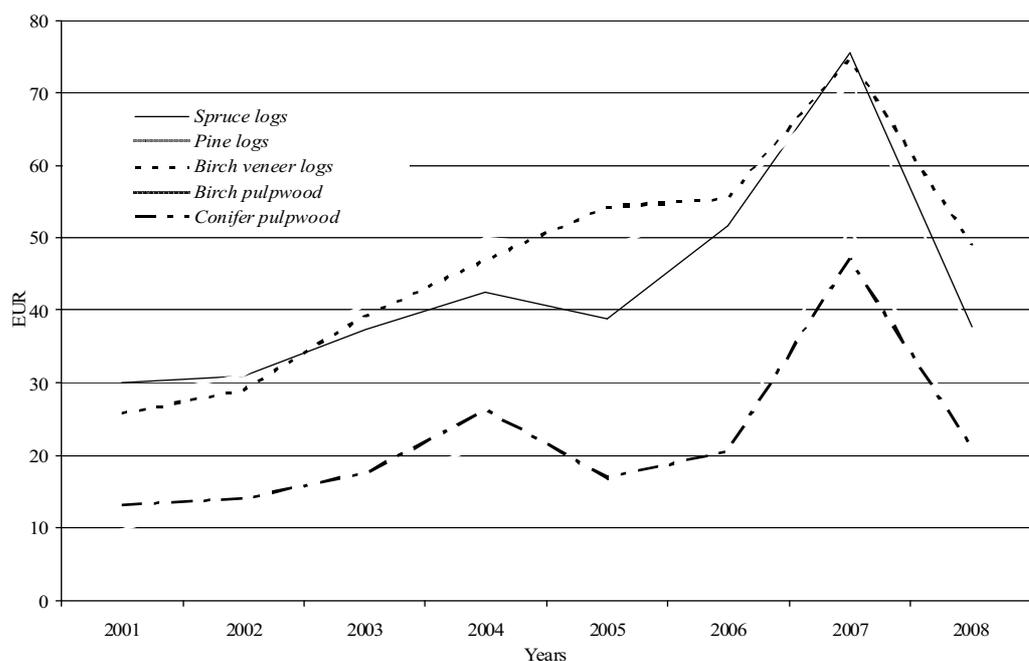
As it is seen from the data in Table 1, depositing 705 EUR in a bank for the same period at the interest rates of 1 to 10 % will result in a return of 1,578 to 1,588,534 EUR (column 2). The investor will obtain an identical income, if he/she invests in 1 ha of spruce or deposits money in a bank at an interest rate of 3-4 %. Table 1, column 3, shows how large simple interest will be earned annually and saved to give equal final result as it is showed in the second column, for pointing out how large sum of money he/she could get from depositing money in the bank every year and how this sum corresponds to tree annual growing. The corresponding theoretical annual earnings from spruce growth are 128 EUR which correspond to the interest rate of 3-4 % (Table 1, column 3). If an investor wishes to receive the amount of 1,588,534 EUR by investing 705 EUR for 81 years with a 10 % rate, then 1 m<sup>3</sup> of spruce wood at the cutting age should cost more than 4,300 EUR, which is not possible. According to the price curve (Figure 2), we can see that in the seven-year period (in 2008 as compared to 2001), in Latvia, spruce sawlog real prices have grown from 30 to 38 EUR, while softwood pulpwood has increased from 13 to 21 EUR. If the roundwood price continues to rise at the same pace, then, theoretically, in 81 years the average spruce assortment prices will not exceed 125 EUR and the income from spruce might reach 45,625 EUR; in this case, a discount rate of 5-6 % would be acceptable.

Obviously, when choosing a discount rate for forestry, such factors as volume growth, cutting age, costs and the future price forecasts for the wood

should be taken into account, because these factors determine what can be earned. This example illustrates that it is unrealistic to assume a discount rate higher than 5-6 % because wood production can not provide a larger return due to its specific features of production: long life cycle and steady annual growth, which corresponds to the low rate of compound interest. Higher interest rates may apply only to future timber price growth.

#### *Timberland investments*

Chapman (1914), in his book "*Forest Valuation*", asserts that in order to determine the basic rate of interest applicable to investments in forestry, two factors must be analyzed: the security of the investment, and the financial nature of the enterprise. Some investors use a high discount rate due to the length of the investment period and the risks in the forest investments. Proper rates of investments can only be judged on the basis of comparison with other forms of enterprise. As the scope of the comparison is confined, the comparison between forestry and business production is impossible. The only enterprises familiar to the public, which are reckoned on a basis of compound interest, are saving banks and life insurance companies. Most banks do not permit the accumulation of compound interests on accounts that run more than 20 years without the owner's active interest about his/her account situation – withdrawal or pay-in on deposit. It is also important that the bank during this period remains solvent. The bank crisis in 2008 has shown to the world as well as to Latvia that banks are



**Figure 2.** Average roundwood real price dynamics in Latvia (EUR), 2001-2008 (Source: Forestry Company Hansa Silvesters Ltd data base)

not able to guarantee security for the deposits and accrued interest. Are the banks safe? This is one of the crucial questions which is being asked not only in Latvia, but in many nations in the world; because nothing is absolutely safe if even a financial structure with a hundred year's history could go bankrupt (Pelane and Ukenābele 2008).

