Operations Review of the German State Forest Office Wald-Michelbach

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Abstract

Forest owners in Germany, independent from category of ownership, have gone through a deep economic crisis for some years already, which results from increasing costs by at the same time declining incomes. However, despite difficult economic frame conditions, there are a few forest offices in Germany that have achieved very satisfactory operating results. To illuminate how this could be achieved, the state forest offices Wald-Michelbach and Beerfelden have been selected for an operations review. This study shows that the favourable financial outcome of the state forest office Wald-Michelbach results from various measures applied, all of which contribute to a high rate of operation optimization.

key word: German forestry, operations review, economic crisis, sustainability

Introduction

The financial results of most German forest offices is very unsatisfactory in recent years. The main reasons are both stagnating/declining wood prices by at the same time increasing direct and indirect labour costs. As a result, German forestry runs the risk of being unable to sustain profitable wood production, which is one of its main targets (2. Wissenschaftlicher Beirat beim Bundesministerium fuer Landwirtschaft, Ernaehrung und Forsten, 1995).

A compensation for so far free environment protection and recovery services provided by the forest owners to the public could bring some financial relief. However, a final decision cannot be expected soon, because beneath other reasons, there is still an acknowledged evaluation method missing to convert the public benefits into monetary categories.

Therefore, to give an example what kind of steps and measures forest owners could take by themselves to improve their financial results, the state forest office Wald-Michelbach was chosen for an operations review. This forest office, which is located in the south western German chain of mountains called Hessischer Odenwald, has already for many years achieved very satisfactory operating results. The adjacent state forest office Beerfelden was chosen for comparison, because despite of very similar natural conditions such as age-class proportion, tree species composition and site quality, financial results achieved were very unsatisfactory.

2. Materials and methods

2.1 Materials

The annual operating statistics, annual reports of the belonging state forest administration, forest management plans and wage statistics have provided the basic data for this operations review. Further, written and oral statements by the head of the forest office Wald-Michelbach provided the necessary background information.

2.2 Methods

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Three comparison procedures were applied in this operations review, firstly, a comparison of theoretically calculated allowances available from forest management plans with real results, secondly, a time comparison for the period from 1987 to 1994 and finally, an enterprise comparison (2. Loeffelholz, 1980 ; 3. Woehe, 1986 ; 4. Speidel, 1984 ; 5. Sagl, 1990 ; 6. Gabler Wirtschaftslexikon, 1988). To be able to compare two enterprises with each other, the basic conditions should be similar. Therfore, natural conditions, short -term unchanging conditions and changeable factors are introduced in the following.

2.3 Short-term unchanging conditions and changeable factors

Short-term unchanging conditions include site quality, timberland, age-class and tree species proportion, growing stock and increment.

Site quality of both forest offices is considered to be very similar, providing sufficient water and nutritive substances. Timberland[1] area is 2,999 hectares (ha) in Wald-Michelbach (WM), which is about 700 ha larger than that of Beerfelden (BF). The spruce management class[2] clearly dominates in both forest

