



THORSTEN STREYFFERT (1892–1983) — ECONOMIST AND FORESTER

K.-G. LÖFGREN &
L. MATTSSON

In 1828, a decision was reached to establish a higher educational institution for forestry in Sweden, the Royal Forest Institute. In 1915 this institute was reorganized to become the Royal Swedish College of Forestry (which today constitutes the Faculty of Forestry within the Swedish University of Agricultural Sciences). It was, however, not until 1939 that a specific professorship in economics was established in the field of forestry. The title of the professorship naturally enough became "forest economics", but it also included certain aspects of the subject "forest mensuration and management planning of forest land" as well as teaching in "forest policy". The first holder of this professorship was Thorsten Streyffert, who held the position for more than two decades until 1961.

The following survey of the academic achievements of Thor-

sten Streyffert in the field of forestry will mainly be confined to his academic work as expressed in his published writings. It is not our ambition to cover all his publications. Instead, we will restrict ourselves to a selection of writings which will be used to characterize Streyffert as a scientist. Special attention will be paid to *Den skogsekonomiska teorien* (The Theory of Forest Economics) from 1938, which, over a long succession of years, became a standard text in Swedish forest economics. We will also touch upon the then prevailing conditions in the Swedish forestry sector, which naturally greatly influenced Streyffert in his research, as well as focusing on works by other economists that influenced him. First, however, a few words about the earlier part of Streyffert's career and his work not only as a scientist but also as an administrator.

Karl-Gustaf Löfgren, Department of Economics, University of Umeå, S-901 87 Umeå, Sweden.

Leif Mattsson, Department of Forest Economics, The Swedish University of Agricultural Sciences, S-901 83 UMEÅ, Sweden.

Translated to English by Per Holgén, Department of Forest Economics, The Swedish University of Agricultural Sciences, S-901 83 UMEÅ, Sweden.

FOREST OFFICER, SCIENTIST
AND LEADER

After completing his secondary education in 1910 in Västerås, Thorsten Streyffert studied to be a "jägmästare" (forest officer) from 1911–13, at the old Royal Forest Institute in Södra Djurgården outside Stockholm. In 1919 he also received a diploma from the Stockholm School of Economics. As was customary for young foresters at that time, Streyffert served as an assistant at many different places all over the country. Already, at an early stage in his career, Streyffert showed an unusual ability. He became district manager at the Fuel Commission, established in connection with the First World War. A short time later, he was appointed secretary at the Board of Nationalization when it was investigating the Government's status as a forest owner. Streyffert's interest in international forest conditions found expression in, what were for the time, very extensive study tours to North America, India, East Asia, the Balkans and Central Europe.

In 1929 Streyffert obtained a position as associate professor in the "Economic Geography of Forestry" at the fairly new Royal Swedish College of Forestry located at Brunnsvik in Stockholm. "My time as associate professor did not turn out too remarkable, since money for research and development was scarce", said Streyffert half a century later to Carl Adelsköld in an interview at the 75-year anniversary

of the College of Forestry Students' Union (Adelsköld, 1980). Still, a considerable part of Streyffert's scientific work belongs to this time period, which can be regarded as the beginning of his development to one of the most prominent characters in the history of the College of Forestry.

In 1939 Streyffert was appointed Professor of Forest Economics, but his activities stretched far beyond this position. It is quite clear that Thorsten Streyffert was a person to have confidence in. This was certainly the case, with regard to the students and it was only natural that he became the inspector of the Students' Union (a commission that less than ten persons have held from 1915 until today). Just as natural, however, was the shortage of time for this and several other positions of trust, when he in 1947 was elected Rector at the College of Forestry. A position Streyffert held for thirteen years, that is until he became Professor Emeritus.