If the savings are placed in the bank, then it is possible to withdraw compounded interest every year (see Table 1), therefore after a period of 81 years the initial capital of 705 EUR will remain. If the savings are placed in the spruce forest, then it is impossible to withdraw them earlier – the cash flow from final felling will come at the end of the rotation. The main question is what the investor wants, because only he/she can judge the positive and negative aspects of the investment and the evaluation may be different for each individual depending on his/her needs. In summary, demands for future profits, which are expressed by the discount rate, are based on the following aspects:

- 1) the average size of interest rates when borrowing money from the bank;
- 2) the possibility of an investor to get more profit from alternative projects;
- 3) the risk level of a project;
- 4) the inflation changes in the society (Hofs 2002);
- 5) the income tax and real property tax etc. of the owner/company;
- 6) available subsidies for the owner/company.

At the beginning of 2009, in Latvia, the interest rate per year on bank deposits was 6-8 % for the LVL currency and 3.8-4.6 % for the EUR currency. Theoretically, to attract investors there should be offered a higher interest rate, which would force them to invest money in the forest properties rather than in the bank. However, if stable profitability with minor risk in the long-term period can be guaranteed, the investor will accept a lower discount rate. So if a long-term investor wants to invest his/her money securely, then forestry could be seen as a relatively safe choice because biological growth of timber is the main driver

of attractive and stable returns. Timberland investment returns can be described as increase in land value and timber product prices. Also the investment in timberland is not expected to be affected by the bank structure collapse, and the demand for timber products is expected to continue forever; therefore the ownership of timberland for investor maximally reduces the risk of negative returns, as well as there are no risk of total financial collapse.

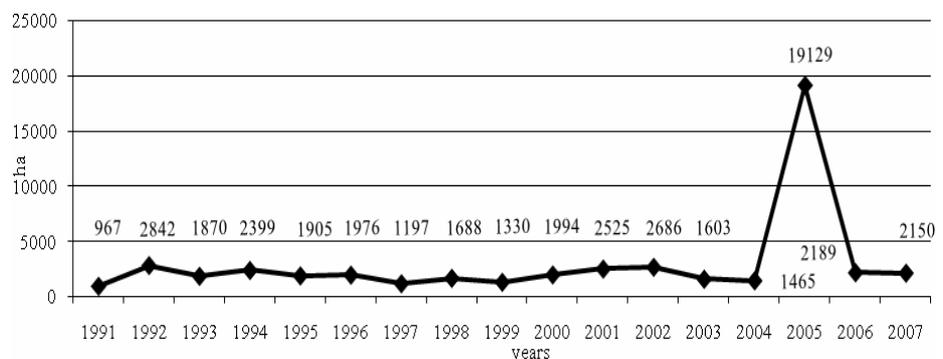
**Examination of forestry risks in Latvia**

It is, however, important to evaluate risks or factors which prevent planned profit in forestry. According to the New Zealand Forest Valuation Standard (1996), sources of risk, associated with forestry, include:

- 1) catastrophic events – e.g. forest fires, windthrow, etc.;
- 2) other losses – e.g. disease, snow damage, etc.;
- 3) growth performance – the closer to maturity the forest is, the more the uncertainty;
- 4) stand quality characteristics – certainty for obtaining a wood assortment composition with a certain amount of specific log types;
- 5) market – fluctuations in wood prices;
- 6) bureaucratic institutions – different restrictions, tax increase, etc.;
- 7) human interaction – poor forest management;
- 8) costs of inputs – administration costs could increase substantially.

Further on the importance of risks in Latvia is examined. The State Forest Service (SFS) provides forest supervision in all Latvia's forests to ensure forest management in such a way that the state of forest stands would not decrease. If a forest stand has damages from insects, windthrow, forest fires, etc., then it should be cut in accordance to SFS sanitary guides. In this way the economic value of the wood production is maximized.

Figure 3 presents only those stands which were totally destroyed in each year. The analysis of data shows that during the 17-years period, taking into



**Figure 3.** Destroyed forest stands (sanitary fellings issued by SFS), ha of forest land, 1991 – 2007

account also the storm in 2005, the annual average size of totally destroyed forest stands was 2,936 ha or 0.1 % of the total forest area of Latvia (2.9 million ha). In 2005, the storm Erwin/Gudrun, the most destructive storm during the last 37 years in Latvia, damaged 285 613 ha of forest. From the destroyed forests 83 000 ha were in protected areas, where any forest management activities are forbidden. Partly destroyed were 184 713 ha of stands, where major regeneration was not needed. In the year 2005, SFS issued sanitary felling rights for 19 129 ha, from which 17 900 ha (0.6 % of the Latvia's forest area) were totally destroyed by the storm damage. Therefore it can be concluded that the risk influence is minor and does not exceed 1 % margins, if we take into account the risk of possible storm.

