

# V-value optimization method for forest planning

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# Background

- traditions in Finnish private forest planning ignore economic analysis
- foresters are striving for good silviculture aiming at maximum production of timber
  - this idea has been also strongly followed in private forest planning
- however, the field of forestry is becoming more liberal and new kinds of services are right now under development work

# Optimization in forest planning

- forest planning is optimization by its nature
- a lot of mathematical programming and heuristic optimization applications have been developed
- however, it is a demanding task to formulate the optimization model in real planning cases
- need for easily understandable, transparent, straightforward and robust methods and user interfaces for practical planning

# Goal of this study

- develop a method for incorporating economic analysis in private non-industrial forest planning
- the idea is to integrate calculating of V-values and a forest simulator
- the method is aimed at supporting private non-industrial forest owners' decision making

# V-value

$$v = I_a - p(A_t + A_l)$$

- where
  - $I_a$  is the value increment (€/ha) of the stand,
  - $p$  is the rate of return (%) offered by the alternative investment object
  - $A_t$  is the timber value of the stand (€) and  $A_l$  is the value of the bare land (€).
- in the standard version of the method the value of bare land is not included into the v-value calculations, because the option to sell the land is excluded
- furthermore, market value of bare land is small

# V-value optimization

- one can calculate the v-values of individual forest stands for any forthcoming year
- v-values are calculated in the midpoints of the sub-periods of the overall planning period (for example 3 + 5 + 5 years)
- decision rules:
  - open forest land areas: Reforestation is proposed in all cases according to the Finnish main stream practices.
  - young and middle aged forest stands: Treatments are proposed in all cases where the minimum requirements for the thinnings are fulfilled.
  - mature stands: Regeneration cutting is recommended for the first sub-period having negative v-value and after that the stand is treated according to the forest management recommendations

## Illustrating stand level V-values for the forest owner

Stand number	Area, ha	Age, years	V-value					Treatment scheme
			1 %	2 %	3 %	4 %	5 %	
5	1,1	43	298	236	174	112	50	Thinning
10	0,3	68	47	22	-4	-30	-55	Clear felling, Hummc
11	2,1	58	240	98	-44	-186	-328	Clear cut with stand:
12	0,5	68	31	-7	-45	-82	-120	Clear cut with stand:
13	4,6	73	637	290	-56	-402	-748	Seed tree cut, Scalpi
14	3,4	68	614	339	64	-211	-486	Clear cut with stand:
15	1,5	14	207	200	193	185	178	No treatments
16	0,4	20	64	60	57	54	51	No treatments
17	0,4	33	47	37	26	15	5	No treatments
18	0,7	78	129	79	29	-21	-71	Seed tree cut, Scalpi

# Illustrating stand level cutting income

Stand number	Area, ha	Age, years	Timber selling income					Treatment schedule
			1 %	2 %	3 %	4 %	5 %	
5	1,1	43	2323	2323	2323	2323	2323	Thinning
10	0,3	68	0	0	2559	2559	2559	Clear felling,Hummocking,Spi
11	2,1	58	0	0	13742	13742	13742	Clear cut with standards,Hum
12	0,5	68	0	3597	3597	3597	3597	Clear cut with standards,Hum
13	4,6	73	0	0	24697	24697	24697	Seed tree cut,Scalping
14	3,4	68	0	0	0	26364	26364	Clear cut with standards,Hum
15	1,5	14	0	0	0	0	0	No treatments
16	0,4	20	0	0	0	0	0	No treatments
17	0,4	33	332	332	332	332	332	Thinning
18	0,7	78	0	0	0	3547	3547	Seed tree cut,Scalping