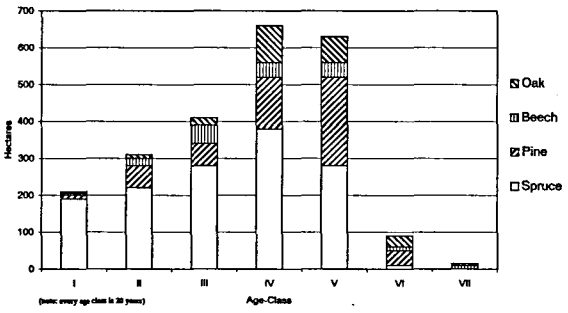

Figure 1-a Age-Class and Tree Species Distribution Beerfelden

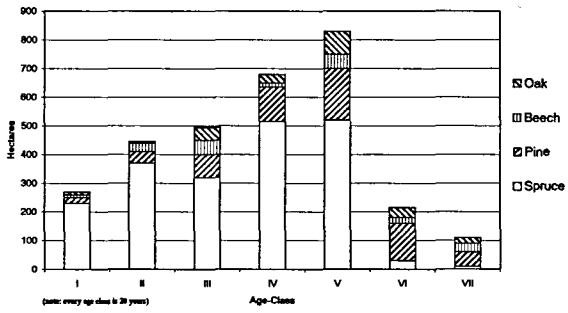

Figure 1-b Age-Class and Tree Species Distribution Wald-Michelbach

offices, covering 1,970 ha in WM (66%) and 1,294 ha in BF (56%). Concerning the age-class structure[3] of forests, the 4th and 5th age-class have a slightly higher share in WM compared to BF (compare Figure 1).

The growing stock[4] is 392 m^3 per ha in WM (in 1987) compared to 400 m^3 per ha in BF (in 1991). In terms of current annual increment, forests achieved 11.4 m^3 per ha in WM, which is slightly higher than in BF with 10.9 m^3 per ha.

Changeable factors include allowable cut, felling volume, number of staff and working hours per hectare. The allowable cut[5] applied for the spruce management class (this management class was the only one focused on in this operations review, because of its clear dominance) is 5.7 shv/ha in WM (4.6 shv/ha in BF), which can be separated into 3.2 shv/ha (2.3 shv/ha in BF) final cut[6] and 2.5 shv/ha (2.3 shv/ha in BF) intermediate cut[7]. The real felling volume in the spruce management class from 1987 to 1994 was as follows (compare Figure 2):

On average, final cut was 4.0 shv/ha in WM for the entire research period, about 25% higher than the allowances fixed by the forest management plan and about 309% higher than that of the forest office BF

1 The part of the forest that is destined for timber production.

2 Management class is the name for a working unit within the same property consisting of one tree species to control, if forest land is managed sustainably according to the forest management plan.

3 Category for classifying forest stands according to their different ages, the gradation being 20 years. Only applied in uniform forests (planted, even-aged forest stands).

4 There are 3 different measure units applied in German forestry: total volume (tv) when referring to the volume of standing crop including roots, branches and stumpage. Standing harvestable volume (shv) when referring to the merchantable volume of standing trees and finally cubic meter when referring to roundwood.

5 The felling volume as stipulated in the working plan of a forest office.

6 Planned cutting volume of a forest crop, which has reached cutting maturity.

7 Planned cutting measures that do not necessitate restocking, for example tending and thinning measures.

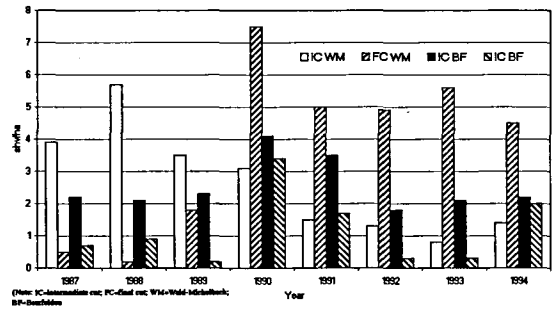

Figure 2 Harvesting in Wald-Michelbach and Beerfelden

(1.3 shv/ha). The intermediate cut was 2.5shv/ha (2.6 shv/ha in BF), which was exactly the same figure as the allowance of the management plan. The extraordinaire high felling volume determined for both forest offices in 1990 can be traced to two instances of storm damages. Concerning the number of forest workers, there were on average five workers per 1,000 ha employed in both forest offices in the research period. The productive working hours were similar for both forest offices, 7.3 hours/ha in WM and 7.1 hours/ha in BF. The felling volume (for all management classes) was 7.2 shv/ha in WM and 4.7 shv/ha in BF, a difference of approximately 35%.