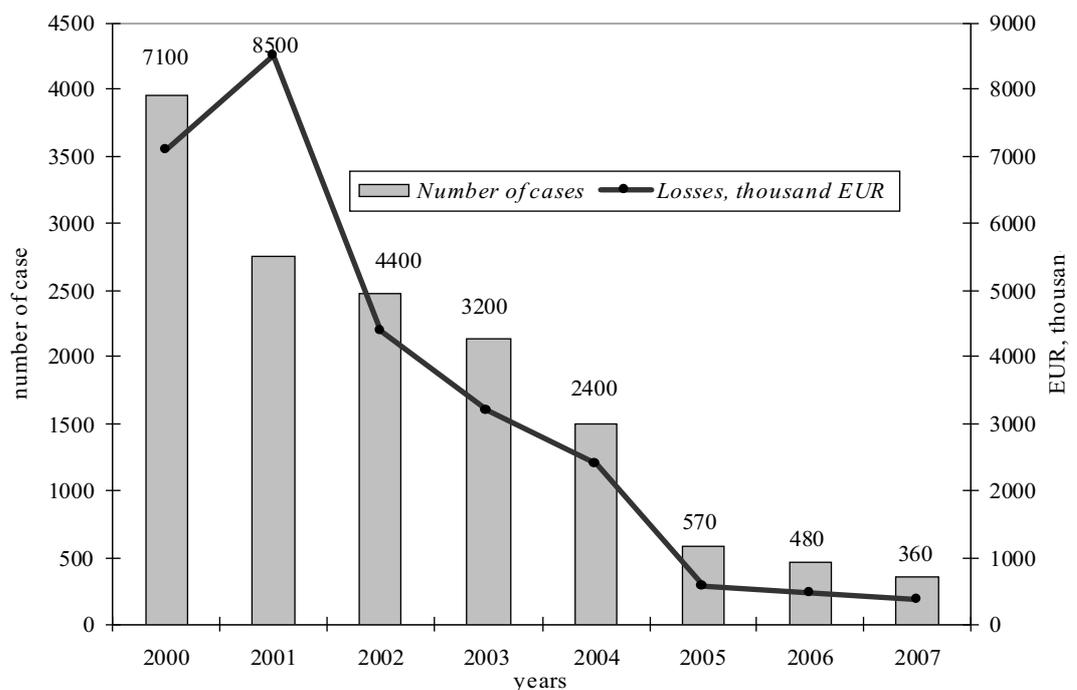
An unauthorized felling could be marked as an additional risk in Latvia. In 2007 there were 346 cases of unauthorized felling with the material loss of 360,000 EUR (Figure 4): in state-owned forests – 62 cases, and in forests of other ownership – 284 cases. In 2007, in comparison to 2000, the situation with illegal felling improved considerably: the number of cases reduced by 91 %, and the material loss reduced by 95 %. It is obvious that unauthorized felling of trees tends to go down both by the number of cases and the volume of timber felled, including the material loss; therefore any further risk is excluded.

Despite the low probability of risks in forestry, it is possible to insure forests against risks in Latvia. Insurable risks are fire risk, storms, plant damage, disease injuries, actions made by mechanical (motor)

vehicles, malicious damage of property, and larceny. In Latvia, the insurance services are offered by three leading insurance companies.

As it is shown, the most important risk from the above mentioned forest risks are changes in roundwood market prices. In spite of the overall fluctuation, roundwood prices have increased in the last seven years in Latvia (see Figure 2), which is connected with the increase of wood use in Latvia and in the world. It has been influenced by several aspects: forest growth may reduce CO<sub>2</sub>; wood is considered as a renewable energy source (bio-fuel); wood is an environmentally friendly material; wood is a naturally renewable material; wood has multiple uses and many advantages compared with other materials (natural beauty, easy furnished, good for health, etc.). Thus, according to the trend of roundwood prices in Latvia and taking into consideration the development of the world's timber market, a fall in roundwood prices is not expected in the future. The prices will be at the same level, or a slight increase could be expected. Experience on a global scale shows that roundwood provides a hedge against inflation, because prices are growing faster than the inflation. As a forest stand does not necessarily need to be cut at the rotation age, an investor can wait until wood prices increase and then sell it. Investors can obtain much higher revenue from their investments in forestry if the prices for wood rise faster than anticipated.