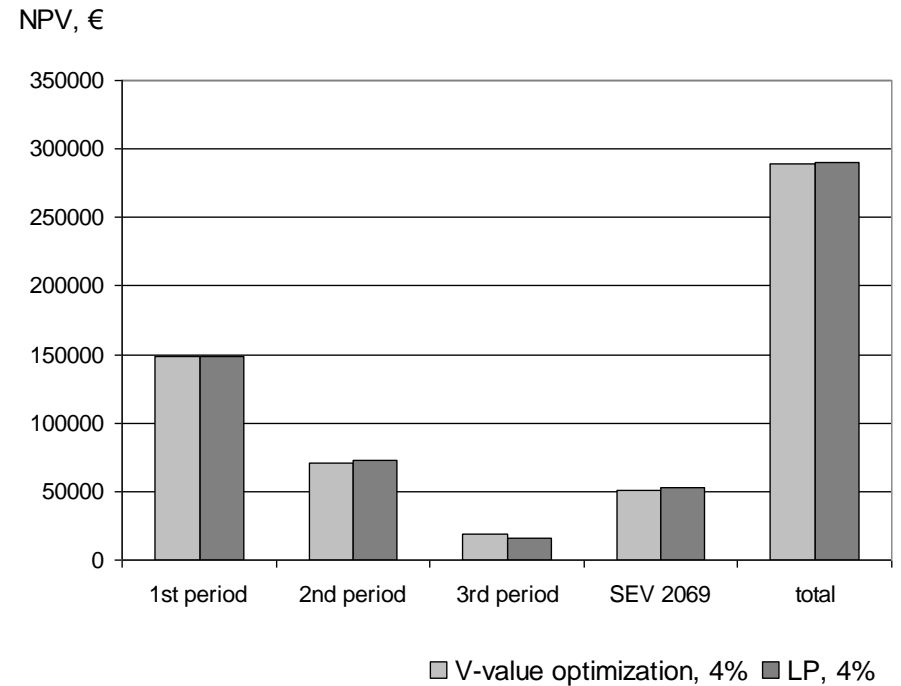
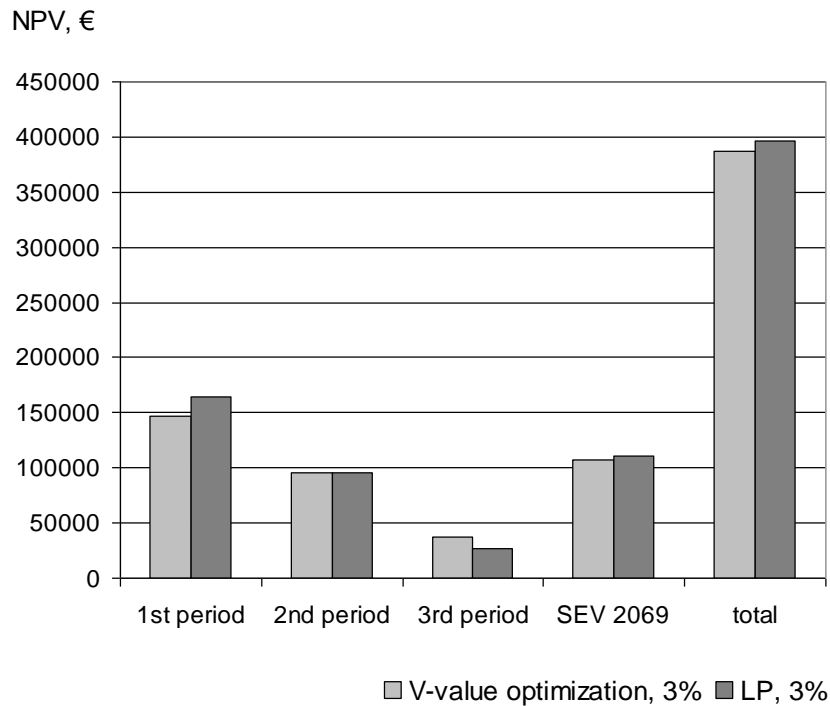
# Planning example

- 120 hectares of forest
- 5 + 10 + 10 years planning period
- optimizing cash flow
- 1,2,3 and 4 % interest rates
- the first period is the most important from the decision support point of view
- the second and the third period must be seen as an overview of the possibilities offered by the forest ownership due to uncertainties included into the calculations
- however, the overall cash flow helps strategic thinking of the forest ownership

## Cash flows and internal rates of return

	interest rate	1 %	2 %	3 %	4 %
SEV 4%	<u>2009</u>	-462000	-462000	-462000	-462000
net income	2010-2014	8913	16948	68943	101793
net income	2015-2024	86654	139898	165974	151636
net income	<u>2025-2034</u>	44500	83833	73842	87091
SEV 4%	<u>2034</u>	724000	625000	521000	469000
IRR	2009-2034	2,70 %	2,92 %	3,07 %	3,11 %
<b>Cash 2034, no reinvestment</b>		140067	240679	308759	340520
<b>Return of reinvestment, €</b>		18943	68316	172792	286617
<b>IRR, reinvestment</b>		2,79 %	3,25 %	3,93 %	4,50 %

