The Relevance of FAUSTMANN Calculations in Public Forests of Hesse, Germany

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Overview

1. Question: Why are FAUSTMANN calculations of little importance for forest management decisions in Hesse?
2. Material: Framework conditions – productivity figures – LEV
3. Approach
   - 3.1 Choice of tree species
   - 3.2 Rotation period
   - 3.3 Thinning models
   - 3.4 Marketing of nature conservation services
   - 3.5 LEV and forest market value
4. Conclusions

Contribution of a practitioner – inspiration for a practice-orientated research.

Framework Conditions for Forestry

- Total Land Area of Hesse: 21,115 km²
- Densely populated: 288 inhab./km²
- Rich in woodlands: 42% forest area
- A high GDP: € 42,300/inhab.
- High proportion of public forests:
  40% State- and 35% communal forests
- A complex system of social welfare-orientated management objectives.
- Close-to-nature and multifunctional managed forests.

Natural Productivity Figures (State Forest)

- Woodland Composition: 12% oak – 40% beech – 28% Norway spruce – 20% Scots pine
- Average age of woodlands: 80 y. – A fairly balanced age structure.
- High growing stock volume: 287 m^3/ha
- Long rotation periods: e.g. oak: 200 y., Douglas fir: 100 y.
- Average current increment: 8.7 m^3/ha/y.
- MAI_{max} [m^3/ha/y.]: oak: 4.5, Douglas fir: 13.4.
- Timber quality (mainly): oak: valuable sawlog timber - spruce, Douglas fir, Scots pine: mass assortments.
- Risk of premature loss by calamities: Highest: Norway spruce, lowest: Scots pine.
- Mean stumpage value: oak: €11,200/ha (highest)– Norway spruce: € 9,900/ha - Scots pine: € 6,200/ha (lowest)

Internal Rate of Return on Capital

Tree Specie	Rotation Period [y]	Yield Class MAI_{max} [m³/ha/y]	Stumpage Value Final Cut [€/ha]	Σ Value of Thinnings [€/ha]	Market Value of Soil [€/ha]	Establishment Costs [€/ha]	Management Costs [€/ha/y]	**Internal Rate of Return [%]**
Oak	180	4,5	25856	17000	4000	8000	143	**0,22**
Beech	140	6,7	16623	11798	4000	2000	129	**0,40**
Spruce	100	10,9	23871	10433	4000	1500	150	**1,02**
Douglas Fir	100	13,4	29023	16523	4000	3000	160	**1,34**
Pine	120	7,2	11481	7079	4000	4000	133	**0,09**

LEV - Forest rent - Capitalized Forest Rent - Woodland Market Price – Return on Investment

Tree specie	Land Expectation Value	Forest Rent		Market Price for Woodlands		**Return on Investment**
			Capitalised			
	[€/ha]	[€/ha/y]	[€/ha]	[€/ha]	σ [€/ha]	**[%]**
Oak	-12800	51	1688	10000	+/-14000	**0,5**
Beech	-5200	60	1990	10000	+/-14000	**0,6**
Spruce	-550	173	5768	9700	+/-5900	**1,8**
Douglas Fir	+3200	265	8849	9700	+/-5900	**2,7**
Pine	-8900	-12	389	8700	+/-6900	**-0,1**

Optimal choice of tree specie?

FAUSTMANN: Replace low profitability species by those with highest LEV. – Prefer to buy forests with the highest return on investment.

Why not?

- Public forests with multi-dimensional and complex objective settings, many non-operational restrictions.
- FAUSTMANN: optima only for stands or partial optima for enterprises – overall optima found by iterative (communicative) procedures (→cost-benefit analysis, AHP, DEXI, SWOT).

Further specifications: →

Optimal choice of tree specie?

Further specifications

- Management principles: Sustainability – profitability – stability – diversity – ability to adapt.
- Tree species composition given by the parliament to meet social welfare objectives: Large proportion of species with a low profitability – mixed stands, no large scaled clear-cuts.
- 10% of the forests: Conservation objectives are to be given priority with promotion of native broadleaved species.
- 15% of the forests are part of NATURA 2000 network with a general ban on deterioration.
- Changing environmental conditions: Promote adaptable tree species, profitability of secondary importance.

Optimal rotation period?

Spruce 60 y.

Spruce 120 y.

Financially optimal (BEINHOFER, 2007):

- Average risk, PCT thinning regime, i: 1,5%: **60 y.**
- No risk, no claim of interest: **120 y.** = **reality** in public-owned forests.

It is a paradox that rotation periods and growing stock volume are increasing in spite of the decreasing profitability of forestry enterprises (MOOG, 1999).

Optimal rotation period?

Rotation periods longer than the financial optimum can be declared rational if a multidimensional approach is adopted, instead of one-dimensional or partial explanatory models.

Vehkamäki (2008a): On a more holistic level mathematical (non-linear feedback effects) and epistemological problems are involved.

Problem: As models become more complex, they become less convincing for practitioners.

An explanatory approach: →

(I) Longer rotation periods in reality- why?

- ✓ Good forestry practice is negotiated within society (→ theory of communicative action, HABERMAS).
- ✓ Ethical implications: Forests that our ancestors had built up under hardship will not be reduced in their multifunctional capabilities by a rich country without good cause.
- ✓ Optimisation calculations for single stands fail when they are transferred to the level of a sustainable structured forest enterprise.

(II) Longer rotation periods in reality - why?

