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## The Income Approach Combined with Market Prices in Forest Property Valuation

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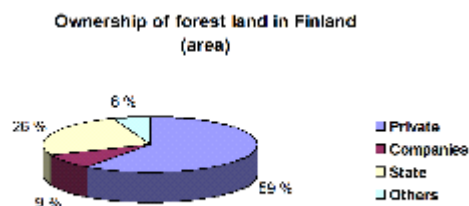
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## Non-industrial forest ownership in Finland from the viewpoint of real estate markets



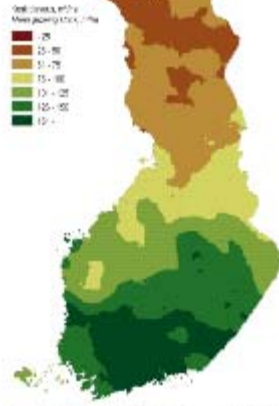
- Some 440,000 families own forest real estates,
- The average private forest owner has 26 hectares.
- Wood production is the most important mode to utilize forests

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## Mean growing stock in Finland



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## The Purchase Price Register of Real Estates by The National Land Survey of Finland

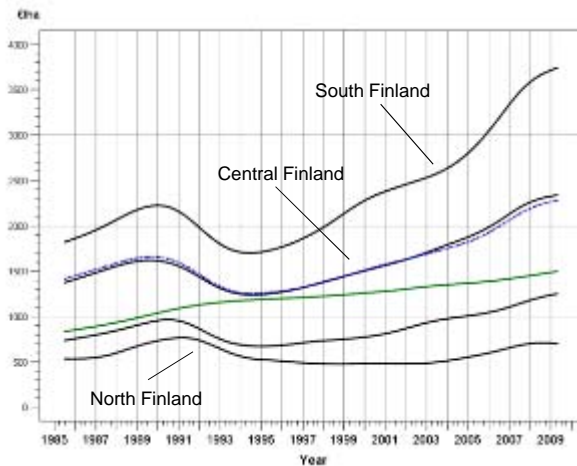
- In recent years, the number of forest property sales has been about 2 500 - 3 000 annually.
- Almost all sales offers come from private ownership, ten percent of buyers are others than private people.
- Donations and sales between relatives are, however, the most common form of exchange between private people and they amount to 12 000 – 15 000 transactions per annum.
- The average price in Finland during the last years of the 2000s has been around 2 000 €/per hectare.
- The stand volume per-hectare of sold properties has in average been 30% lower than in private forests.

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## The sales of forest real estates in Finland



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## Finnish tradition of forest property valuation

- The tradition of the summation approach, an application of the long-term income approach, has been used to value forest properties since the 1920's in Finland.
- Based on the formula for calculating what is known as the bare land value (Faustmann 1849)
- In the summation approach, the value of a forest property is calculated from stand-specific sub values:
  - value of the bare land after the final cutting
  - the expectation value of the seedlings and young stands
  - The cutting value (on the basis of timber volume and their wood assortments and the stumpage prices)
- By the summation of these four sub values we arrive at the sum total.

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## The Market Oriented Income Approach

- A "new" market oriented income approach, first suggested and in line Heyer (1887), combines cash flow, discount rates and present values to market prices. Market prices and discounted cash flow during one rotation should be equal.
- First, how should the discounting rates be estimated and secondly applied in forest real estate valuation?
- First analysis has been done using the internal rate of return method.
- The investments were the actual transaction prices and income series was estimated using the cutting budget for a desirable growing stock (1995).
- The idea to classify real estates by the average volume mainly means that the lower the average growing stock on the property, the longer the expectation time of incomes.