As Rector, administrative problems naturally took much of his time. This was the case especially in connection with The 1956 Royal Commission on the College of Forestry and Forest Research. In its 1960 report, it suggested a merger of the College of Forestry and the Governmental Institute of Forest Research (not to be confused with the old Forest Institute), something that Streyffert opposed. Even in this matter he showed his concern for the students, when he expressed fears that the research interests would dominate too much over the edu-

cational interests. Indeed, Streyffert recommended that the "research specialists" to a greater extent than previously should be engaged in teaching, however, he felt that the division of responsibility would become indistinct if the proposition was carried through, with the possible negative effect that teaching would be "split up and neglected under the influence of the — in itself — gratifying interest that is now devoted to science". Streyffert suggested instead that the College of Forestry should be incorporated as a faculty at the University of Stockholm. The Swedish Parliament, however, voted in favour of the committee proposal. Consequently, Streyffert, just before his retirement, had to bow to a reorganization that was not at all to his liking. In this context it should be mentioned that several petitions, especially from the Students' Union of the College of Forestry during the 1970s, indicate that Streyffert's fears were realized to a considerable degree (Söderström, 1979).

At the time when Streyffert advanced to a senior academic position, forestry and the forest industry was at a very dynamic stage. The pulp industry had undergone a powerful expansion and during a twenty-year period after the First World War its wood consumption had almost tripled to reach the same level as the sawmill industry. The importance of the forest as a wood supplier thus increased at a fast pace, and at the same time the importance of the forest in the agrarian sector (as grazing area etc.) was in a fast de-

cline. To gain better control over the wood supply in the forest, a National Forest Inventory had been carried out in 1923–1929, and the silvicultural legislation had successively been strengthened with regard to reforestation and felling forms — all in order to promote the country's very important forestry sector. It should be mentioned that the forest industry's share of the total Swedish export of goods amounted to about 45 per cent at this time (Fridlitzius, 1963).

In his earliest works Streyffert covered just about all of this field of subjects, with what can be called popular scientific reports. His ambition in this respect is expressed for example in the introduction to *Sveriges skogar och skogsindustrier* (Forests and Forest Industries of Sweden) in 1931. There he wrote:

"If one considers the great importance of forestry and related industries to our national economy, it appears to be a deficiency, that we have lacked an economically oriented book serving those who in their work are connected to these branches of business. It has been the intention of the author to remedy this deficiency by way of this book."

The book mirrors Streyffert's interest not only in "pure" economics, but also in biology and the timber balance (i.e. the relation between timber supply and timber consumption).

The latter issue was very much in focus for Streyffert in the very extensive work *Världens barr-*

skogstillgångar (Softwood Supplies of the World), which was also published in 1931. Here he discusses forests and forest industries in different countries and also the trade in wood products, pulp and paper. One conclusion of this discussion is the great international importance of Swedish forest industry companies. In this publication Streyffert also reveals his interest in economic-historical analyses.¹ Among Streyffert's works published during the period as associate professor should also be mentioned *Rysslands naturtillgångar under fem-årsplanen* (Natural Resources in Russia during the Five-Year Plan) in 1933. However, an even more significant work was *Den skogs-ekonomiska teorien* (The Theory of Forest Economics) published just before his appointment as professor in 1939.

THE THEORY OF FOREST ECONOMICS

The classic problem in forest economics is the choice of harvest time. This problem was solved in the mid-1800s by the German forest economists Martin Faustmann and Max Robert Pressler (Faustmann, 1849 and Pressler, 1860). Their solution is identical to what is called "the chain of replacement problem" in operations research. The works by Faustmann and Pressler were brought to the attention of Swedish foresters by Carl Gustaf

Holmertz's epoch-making work *Studier i skogstaxation* (Studies in Forest Surveying), which was published in two volumes in 1876–1877. Very few of the Swedish researchers studying the forest even tried to understand the economic reasoning in the book. In the early 1900s, the so-called profitability war broke out among foresters. It started in 1907 when the colourful forest officer Uno Wallmo made a speech on the subject "Sustainable forestry" at the annual meeting of the Swedish Forestry Society. Wallmo argued in favour of the so-called doctrine of the forest rate of interest (*Waldreinertragswirtschaft*), which implies that the harvest time is chosen when the mean increment of a forest stand culminates.

