Investments in small-scale forestry: Comparison between uneven- and even-aged stands in Croatia

Karlo Beljan*, Stjepan Posavec, Filip Koren | University of Zagreb, Faculty of Forestry, kbeljan@sumfak.hr

Keywords: *investment analysis, private capital, NPV, IRR*

Introduction

One of the main characteristics of forests as capital is having a long investment return period (Posavec, 2003, Beljan, 2015). Such an investment characteristic is not always acceptable from a private capital point of view. The internal rate of return (IRR) of state-owned forests in Croatia is within 2-3 % (Figurić, 1996), according to Partaš (1896) it is 3 %, according to Nenadić (1930) at least 1-2 %, Plavšić (1940) 2.5 % at most, Zelić (2006) 1.19 %, Beuk (2012) 1.9 %, Beljan (2015) 2.17 %. Therefore the expected rate of return ranges of 1-3 %. Investment in private forests implies the purchase of a forest property and its management. The aim of the research is to compare the economic effects of investing and managing two private forests of different characteristics. Economic advantages and disadvantages of investing in private uneven- and even-aged forests in Croatia were explored over the next 30 years.

Material and Method

Research area was divided in two parts. In Gorski Kotar region, private uneven-aged forest was analyzed (2,5 ha), while in wider Zagreb area, private even-aged forest was analyzed (3,0 ha). The two forests differ in quantitative and qualitative characteristics (Table 1.), whereas surfaces, although different, were presented on average 1 hectare.

Future management was simulated through MOSES 3.0 (Hasenauer et al., 2006), program package for simulation of growth and forest management. Management simulation for each private forest was done according to the rules of un-even aged and even-aged management. In un-even aged forest a cutting period is 5 years, and cut yield is determined according to Klepac (1953). In even-aged rotation period is 80 years, and cut yield is determined according to Matić (1989). More details on this segment can be found in Koren (2017), Posavec et al. (2017) and Gregur (2017). According to available market data, the assessed buying price of forest property of 0.13-0.54 EUR m^{-2} (1-4 HRK on March 3rd 2017) was used in this analysis. Forest property purchase costs occur once at the beginning of investment period. During the 30-year forest management period the forest owner realizes income from the sale of wood assortments (investor sells standing timber and does not have own machinery and workers). Cutting revenue was analyzed for each year using the Croatian Forests Ltd. price list. Investment analysis based on cash flow was made using the NPV- net present value (Klemperer, 2003) and IRR - internal rate of return (Damodaran, 2002). All elements of analysis were regarded in the 30-year time frame. During the analysis, a referent constant discount rate was used, which according to Beljan (2015) for Republic of Croatia forestry amounts to 2 %, although the possibility of applying 1-3 % rates was examined.

Table 1. Average initial assortment structure and financial value of forest stands

Timber assortments	Uneven-aged	Even-aged	Uneven-aged	Even-aged
	[m^3 ha^{-1}]		[EUR ha^{-1}]	
Veneer	2.42	49.11	239,69	6.988,94
Peeled veneer	3.02	40.93	168,94	1.811,37
Sawlog 1st	29.7	96.49	1.824,40	4.704,90
Sawlog 2nd	25.06	106.74	1.020,45	3.413,84
Sawlog 3rd	17.75	67.34	515,54	1.606,18
Thin roundwood	18.4	21.62	614,38	375,58
Long-meter firewood	18.27	36.28	318,24	531,50
One-meter firewood	101.36	192.76	1.544,67	2.115,27
Timber waste	132.58	97.36	1.634,91	1.024,60
Σ	348.56	708.63	7.881,20	22.572,19

Results

Cash flow comparison (Figure 1) is shown at the level of 1 average hectare. Dynamic of cash flow is direct result of simulated management plan. The cash flow from an uneven-aged private forest is more stable due to approximately constant cut of accumulated increment. However, even-aged forests have greater cash flow oscillations (Figure 1). Although the initial characteristic of even-aged forest is homogenous, the cash flow oscillations are the result of planned establishment of normal forest (normal balanced forest which is complex of stands with all ages, from 0 to 80 years). Even though on the surface of merely 3,0 ha is not possible to renew ideal normal forest, so in some time periods the investment profit is not expected (Figure 1).