3. Results

3.1 General financial results

During the research period, a clear profit[8] of 2,068,369 German marks[9] (DM) was achieved in WM,

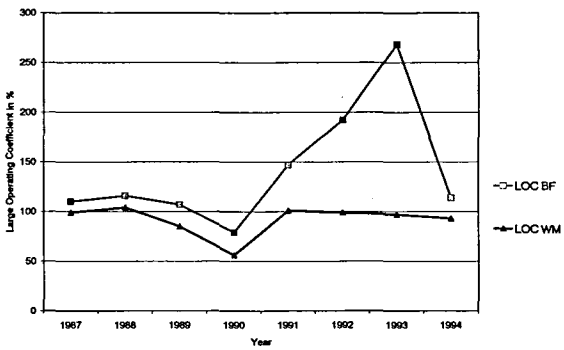

Figure 3 ☆☆☆☆☆☆

which corresponds to 86 DM/ha.

The average large operating coefficient[10] in WM was 86 compared to 126 in BF (compare Figure 3).

The following chapters will illuminate the structure of earnings and costs to find out how these significant differences in operating results have come about.

3.2 Earnings

On average, total earnings[11] were 766 DM/ha timberland in WM and 510 DM/ha in BF between 1987 and 1994.

Wood sales clearly contributed most to the earnings with an annual average of 692 DM/ha in WM and 452 DM/ha in BF. The immense difference in average annual sales of 240 DM/ha resulted mainly from the

8 Clear profit=difference between total earnings (incl. wood sales, hunting/fishery and other operation areas) and total costs (incl. wood harvest, cultures, forest conservation, forest road repairing, forest cultivation, different operational work and hunting/fishery).

9 1 DM=81.1 Yen (14.8.1998)

10 The large operating coefficient expresses the relation between costs and earnings (costs/earnings*100). The large operating coefficient includes in contrast to the small operating coefficient also administration costs.

11 Earnings as defined in footnote 8.

fact that the average harvesting volume in WM with 6.5 shv/ha was clearly higher than that of BF with 4.9 shv/ha. Based on an average sales price of 107 DM/m³ in WM (17 DM/m³ higher than in BF), this difference in harvesting volume resulted in a higher income of almost DM 2.9 million with regard to the entire research period.

The average roundwood sales price increased from 104 DM/m³ to 110 DM/m³ between 1987 and 1989 in WM. In the same period, the saw log percentage[12] increased from 49 to 60%. In comparison, the average roundwood sales price in BF declined from 96 to 94 DM/m³ with the saw log percentage decreasing from 50 to 35%. After the storm incidents in 1990 wood supply and demand was in complete disorder so that in spite of very high saw log percentages between 1990 and 1994, roundwood sales prices fluctuated strongly in WM as well as in BF. However, the conclusion can be drawn that the higher average sales prices of 17 DM/m³ achieved in WM results at least for a certain part from a higher share of saw logs. The fact that the medium breast height diameter[13] (BHD) of timber removed in WM was about 42% higher than in BF confirms this assumption. Another factor contributing to the higher roundwood prices achieved in WM is the harvesting strategy, which responds to the actual market demand.

3.3 Total costs

On average, annual costs amounted to 656 DM per ha in WM and to 644 DM per ha in BF. This relative small difference in costs is especially astonishing when taking into account that the average harvesting volume, which primarily sets the cost frame of a forest enterprise through expenses for harvesting and hauling, was 2.5 shv/ha higher in WM than in BF. It can therefore be concluded that work was carried out in a more efficient way in WM. To verify this thesis, the average total costs per ha mentioned before have been related to the average annual felling volume per ha (7.2 shv/ha in WM and 4.7 shv/ha in BF). The calculation shows that the costs per m³ harvested are significantly lower in WM, about 46 DM per m³ or 34% respectively. The following analysis will focus on the two main cost centres determined for the forest enterprises WM and BF, wood harvest and cultures, to uncover the reasons that determine this difference.

3.3.1 Wood harvest cost centre

Average wood harvesting costs came to 37 DM/m³ in WM, which is clearly lower than in BF, where wood harvesting costs amounted to 62 DM/m³. To find out the reasons that caused this big difference, the wood harvesting cost centre was further divided into the tree felling and wood hauling sub cost centres.

Average tree felling costs totalled 25 DM/m³ in WM, 39% less than in BF. Wood hauling costs were 12 DM/m³ in WM, 43% less than those in BF.