The right harvest time from an economic point of view should be chosen where the current annual value increment (marginal increment) is equal to the interest on the growing stock plus the interest on the value of the forest land. This principle, the theory of soil rent (*Bodenreinertragswirtschaft*), was, among foresters, considered to result in a too short growth period. The debate was to continue during many annual meetings. It did not, however, result in any real unity. Eli F. Heckscher was among the Swedish economists who participated in the debate. Heckscher argued in favour of a harvest time where the current annual value increment is equal to interest on the value of the growing stock. In other words where the relative value increment (current annual

¹ His achievements in this respect have been acknowledged in e.g. Björklund (1988).

increment in relation to the value of the growing stock) is equal to the market interest rate. The idea of the theory of money rent (Geldreinertragswirtschaft), as this principle was called, is that when the relative value increment is higher than the interest rate, it is profitable to keep the trees in the forest. When the opposite is the case, it is more profitable to cut the trees down and put the money in a bank account. This is the so-called Jevons wine maturity formula which was also used by the Swedish economist Knut Wicksell.² The difference between wine maturity and forestry is that trees, as opposed to wine, have to be "consumed" before a new stand can be established. The result of this is that the interest on the value of the forest land is added as an opportunity cost. A person who realized this early in his career was Bertil Ohlin, later to become Nobel Laureate in Economics. His entrance examination at Heckscher's seminar at the School of Economics in Stockholm was to act as discussant on a paper on the rotation period problem written by a forester.³ Ohlin solved the problem, and the

elegant solution was to be published in a commemorative publication for Wicksell (Ohlin, 1921). When Streyffert, in the 1930s, began to work on his "thesis"—*Den skogsekonomiska teorien*—the rotation period problem was consequently not an open problem, not even in the sphere of Swedish foresters.⁴ To get around the problem that the rotation period had become too short in the eyes of the forester, the "increment in periods of high prices" (Teuerungszuwachs) was invented. This can be interpreted as the discovery of the distinction between nominal and real interest rates.

Consequently, Streyffert contributes very little to the theory dealing with the choice of harvest time. Nevertheless, he shows a clear understanding of the theory and his introductory summarizing chapters are, indeed, worth reading. In the title of the second chapter, "The Theory of Forest Economics under Static Conditions", Streyffert indicates what is to come. He was much influenced by the dynamic way of arguing of the Stockholm school, and especially by Gunnar Myrdal's dissertation *Prisbildningen och föränderligheten* (Price Formation and Changing Conditions) in 1927. (Myrdal later became Nobel Laureate in

² Wicksell also pondered on forestry as a foundation for capital theoretical reasoning and, in an incomplete manuscript, he solved the problem in a "proper way". See Hedlund-Nyström *et al.* (1993).

³ The Swedish industrialist Ruben Rausing who was present mentions, in a letter to Mrs. Evy Ohlin, that Streyffert was the forester, but in a letter to one of the authors of this paper (Löfgren) Streyffert denies this. We have carried out certain investigations in the library of the Stockholm School of Economics, but we have not found any seminar paper by Streyffert.

⁴ Streyffert never defended a doctor's thesis, possibly owing to the fact that he was appointed professor in connection with the publication of *Den skogsekonomiska teorien*. This book is, however, arranged in a way that indicates that the intention was to defend it as a thesis at a philosophical faculty. At that time, it was impossible to defend a doctor's thesis at the College of Forestry.

Economics). What Streyffert opposes in the traditional theory is the fact that, under the conditions of constant prices, a constant interest rate and a known increment function, it is already possible to calculate the harvest time when establishing the forest stand. He wanted to create a theory of forest economics under dynamic conditions, and a major part of the book is devoted to this task. In this context, he discusses the advantages and disadvantages associated with the long production time in forestry. He argues that it involves both unfavourable and favourable changes. For example, by being adaptable, carrying out extensive fellings when the conditions are favourable and no fellings at all when conditions are unfavourable, one can benefit from changing prices. Today, we know that the fact that the profit function is convex in prices, in combination with Jensen's inequality⁵ can be used to show, formally, that an adaptation to variability is profitable compared with an average static situation.