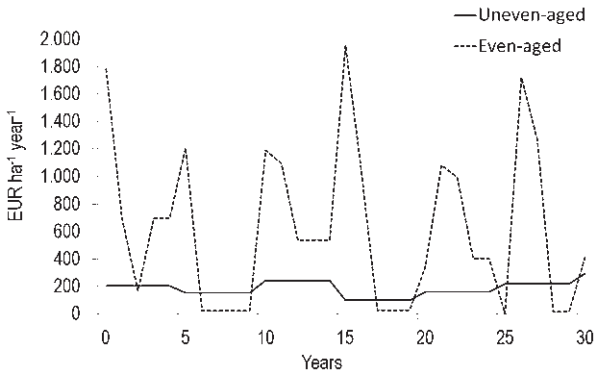

Figure 1. Cash flow

Using the basic economic analysis (Net Present Value), differences between investing in different forest stands were established (Table 2). From cash flow comparison (Figure 1) and qualitative characteristics of stands (Table 1.) it was shown that, as expected, even-aged stand is economically more favorable.

Table 2. Comparison of net present value with different forest property buying price and different discount rates

Investment cost [HRK m^{-2}]/[Eur m^{-2}]	UA*	EA**	UA	EA	UA	EA
	Discount rate					
	1 %		2 %		3 %	
1 / 0.13	3.530	15.182	2.908	13.212	2.402	11.593
2 / 0.27	2.183	13.834	1.561	11.864	1.054	10.245
3 / 0.40	835	12.486	213	10.516	-294	8.897
4 / 0.53	-513	9.791	-1.135	9.169	-1.641	6.202
5 / 0.67	-1.860	9.791	-2.482	7.821	-2.989	6.202
6 / 0.80	-3.208	8.443	-3.830	6.473	-4.336	4.854
7 / 0.94	-4.555	7.095	-5.177	5.125	-5.684	3.506

UA* uneven-aged, EA*even-aged

From the results of net present value (Table 2) and internal rate of return (Table 3), a decision can be made about higher or lower cost-effectiveness of investing in uneven-aged or even-aged stand.

Table 3. Internal rate of return

Investment cost [HRK m^{-2}]/ [Eur m^{-2}]	IRR	
	UA*	EA**
1 / 0.13	16.1	>100
2 / 0.27	6.0	60.3
3 / 0.40	2.3	23.9
4 / 0.53	0.3	14.9
5 / 0.67	<0,1	10.7
6 / 0.80	<0,1	8,01
7 / 0.94	<0,1	6,14

UA* uneven-aged, EA*even-aged

Although a wide range of potential buying prices of private forest was examined, IRR results can seem unrealistic (Table 3). It is important to emphasize that the price is defined by supply-demand relationship. For example, in this research in even-aged forest the IRR is 2,6 % with buying price of only 10 HRK m^{-2}/1,34 Eur m^{-2}.

Discussion

Initial differences of uneven-aged and even-aged stand are big and evident. Differences in growing stock are double, and in financial value triple (Table 1.). It can be assumed that buying price would be in that ratio (1:3 for even-aged forest). Stands of said characteristics attain average prices on actual local market of 2 HRK/0.27 Eur m^{-2} for uneven-aged and 6 HRK/0.80 Eur m^{-2} for even-aged stand. Realistic projection of economic cost-effectiveness and difference between investments should be made based on assumption that investment costs will have the aforementioned ratio. In Table 2, highlighted gray fields show which values to compare in order to obtain correct economic conclusion. With 1 % discount rate, NPV is higher at 3.8 (3.8=8.443/2.183), with 2 % the rate is 4.14, and with rate of 3 % it is 4.6 times bigger in favor of even-aged stand. It can be noted that investment in even-aged stand, which is three times more expensive, results in revenue bigger than the investment difference. In Croatia, investor can have influence on forest purchase price (through negotiations with seller), but has no or very small influence on market price of the produced product (logs, assortments) due to the fact that Government is defining prices. This is supported by the fact that it is not rare that state administrations regulate prices through their mechanisms (Leefers and Ghani, 2014, Beljan et al., 2017). Investment costs are the major factor that dictates the cost-effectiveness of investment. In other words, unrealistically large investment cost cannot be substituted by produced wood assortments. It is almost impossible to define realistic buying price that

mostly depends on the wood assortments market. IRR is under great influence of investment size, i.e. buying price, so the investor's ability to negotiate prices is crucial for all economic results. Along with the cash flow (Figure 1) that is the result of standing timber sales, other income sources can be considered: hunting, gathering of non-wood forest products, that can only have positive influence on financial projection of investment. Also, potential investors should consider the fact that in the Republic of Croatia there is a measure no. 8.5 currently in effect in form of *Subsidies for investment in improving the resilience and environmental value of forest ecosystems* (NN, 30/2015) which can be used by 2020 to finance works in private forest properties. It is clear from the literature that the expected IRR is within 1-3 %, but in this article as well as in practice there are cases of many times larger IRR.