Tree felling sub cost centre

About 68% of the annual average wood harvest costs in WM, corresponding to about 530,000 DM, can be attributed to wood felling. When comparing tree felling costs with working costs between 1982 and 1993, it is evident that despite of a significant increase in working costs from 34 DM/hour to 54 DM/hour, an increase of 59%, tree felling costs declined from 32 DM/m³ to 24 DM/hour by 31%. These results indicate an increase in tree felling efficiency. To verify this conclusion, tree felling costs are compared to tree felling efficiency (compare Figure 4).

Tree felling costs in WM decreased from 11.37 DM/m³ in 1987 to 10.68 DM/m³ in 1994 at a rate of 6%, while tree felling efficiency increased from 2.4 to 2.7 m³/hour by 14%. In contrast, tree felling costs in BF increased in the same period from 17.38 to 29.53 DM/m³ at a rate of 70%, while tree felling efficiency

12 Share of saw logs compared to total felling volume (expressed in %)

13 The diameter of a trunk measured at breast height (1.3 meters above ground level)

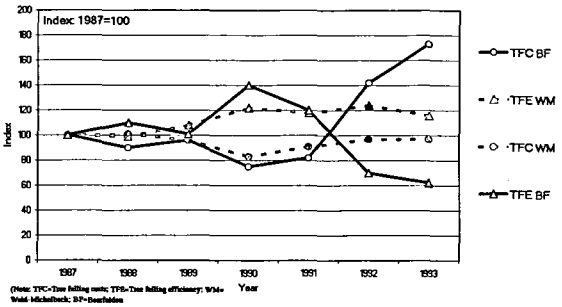

Figure 4 Tree Felling Efficiency and Tree Felling Costs

decreased from 1.56 to 1 m³/hour by 36%.

To understand, to which extent the higher tree felling efficiency depends on the higher average BHD of timber removed mentionned before, 34 cm in WM compared to 24 cm in BF, an efficiency curve was

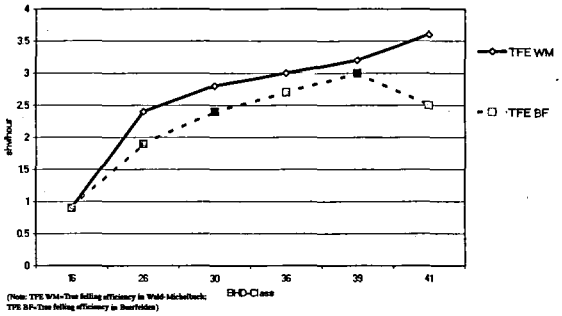

Figure 5 Tree Felling Efficiency Curves in Wald-Michelbach and Beerfelden

set up (compare Figure 5), in which tree felling efficiency of both forest offices are compared with each other in the same BHD classes.

This figure shows that, independent from the BHD of timber removed, tree felling efficiency was on average 20% higher in WM than in BF. According to a statement of the head of the WM forest office, this result refers mostly to the fact that the number of tree felling assignments given to outside contractors was clearly higher in WM than in BF. The strategy is to restrict the assignments of outside contractors to forest stands with a small average BHD, because in doing so, the BHD of the forest stands harvested by the forest office's forest workers increases greatly so that work efficiency improves and costs decrease greatly.

Wood hauling sub cost centre

Wood hauling costs came to an average of 12 DM/m³ in WM for the entire research period, which is 9 DM/m³ lower than in BF. To determine the reasons, the relationship between saw log percentage and wood hauling costs is focused on in the following. From 1987 to 1992 the saw log percentage increased from 49% to 93% in WM, while wood hauling costs decreased from 11 DM/m³ in 1987 to 8 DM/m³ in 1991. In 1993 and 1994 the saw log percentage diminished at a rate of 5%, while the wood hauling costs increased from 13 DM/m³ to 15 DM/m³ at a rate of also 5%.

Besides the saw log percentage, the strategic approach of the forest office WM towards wood hauling to buy and use three own skidders might have contributed to the comparatively lower wood hauling costs, because wood hauling can be carried out independently from forest contractors, thus guaranteeing a high flexibility and work efficiency. Furthermore, a special wage system is used in WM based on speed and abilities of the forest workers, which also contributes to a high wood hauling efficiency and thereby to low costs.