Streyffert also discusses how the existence of incomplete capital markets (even if he does not define exactly what he refers to) causes a problem of finance. This can render it optimal for the forest owners to diverge from a silvicultural behaviour that would have been optimal under

perfect capital markets. The formal dynamic analysis is, however, mainly restricted to what we today call comparative statics. Streyffert studies e.g. how rotation and profitability change if the timber prices increase by the same percentage for all dimensions. He notes that the optimum rotation is practically uninfluenced by this change, and that the "inoptimality loss" that arises if the forest owner does not adapt the rotation to the price change is negligible.

Here it is evident what Streyffert means by a concept that he has minted, and incidentally one that is still valid in forest education and in practice. Inoptimality loss is the decrease in profit that arises when the forest owner does not adjust his originally optimal silviculture to altered conditions. In his dissertation, Myrdal speaks of obsolete losses. Basically, he refers to the fact that new technical knowledge can lead to a situation where the production technology, under the new conditions, should have been differently composed.

From the above example, the analytical problems appearing as a consequence of the lack of analytical tools at that time are evident. The book by Sir John R. Hicks, called *Value and Capital* (1939), was published after the appearance of Streyffert's book. Even if he had been able to read Hicks's book, it is not certain that Streyffert would have readily realized that the optimum rotation is homogeneous of degree zero in the prices (revenues as well as costs) and, therefore, is not af-

⁵ $E[f(p)] \geq f[E(p)]$, which tells us that the mathematical expectation of a convex function of a stochastic variable (p) is not less than the value of the function at the mathematical expectation of the stochastic variable.

fectured by simultaneous proportional price changes. Further, he would hardly have discovered that the inoptimality losses are zero for marginal changes in prices, even if he had happened to read Harold Hotelling's paper from 1932 on a related subject. Much experience is still needed today to find what is now called "Hotelling's lemma". The tools required to pursue genuine dynamic analysis under uncertainty were essentially still missing. This is probably one of the main reasons why the Stockholm school, as well as Streiffert's entirely sound effort, which emphasizing dynamic courses and uncertainty, came to an impasse.

One is sometimes astonished by the knowledge that Streiffert seemed to possess. It is, for example, straightforward but not completely trivial, using the Hicks-Samuelsonian comparative static method, to show that an increase in the discount rate will decrease the rotation period. In *Den skogsekonomiska teorien* this result is mentioned as if it were common knowledge. Such insight may depend on practical calculations that have yielded results in this direction and/or on good economic intuition. It is our impression that Streiffert possessed such an intuition.

A whole chapter is devoted to an economic analysis dealing with the transition from exploitive forestry to sustainable forestry. How rapidly should the supply of virgin forest in northern Sweden be harvested and replaced by stands established in a modern fashion? Here he puts

forward some economically incorrect principles regarding the allocation of the forest raw material. He argues, for example, that the raw material should go to the industry with the highest net value per cubic metre. This is equivalent to maximizing the profit per worker or kilowatt hour. Today we know that it should be distributed in such a way that the yield from the last unit of input would be the same for all uses.

It is difficult to determine exactly how important Streiffert's book has been for education and research in forest economics in Sweden. There is, however, no doubt that, together with Uno Wallmo's book *Rationell skogsafverkning* (Rational Forest Felling, 1897) and Sven Petrini's *Skogsuppskattning och skogsekonomi* (Forest Mensuration and Forest Economics, 1937), it is among the most studied textbooks in forest education. Wallmo's book has been read by the advocates and opponents of the selection system, principally because of its racy language. Streiffert's and Petrini's books have been read on account of their universal contents and high scientific substance.