- ✓ Multi-story-structured forests (all timber assortments, natural regeneration) are only gained by silvicultural systems with long rotation periods.
- ✓ The ecological and recreational value of a forest increases with its age.

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(III) Longer rotation periods in reality - why?

- ✓ Establishment costs for a 200 y. old oak stand invested before a number of monetary reforms do not influence today's harvesting decisions.
- ✓ Long prediction time – uncertain demands in the future. Many examples for a change of objectives:
  - ✓ *Oak stand established in 1809 for fire wood & pig fattening, today a natural forest reserve.*

(IV) Longer rotation periods in reality - why?

- ✓ The longer the rotation period, the greater the extent to which time preference (interest rate), loses its significance (i.e. oak, rotation: 200 y., i: 1,5% or 3%: → same LEV).

(V) Longer rotation periods in reality - why?

- ✓ A purchaser of a forest is conscious of its low profitability.
  - ✓ Non timber production motives are often prevalent.
  - ✓ Purchasing price is much higher than LEV or forest rent.
  - ✓ Derivation of a calculatory interest rate from an alternative investment is questionable.

Germany: 44% private forests;
66% of that are small holdings (< 10 ha)

- ✓ "Saving bank function" of small-scale privately-owned forests in rural areas.
  - ✓ Timber of different size classes ("Plenterwald") is stored up for uncertain times.
  - ✓ Very seldom: Liquidation and reinvestment into more profitable assets.
  - ✓ A traditional form of risk protection for economic emergencies (→ portfolio theory).
  - ✓ Recommended also for larger forestry estates (DUFFNER, 1999).

Optimization of thinning models – Practitioners perception

- ✓ Recommendation depends decisively upon the assumed interest rate.
- ✓ The differences in net present value for different variants are so low that the slightest change of premises or unpredictable developments alter the ranking.
- ✓ Important side conditions are often not taken into account (e.g. stability, number of PCT/ha)

Optimization of thinning models –Practitioners conclusion

On the basis of forestry experiences gathered in the past

- within a certain framework –

The greatest possible diversity in conduct should turn out to be **optimal**,

according to regions, sites, thinning models, the protagonists and their different preferences.

(I) New optimization challenge: Marketing of nature conservation services

- Hessian Compensation Directive: Anyone who disturbs the ecological balance of an area through construction measures is obliged to perform a compensation measure.
- Possible compensations in forests: e.g. reconstruction of site-adopted native woodlands, long-term preservation of mature native woodlands until the decaying phase.

(II) New optimization challenge: Marketing of nature conservation services

- For what price should the forest owner supply the service? – At least the difference to the profit from an optimal profit-orientated forest management (MÖHRING, 2008).
- Alternative according to the Compensation Directive for a native woodland, in future unmanaged:
  - Conservation value of the woodland, calculated as a point score according to ecological criteria.
  - Sum of point scores x 0,35 €/m² of forest area (recommended price).
  - Amount: 4 to 5 times as high as the net present value of a mature stand from timber production!

(III) New optimization challenge: Marketing of nature conservation services

The altered situation shows the following difficulties with applying dynamic investment calculations in the common way:

- The market value of a forest is increasingly determined by its ability to supply conservation services.
- The ability is not timber-yield but growing-stock-volume-oriented.

(IV) New optimization challenge: Marketing of nature conservation services

The increased demand for conservation services points to an unsolved complex national economic optimisation problem:

- The more forest owners are orientated towards profit-making, the greater the expectation of society that they should supply conservation services as a way of making reparation to nature.
- The profits made by public forest owners are marginal in comparison to the public sector expenditure in the field of conversation.
- The timber balance, already negative, must in the long-term be compensated by increase of timber imports.

(I) LEV and forest market value

- LEV is for most forests negative and no decision factor for determining its market value. – Market value is also considerable higher than the capitalized forest rent (CFR).
- Location factor is decisive: The higher the population density the higher the price (up to 7 times higher) although forests can not be converted into a higher quality type of usage.
- Extremely high standard deviation of woodland prices.

(II) LEV and forest market value

- Conclusion: Woodland prices can only be explained to a very limited extent by its profitability.
- Deduction from price difference to CFR of **small** woodlands (< 5 hectare): Proportion of value of non-timber related purchasing motives is between 1.5 and 20-times above CFR.

(III) LEV and forest market value

- How to gain a better understanding of woodland purchasers' behavioural pattern?
  - By means of an investment theory explanatory model in accordance with the paradigm of Darwinism?
- Hypothesis: The currency of overall fitness exceeds the time-scale of one's own existence (sustainability concept) and goes well beyond the profit-maximization concept of the neo-classic economy.

(I) Conclusions

LEV is of little importance for steering public forests in Hesse because of:

- A complex system of target settings.
- Very long production times whilst dissolving the question of time preference.
- A strict sustainability concept which shows its importance as prognosis for the future (e.g. climate) is extremely uncertain.
- Many management constraints by conservation directives.

(II) Conclusions

- Investment calculations supply only partial optima – emergence problems arise from the transition from the stand to the forestry enterprise level.
- Calculation results depend decisively upon the assumed interest rate, other calculation and unpredictable factors – a high volatility in the results and often contradictory recommendations which confuse practitioners.
- Conservation services from forests become marketable to prices which can exceed income from timber production considerably.
- Often precedence of non-timber production related purchasing motives for woodlands.

(III) Conclusion

- "We feel and know that forests consists of more than trees".
- An appeal for a more practice-orientated research.
- Forest economists and practitioners should meet more regularly.

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Thank you for listening!

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