3.3.2 Culture cost centre

Average annual culture costs came to 53 DM/ha in WM and to 45 DM/ha in BF during the research period. In relation to the area of new culture, which is a much better indicator to determine how efficient work was carried out, new culture costs in WM amounted to 10,500 DM/ha, 21 less than in BF. To analyse this cost centre in a more detailed way, it was divided into two sub cost centres, artificial regeneration and young growth tending.

Artificial regeneration sub cost centre

This sub cost centre accounts for most of the culture costs with a share of 74% in WM and 80% in BF. Culture costs set into relation with the percentage of broadleaved tree cultures is a suitable indicator to illuminate how effective the funds were used, because their establishment is about five times more expensive than the establishment of a coniferous tree culture.

Between 1987 and 1989 average artificial regeneration costs for new culture amounted to 5,300 DM/ha in WM and to 6,200 DM/ha in BF. The average percentage of broadleaved trees was 26% in WM, almost three times higher than that of BF. From 1990 to 1994, costs increased to 5,800 DM/ha in WM, while the percentage of broadleaved trees increased to 66%. In the same period, new culture costs in BF increased 10,200 DM/ha in BF, while the percentage of broadleaved trees was 24%. On average, artificial regeneration costs were approximately 43% lower in WM than in BF between 1990 and 1994, although the proportion of broadleaved trees was approximately 175% higher. According to statements of the head of the forest office WM, these comparatively low costs can be attributed to the introduction of a more efficient planting method and to an enlargement of the planting distance between the tree seedlings in connection with the use of higher tree seedlings or staddles[14].

Young growth tending sub cost centre

The relationship between new culture area and tending area shows how efficient funds were used in this sub cost centre. Figure 6 illustrates their development between 1987 and 1994. The basic data in 1987

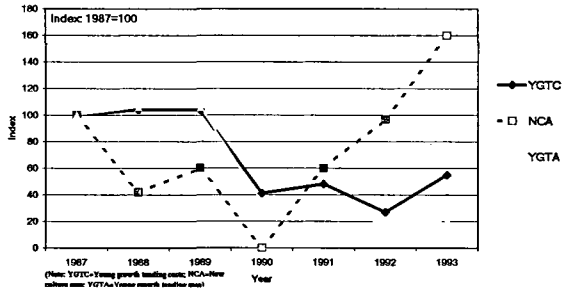

Figure 6 Young Growth Tending Costs, New Culture Area and Young Growth Tending Area in Wald-Michelbach

for young growth tending were 22 DM/ha with a young growth tending area covering 55.5 ha and a new culture area covering 31 ha.

Figure 6 shows that in spite of the 60% increase in size of new culture area since 1990, costs for young growth tending decreased by 47%. This reduction resulted from a significant reduction in young growth tending area from 55.5ha in 1987 to 14ha in 1994 by using higher plants and staddles.

3.4 The effects of harvesting on natural sustainability and profit in WM

The economic success of a forest enterprise cannot be entirely described by the financial results, because at the same time a sustainable management of the forest resource must be guaranteed (7. Villa,

14 broadleaved plant, which is from 1.5 to 4 m tall.

1996). For this reason, the temporal development of the determined overharvesting in WM in the final cut section of the spruce management class (compare chap. 2.3 and Figure 2) is focused on in the following.