STUMPAGE VALUE AND CULTIVATION MEASURES

Two central problems in forest economics are the choice of interest rate and the profitability of forestry. The latter naturally depends on the interest rate and on how the stumpage value develops over time. This question has, in recent years, gained renewed

interest, among other things as a consequence of a now classic article from 1971 by Paul Samuelson, where he discusses whether the prices on perfect markets are stationary or not.⁶

It appears that the properties of the process behind the development of the stumpage value over time have significance for forest economic theory under dynamic conditions. It has been shown by e.g. Harold Clark and William Reed (1994) that if the stumpage value follows a so-called *random walk* (a non-stationary process), then there is no optimal rule as to when the forest should be harvested. If, on the other hand, the process is stationary, then one can show that a reservation price rule is optimal. In other words harvesting should take place as soon as the stumpage value exceeds a certain level decided in the optimization problem.

Streyffert naturally had no idea of how central the development of the stumpage value was to the basic problems that he studied in *Den skogsekonomiska teorien*. In 1960, just before his retirement, he wrote the book *Utvvecklingstendenser beträffande rotvärden och priser på skogsprodukter* (Trends Regarding Stumpage Values and Prices of Forest Products). The annual data on net conversion contribution and stumpage value from the turn of the century and onwards, which he collected and analysed is, today, a goldmine for modern analysts of forest price series.

Streyffert himself came to the conclusion, based on data from the period 1909–1958, that a positive trend existed for the price series of stumpage value. He had, however, no reason and no analytical tools to determine whether the trend was deterministic or stochastic. In the latter case, the above-mentioned analytical problems arise. By prolonging the series to 1990 and applying modern statistical techniques, Lars Hultkrantz has been able to reject non-stationarity for the time series of the stumpage value (Hultkrantz, 1995). The research programme on silviculture under dynamic conditions was initiated by Streyffert himself in his capacity as Associate Professor at the College of Forestry. He consequently contributed even indirectly through his collection of data, to providing the programme with a firm empirical basis.

The investment problem associated with forest cultivation was also analysed by Streyffert in works which followed *Den skogsekonomiska teorien*, e.g. in *Skogskulturråtgärdernas ekonomi* (The Economy of Forest Cultivation Measures, 1949). By means of a circular within the Swedish Forest Service in 1950, a boost was given to the so-called clear felling system. This system is characterized by a demarcated “mature” forest stand being “finally felled”, whereupon a new stand is established by planting or sowing. In 1948, a motion was proposed to the Swedish Parliament that the new silvicultural law should be altered to encourage intensified cultivation measures. At the same

⁶ I.e. if they (in real terms) have constant mean and variance over time.

time the “never-ending debate” on how the cultivation costs should be handled in economic calculations continued. Streyffert also dealt with this problem in popular scientific articles, such as “Kulturkostnaden — investering eller avverkningskostnad?” (The Cultivation Cost — Investment or Harvesting Cost?, 1956). “The reason for two such conflicting opinions in a seemingly simple matter is probably to be sought principally in the difficulty of making any profit out of the cultivation cost”, says Streyffert. However, he realized that regard must evidently be paid to the time aspect, “if not, a calculation regarding the choice of the most appropriate alternative to achieve regeneration is without meaning” (Streyffert, 1956a).

Streyffert was, on the whole, anxious to spread his message not only to the scientific community, but also to the outside world through articles in business periodicals. Among such popular articles, “Bondeskogsbrukets ekonomi” (The Economy of Farm Forestry, 1953) and “Principiella synpunkter på kostnadernas fördelning i skogsbruket” (Aspects of Principle Regarding the Distribution of Costs in Forestry, 1954) are for example, worth mentioning. He also, as Professor Emeritus, produced *Handbok i skogsekonomi* (Handbook in Forest Economics, 1965). Furthermore, Streyffert considered it important to spread knowledge to the public at large. One of the occasions when this happened was in a series of radio talks in 1944 with the theme “The Swedish Forest”

(published as Streyffert, 1945). The basis for all such popularscientific reports was the research that Streyffert presented in scientifically recognized books and publication series (for example the Publications of the Royal College of Forestry).