## Calculations with IRR method

IRR (Internal Rate of Return) is the rate at which the project NPV equals 0. It also provides the expected return rate of the project, assuming certain conditions are met. In other words, if  $C(n)$  is the cash flow for each period, then

$$NPV = C(0) + C(1)/(1+r) + C(2)/(1+r)^2 + \dots + C(n)/(1+r)^n \quad (1)$$

Replacement

$$NPV = MV \text{ (Market Value)}$$

$$MV = C(0) + C(1)/(1+r) + C(2)/(1+r)^2 + \dots + C(n)/(1+r)^n \quad (2)$$

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### Study materials

Empirical study material of 250 sales of forest properties in southern Finland in 1995 classified using the average amount of growing volume.

Volume of growing stock, m <sup>3</sup> /ha	Total area ha	Forest land ha	Number of transactions	Average size, ha
under 40	987	965	40	25
41-80	1 848	1 836	68	27
81-120	1 836	1 808	73	25
121-160	745	740	36	21
161-200	356	345	18	20
over 200	236	231	15	16
<b>Total/average</b>	<b>6 008</b>	<b>5 925</b>	<b>250</b>	<b>24</b>

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### Study materials

Empirical study material of 197 sales of forest properties in southern Finland in 2006-2007 classified using the average amount of growing volume.

Volume of growing stock, m <sup>3</sup> /ha	Total area ha	Forest land ha	Number of transactions	Average size, ha
under 40	1 021	969	40	19
41-80	2 135	1 925	67	27
81-120	1 829	1 785	61	24
121-160	530	524	16	21
161-200	261	260	10	22
over 200	41	40	3	10
<b>Total/average</b>	<b>5 818</b>	<b>5 503</b>	<b>197</b>	<b>23</b>

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## Results

Southern part of Finland						
Year	1995			2006-2007		
Volume of growing stock, m <sup>3</sup> /ha	Obs, n	Price, €/ha	Rate of return, %	Obs, n	Price, €/ha	Rate of return, %
under 40	40	780	5,7	40	1 742	3,6
41-80	68	1 029	8,5	67	2 241	5,0
81-120	73	1 408	8,1	61	2 812	5,4
121-160	36	2 059	8,4	16	3 363	6,2
161-200	18	2 609	10,6	10	3 678	7,5
over 200	15	3 451	13,1	3	7 081	8,8

## Results

- What the recommendation for the income approach in forest property valuation means is to use a high discount rate for the first years, or decades, and then lowered rates for more distant periods.
- The classical discounting methods using a constant rate do not determine the market price of forest properties
- Investors behave differently than assumed on the perfect capital markets. That's why Faustmann's summation approach with low and constant rates, like it has been applied in Finland, does not explain market prices.
- The subjective rate of the investors seems to depend on the length of the time horizon (See Portney & Weyant, 1999 and Manley, 2001).

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## Preliminary thoughts

- Investing in forest properties seems to follow human aspects like
  - greediness
  - risk
  - lack of market information and
  - motive to inheritance
  
- The first three explains high and instant needs in rates and gains. The fourth alternative indicates willingness to invest for the next generation.

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## Development of an expert system at the National Land Survey of Finland

- The target is to develop new applications, hybrid using income approaches and market based data material as reference.
  
- Input data is based on inventoried forest stand characteristics, simulated growth models by sites and main tree species, stumpage prices of round wood assortments and costs in silviculture.
  
- As output you get the estimated future net cash flow and market values.
  
- The market values are calculated using the market oriented discount rates, depending on the time horizon. The important known factors are the expected net cash flow and waiting periods in years. As the discount factors have been estimated from market prices, they can be applied to all expected incomes from any forest real estate (forest stand) to estimate the probable market price of the whole forest property.

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## Development of an expert system at the National Land Survey of Finland (cont.)

- The method meets the requirements for the comparison approach in the sense that the internal logic of price formation is sought from reference material and the interest solution also corresponds to the recommendations of The International Valuation Standards (IVSC 2007).
- The system is built to be transparent in order to ensure reliability and to utilize and monitor the market information available in the real estate market price register (NLS).
- An entity based on the same valuation principles can be transferred to countries where the value of forest properties is mainly based on forestry and where information about property deals are available.
- Market Value must be recognized as the fundamental basis of valuation.

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**Thank you for your attention !**

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