Conclusions

Based on the conducted research, it is possible to conclude that in comparison of two studied stands, even-aged stand provides more favorable economic effects for the investor. The reason is that in this stand, more financially valuable wood assortments can be produced. This conclusion is not unique and universally applicable. It is valid in case when an investor is willing to invest a three times larger amount in order to obtain described economic advantages. Moreover, it should be emphasized that there are stands of various economic potentials present on the market that can generate higher or lower profit from the one shown here, as well as stands that have potential for larger income from non-wood forest products and services. However, current investment of capital into private forests in Croatia represents and investment with low risk premium and relatively high internal rate of return.

References

Beljan, K., 2015. Economic analysis of even-aged silver fir (*Abies alba* Mill.) forest management (in Croatian with English abstract). PhD thesis. University of Zagreb, Croatia, 166 p.

Beljan, K., Posavec, S., Orsag, S., Teslak, K., 2017. Simulation model for prediction of timber assortment price trends in Croatia - a case study of Forest Office Brinje. Drvna industrija 68(2), 145-152. doi:10.5552/drind.2017.1643

Beuk, D., 2012. Hunting in the integrated management of Spačva forests (in Croatian with English abstract). PhD thesis. University of Zagreb-Faculty of Forestry, 216 p.

Damodaran, A., 2002. Investment valuation - Tools and Techniques for Determining the Value of *Any* Asset, John Wiley & Sons, Inc. New York, 992 p.

Figurić, M., 1996. Introduction to economics of forest resources (in Croatian), Šumarski fakultet Sveučilišta u Zagrebu. Zagreb, 343 p.

Gregur, J., 2017. Investment analysis of capital investment in small-scale even-aged forest estates (in Croatian). Master thesis. University of Zagreb-Faculty of Forestry, 35 p.

Hasenauer, H., Kindermann, G., Steinmetz, P., 2006. The tree growth model MOSES 3.0. In: Sustainable forest managemet growth models for Europe (Hasenauer, H. ed., Springer, Berlin, 64-70 p.

Klemperer, D.W., 2003. Forest Resource Economics and Finance, McGraw-Hill. 551 p.

Klepac, D., 1953. Several formulas for the intensity of logging (in Croatian). Šumarski list 77(9-10), 373-385

Koren, F., 2017. Investment analysis of capital investment in small-scale forest estates (in Croatian). Master thisis Master thesis. University of Zagreb-Faculty of Forestry, 26 p.

Leefers, A.L., Ghani, A.N.A., 2014. Timber pricing. In: Handbook of Forest Resource Economics (Kant, S. and Alavalapati, J. eds.), Routledge, Great Britain, 81-96 p.

Matić, S., 1989. The intensity of thinning and its impact on the stability, productivity and regeneration stands of oak (in Croatian). Glasnik za šumske pokuse 25(261-278

Nenadić, Đ., 1930. A productive factors and profitability of forest economy (in Croatian). Šumarski list 54(5), 209-225

NN, 30/2015. Subsidies for investment in improving the resilience and environmental value of forest ecosystems (in Croatian). Official Gazette 30/2015

Partaš, I., 1896. The internal rate of return of invested capital in the woods (in Croatian). Šumarski list 20(6), 205-210

Plavšić, M., 1940. Accounting and profitability of forest economy (in Croatian). Glasnik za šumske pokuse 7), 313-434

Posavec, S., 2003. Bussiness analysis characteristic in management of renewable natural resource-forest (in Croatian). Master thesis. University of Zagreb, Faculty of Economics and Business, 132 p.

Posavec, S., Beljan, K., Koren, F. Justification of capital investment in small-scale uneven-aged forest estates. *In:* Dudik, R., ed. More wood, better management, increasing effectiveness: starting points and perspective, May 24th-26th, 2017 2017 Prague, Czech Republic. WoodEMA, 161-169.

Zelić, J., 2006. Calculating the value of standing timber (forest tax) in regular stands of Sessile oak (in Croatian with English abstract). Šumarski list 130(3-4), 113-124