Other forestry risks have also been encountered in other sectors, for example, poorly organized forest management, which it is possible to avoid with the



**Figure 4.** Number of unwarranted tree cuttings and losses caused by them (thousand EUR) in Latvia, 2000 – 2007

employment of well-skilled experienced professionals. The labour costs would not be a risk in future in the forest sector because at the moment deflation can be observed in Latvia, and labour costs go down (even by 35 %). It should be noted that previously the wages were inadequately high. At the moment the market is stabilizing and the crisis is normalizing the wages in Latvia. As economics is a cyclic process, a sharp wage increase is not predicted in the near future. Increasing labour costs were a case in Latvia before, but not now taking into consideration the latest political decisions. As the investments in forest land deal with more than 80-year horizon it is hard to predict an exact situation in labour costs but the current trend should be taken into account. Due to the fact that it is very difficult to influence public policy decisions, strong and powerful forest industry associations are required to avoid inappropriate forestry law shortcomings and restrictions. One of the possible risks in forestry is overestimation of the future standing volume of timber, which can occur due to the lack of knowledge and a non-professional approach. Awareness of the risks in forestry may improve the basis for making appropriate decisions.

### Conclusions

1. In the literature, is not possible to find a single discount rate for forestry investments.
2. Internal Rate of Return (IRR) could not be defined as a discount rate determination approach. IRR is mostly the owner's or investor's expectation, and it can differ from standard discount rate application in forestry.
3. A series of discount rate approaches offers different discount rate estimating options, but it should be recognized that none of them is universally applicable, and the choice of discount rate approach needs justification and owner or investor should be aware of the margin which is not rational to exceed in particular forest investments.
4. The exact discount rate determination depends on the forest owner's or investor's expectation, risk recognition, and cutting age for each stand, which needs future studies. It is possible to define a margin.
5. The compounding justifies why application of a high discount rate in forestland valuation is impossible. The discounting involves decreasing of a future value to its present value whereas compounding is the reverse. The compounding shows that use of low rates of compound interest lead to a very slow investment growth, which can be observed also in forestry, but high rates of compound interest cause a fast and strong investment increase, which is not typical of forestry processes.

6. When choosing a discount rate for calculating the Net Present Value (NPV) for timberland, the following factors should be taken into account: volume growth, cutting age, future price and cost forecasts, inflation, taxes, subsidies, as well as risks associated with forestry.

7. It is not be advisable to apply a discount rate higher than 7 % in the NPV estimation for all stands of forest holdings in Latvia because the expected return on investments is below this level as well due to its specific features of production: long-lasting production cycle and steady annual growth. Higher interest rates may apply only if future timber prices are expected to increase.

8. In Latvia, the area of forest stands, which are destroyed by windthrows, fire, insect or animal damage, *etc.*, does not exceed 1 %, hence it can be concluded that the risks have minor influence on the forests. Forestry investments are appraised to be relatively secure taking into consideration relevant risk probabilities.

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## ЗНАЧЕНИЕ ДИСКОНТНОЙ СТАВКИ В ОПРЕДЕЛЕНИИ СТОИМОСТИ ЛЕСА В ЛАТВИИ

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Резюме

Многие ученые мира посвятили долгие годы определению стоимости леса. Одним из чаще всего используемых методов определения стоимости леса, является метод чистой стоимости в настоящем времени, где стоимость активов рассчитывается по будущим денежным потокам в текущую стоимость. Слабым местом данного метода является выбор соответствующей дисконтной ставки. Высокие дисконтные ставки снижают стоимость леса. Поэтому анализируются доступные материалы по дисконтным ставкам в лесном хозяйстве, оцениваются методы определения дисконтных ставок, а также сравниваются конкретные вложенные суммы при разных дисконтных ставках с доходом на 1 га саженцев ели, которые просили идентичный начальный капитал. В исследовании констатировано, что дисконтирование предполагает снижение будущей стоимости к ее текущей стоимости при обратной формуле суммарного процента. Графически очевидно, что высокая процентная ставка показывает резкое и нереальное повышение стоимости леса в будущем, в свою очередь низкая процентная ставка предуславливает медленный долгосрочный прирост стоимости. Это более соответствует циклу в лесном хозяйстве, поэтому использование высокой дисконтной ставки в лесном хозяйстве не рационально. Оценивая лес, определение подходящей дисконтной ставки, в первую очередь, обуславливают следующие факторы – цена древесины, затраты, прирост и достижение возраста рубки, поскольку эти факторы определяют, что можно заработать. Рассмотрено также и влияние риска на лесную отрасль, так как потенциальный инвестор предпочитает высокую дисконтную ставку, если будущие доходы будут поставлены под угрозу.

**Ключевые слова:** дисконтная ставка, инвестиции в лесное хозяйство, методы определения дисконтных ставок, суммарные проценты, лесохозяйственный риск.