# Comparison to linear programming, 3\*20 years planning period



# Conclusions

- V -value optimization is a transparent, straightforward and robust method for economical optimization of forest use
- it is easy to understand for the forest planners and the forest owners which makes it a promising approach for practical applications
- due to its "local nature" it is especially suitable for continuous planning; no long simulation periods are needed
- development work going on: a WEB based service for continuous planning

**Metsänomistajan tiedot**  
 nimi Olli Omistaja  
 osoite  
 puhelin  
 sähköposti

**Alueen tiedot**  
 pinta-ala 81,6  
 kiinteistö(t)  
 kunta ja kylä

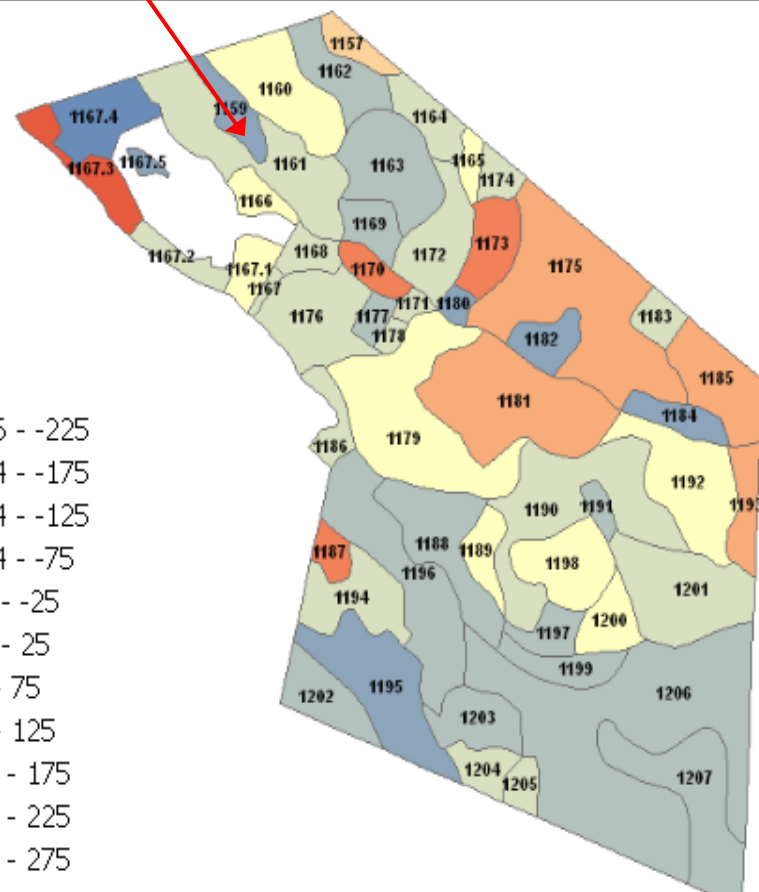
## V-values

[Ohje](#) [Tulosta raportti](#)

Yhteenveto V-arvot Kantorahatulo Hinnat Toimenpideilmoitus

### Puuston kasvatuksen vuotuiset voitot ja tappiot verrattuna vaihtoehtoisiin sijoituksiin

1167,3	1,1	86,3	91,08	-7,7	-106,48	-205,26	-303,93	Avohakkuu säästöpuin, Kaiv istutus
1167,4	1,4	25,3	362,32	340,34	318,36	296,24	274,26	Ei käsitellä
1167,5	0,2	39	53,34	46,42	39,5	32,58	25,66	Harvennus
1168	0,5	42	56,05	46,3	36,55	26,8	17,05	Harvennus
1169	0,7	37	161,49	136,57	111,65	86,73	61,81	Ei käsitellä
1170	0,4	80,7	45,68	8,84	-28,04	-64,88	-101,76	Avohakkuu säästöpuin, Kaiv istutus
1171	0,2	29	16,7	14,84	12,96	11,1	9,24	Ei käsitellä
1172	1,6	62	299,04	236,64	174,24	111,84	49,44	Ei käsitellä
1173	1,1	87	102,19	14,41	-73,37	-161,15	-248,93	Avohakkuu säästöpuin, Kaiv istutus





Thank you!

Contact information

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