FORM OF BUSINESS AND OTHER PROBLEM FIELDS

One of Streyffert’s most important research fields as a professor dealt with the form of business in forestry. This was a field of research that arose from another debate in the Swedish forestry sector, namely whether “large-scale” or “small-scale” forestry was best from a social point of view. This debate naturally had come to cover which form of ownership — government owned, company owned or farm owned forestry — was to be preferred. In *Skogsbrukets företagsformer — en principutredning* (Forms of Business in Forestry — a Report of Principles) from 1956, Streyffert deals with this problem in a thorough way. (In the same year he presented a popular version of these ideas in “Synpunkter på skogsbrukets företagsformer” (Ideas on the Forms of Business in Forestry). He analysed how the size of the management unit affected the economic result, principally by way of its influence on efficiency, and how the type of ownership manifested itself mainly by determining the goal for forestry. Streyffert found that large-scale forestry was more efficient than small-scale forestry, and that the forestry run by the

state and the forest companies was better than farm forestry in achieving the “interest of society to maximize the national income in the long run” (Streyffert, 1956b).

It was burning hot stuff that Streyffert delivered here, and it was probably just this fact that caused him to point out that “from the point of the view of society, it is, however, not essential to conclude which group of owners ‘manages the forest in the best way’ [...] the task is mainly to point out the imperfections, wherever they may be present, and to find means for their remedy” (ibid). In a later work — *Lönsamheten hos olika skogsbruk med särskild hänsyn till företagsformen* (Profitability in Different Types of Forestry with Special Attention Paid to the Form of Business, 1964) — he also stressed that “small-scale forestry can, at a lower cost, obtain expert knowledge through the Forest Owner Associations” and, as an advantage of small-scale forestry, he also pointed out that “planning etc. is less demanding than in large-scale forestry” (Streyffert, 1964). Streyffert’s forest economic research dealing with forms of business has also been described in several other publications, one of the most important being *Bondeskogsbruket — ekonomisk undersökning grundad på bokföring 1953–1960* (The Farm Forestry — Economic Investigation Based on Accountancy 1953–1960) that was published together with Christian von Malortie in 1963.

During the first part of his period as an Associate Professor,

Streyffert often had an enormous span in his works, in the sense that he analysed and compared the conditions of the forestry sector in the major part of the world, and considered the changes taking place over long periods of time. Streyffert never really let go of this perspective. However, instead of analysing the situation in a historical perspective as in *Världens barrskogstillgångar* (1931), he looked ahead in the very extensive work *Världens framtida virkesförsörjning* (The Future Provision of Timber in the World) published in 1957. It is obvious from a piece of work from 1965 — “Malingsbo revir 1912–1962. En skogsekonomisk studie” (Malingsbo Forest Management District 1912–1962. A Forest Economic Study) that his historical interest lasted. Here Streyffert restricts himself to the territory that constituted the “teaching grounds” of the College of Forestry. He presented an analysis of “the change that the economy of forestry has gone through during the dynamic period from the time before the First World War until the present time” (Streyffert, [1965b]) — i.e. the period starting when Streyffert himself was a forest officer student and ending when he had just become Professor Emeritus.

It is evident that a substantial part of Streyffert’s scientific production really belongs to the time when he was professor emeritus. In one of his last publications, “Dagens skogspolitik — problem och framtidsutsikter” (Forest Policy of Today — Problems and Future Prospects) from 1977,

Streiffert says, by way of introduction, that "Our forestry now lives in a time of unrest, as never before, and there is a need for a thorough survey of its problems in the current debate that can be further expected after the presentation of the Forestry Committee report" (Streiffert, 1977).⁷

When reading this survey, it is not so hard to understand Carl Adelsköld's reaction when, a couple of years later, he visited the 88-year-old Thorsten Streiffert for an interview — "What most astonished a former student was his impressive perspicacity regarding current problems both in forestry and society, he was as before crystal clear in his reasoning [...] It was a peculiar rendez-vous" (Adelsköld, 1980).

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⁷ The Forestry Committee report, *Skog för framtid*, came out in the following year (SOU 1978:6–7).

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