From 1987 to 1989 the felling volume was characterized by a low final cut (13,200 m^3 less than the allowances of the forest management planning) and a high intermediate cut (10,200 m^3 more than the allowances). In this period, the total allowable cut of 5.7 shv/m^3 was fulfilled up to 91%, mainly through intermediate cut. Between 1990 and 1994 the situation changed completely as the intermediate was 10,047 m^3 below the allowances, and the final cut 26,398 m^3 above the allowances. Hence, the final cut exceeded the allowances for the entire research period by 13,198 m^3, while the intermediate cut met the allowances almost exactly. This shows that the overharvesting determined was due to storm incidents and not a strategy to achieve positive operating results. On the other hand, the strategy to increase the growing stock in the years prior to 1990 mainly by carrying out intermediate cuts contributed to a reduction in overharvesting volume of approximately 50% for the entire period. Nevertheless, the harvesting volume in the final cut section did not conform to levels of natural sustainability as the average felling volume exceeded allowances by 0.8 m^3/ha and year. According to a statement issued by the head of the WM forest office, it is one of the future main targets to compensate for such overharvesting by reducing the felling volume in the years following. Overall, however, natural sustainability is not endangered as a simple reduction in felling volume of 1 shv/ha could compensate for this overharvesting if carried out over the next 6-7 years.

Calculation of the financial contribution of the overharvesting to profit amounted to approximately 1.4 million DM (based on an average profit per m^3 of 107 DM and an overharvesting mass of 13,198 m^3). This profit reduced by the average harvesting costs of 37 DM/m^3 (comp. 3.31), led to a profit of approximately 920,000 DM. This sum accounted for 46% of the total profit of approximately DM 2 million.

3.5 Cultivation measures in Wald-Michelbach

Cultivation measures as cleaning and pruning account for a significant part of the total costs and therefore could contribute in case that they are not done properly to a significant improvement of the financial results. Therefore, it is necessary to compare the cultivation measures completed to the allowances fixed in the forest management plan.

Between 1987 and 1989 cleaning and pruning measures were overfulfilled. As a result of this, the allowances for the entire research period were fulfilled as well, although forest workers were diverted from cultivation measures to harvesting activities due to the storm incidents in 1990. This shows that the economic success of the WM forest office is not based on a neglect of cultivation measures.

4. Summary and conclusions

The state forest office Wald-Michelbach (WM) was chosen for an operations review, because, despite very difficult economic frame conditions, it has achieved already since many years very satisfactory operating results. The adjacent state forest office Beerfelden (BF) was chosen for comparison, because the financial results achieved there were very unsatisfactory, although natural conditions are very similar.

The high proportion of the spruce management class with dominating 4 th and 5 th age-classes together with the strong determination of the head of the forest office to make the best use of this great forest resource surely contributed to the financial success of the forest office WM. However, this study shows that the favourable financial results of the state forest office WM base also on various strategies and measures applied, all of which contribute to an overall high rate of operation optimisation.

Wood harvest, traditionally the main cost section of a German forest office, which as a very labour intensive work has suffered most from the increase in working costs during the last years, remained on a constant level throughout the research period in Wald-Michelbach. This can primarily be explained by a higher tree felling and wood hauling efficiency, which on the other hand results to a certain extent from the harvesting strategy applied in WM to focus mainly on final cutting of the dominating spruce management class. As a result, a high share of logs harvested has a large breast height diameter (BHD), which induces high sales prices per cubicmeter on the one side and lowtree felling and wood hauling costs on the other side as working efficiency increases. Low wood harvest costs result also from a performance oriented wage system applied in both felling and hauling and finally from the assignment of self-cutting and hauling contractors in forest stands selected for intermediate cut.

Furthermore, harvesting measures are either done according to current market demand or are linked to special orders, both of which sales strategies guarantee a strong market position and therefore high sales prices. The necessary flexibility needed for such kind of harvesting strategy is provided in WM through the use of three own skidders for wood hauling. This also allows a very reliable wood transmission to the buyer at the forest road.

Compared to BF, culture costs were lower in WM. This can be traced mainly to the introduction of a highly efficient planting method and to an enlargement of space between the trees to be planted. The latter was achieved by using larger plants or staddles. It is, however, important to keep in mind that lower planting costs achieved today through these methods could cause a deterioration of wood quality, which then would have an impact on log sales prices.

A comparison of felling volume and allowances fixed in the forest management plan showed overharvesting of about 13,000 m^3 during the research period contributing to the total operating profit of about DM 2 million with 46%.

In addition to favourable natural conditions and to specific strategies and measures applied, human potential, which cannot be expressed in figures, contributed decisively to the financial success achieved in WM.

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