WORKING PAPER

FUTURE MARKET CONSEQUENCES OF FOREST DECLINE IN EUROPE

Gabor Kornai

June 1988
WP-88-041

IIASA
International Institute
for Applied Systems Analysis

FUTURE MARKET CONSEQUENCES OF FOREST DECLINE IN EUROPE

Gabor Kornai

June 1988
WP-88-041

PUBLICATION NUMBER 75 of the project: Ecologically Sustainable Development of the Biosphere

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
A-2361 Laxenburg, Austria

ABOUT THE AUTHOR

Dr. Gabor Kornai, economist, is Head of the Modeling Department at the Institute for Economic and Market Research and Informatics (KOPINT-DATORG), Budapest, Hungary. His basic research field is econometric modeling, with applications in both small and large-scale national econometric and sectoral trade models as well as economic modules of integrated environmental models. In the period 1983-1985, he was a member of the Forest Sector Project at IIASA and participated in the construction of the IIASA Global Trade Model for Forest Products. In 1986-1987 he worked for the Acid Rain Project of IIASA, contributing to the Projects' modeling efforts. His address is:

Institute for Economic and Market Research and Informatics (KOPINT-DATORG)
Dorottya u. 6, H-1389 Budapest V., Hungary

FOREWORD

Within IIASA's Environment Program, the Project on Ecologically Sustainable Development of the Biosphere seeks to clarify the policy implications of long-term, large-scale interactions between the world's economy and its environment. The Project conducts its work through a variety of basic research efforts and applied case studies. One such case study, the Forest Study, has been underway since March 1986, and is focusing on the forest-decline problem in Europe. Objectives of the Forest Study are:

(a) to gain an objective view of the future development of forest decline attributed to air pollution and of the effects of this decline on the forest sector, international trade, and society in general;

(b) to build a number of alternative and consistent scenarios about the future decline and its effects; and

(c) to identify meaningful policy options, including institutional, technological and research/monitoring responses, that should be pursued to deal with these effects.

As in North America, most of the forests of Europe are dedicated at least partly to timber production for industrial purposes. Thus, wood raw materials are processed into wood and paper products to meet demands for a wide range of goods. Many decisions that bear on the management of European forests are driven by market forces. These forces, and the trade and prices patterns that accompany them, must be taken into account in any study of the long-term outlook for timber-production forests and the forest-products industry. In this connection, the Forest Study is using a modification of the global trade model (GTM) for forest products (the original version of which was the major software product of IIASA's Forest-Sector Project (1982-1985)) for building scenarios of forest-products trade and prices throughout the world. Through a special investigation conducted for the Forest Study, Gabor Kornai has adapted the GTM specifically for use in generating scenarios for consideration in policy terms. This paper, one in a series of several Forest-Study background papers, looks into the structure of the modified European-focus model, presents detailed projections for several wood-supply scenarios, and discusses the limitations of interpreting such forecasts in relation to the uncertainties inherent in the model. Dr. Kornai has been contracted this year by the Forest Study to deliver a version of the model that runs on IBM-compatible personal computers, thus greatly facilitating use of the model in "policy exercises" which comprise the Study's main approach to its third objective above.

R.E. Munn
Leader
Environment Program

ACKNOWLEDGEMENTS

I am indebted to Peter Schwarzbauer of the Universitat fur Bodenkultur in Vienna, Austria, for devoting considerable work to the database and the construction of the Austrian Trade Model serving as a framework for the European Trade Model. Without his valuable contribution this analysis could never have taken place. I am grateful to Peter Duinker and Sten Nilsson of the IIASA Forest Study for their continuing help and advice in undertaking this study. Financial and computational support from IIASA is gratefully acknowledged.

ABSTRACT

The significant and rather widespread decline of European forests is attributed mainly to air pollution. As of today there is no evidence yet of any major market disturbances caused by the decline. Long-term outlooks, however, on the extent of probable future decline indicate that first the local, then the regional, and finally the global markets of forest products may face significant imbalances. Due to forest decline, sanitation fellings will inevitably increase further and various tree species may even vanish from large areas in Europe. In this paper, to assess the extent of some economic consequences of these emerging surpluses and deficits, scenario analysis is used. The scenarios compared here were computed on the basis of a European model of consumption, production and trade in the forest sector (also referred as European Trade Model or ETM). The ETM is a partial equilibrium model cast in a partly non-linear mathematical programming framework, a method originally developed by the Forest Sector Project of IIASA. Side constraints on final-product demand have been set to incorporate assumptions about the future development of demand based on the projection system used by FAO. With no limitations on the structure and volume of timber removals, a base scenario is derived consisting of projections for production, trade and prices for each five-year period up to year 2020. Then several forest-decline scenarios were generated, applying externally given time series of timber removals indicating various intensities of both sanitary fellings and forest decline. In the first section of the paper the problem is exposed. Then the ETM methodology, data, and assumptions are described in some detail. The base scenario is introduced in the next section, followed by the forest-decline scenarios. The final section presents the main conclusions of the exercise.

CONTENTS

LIST OF TABLES

FUTURE MARKET CONSEQUENCES OF FOREST DECLINE IN EUROPE

Gabor Kornai

1. INTRODUCTION

The main goal of the Forest Study at IIASA is to assess the long-term regional consequences of a changing forest-resource environment in Europe. The recent facts on the extent of forest decline leave no doubt about the seriousness of the issue. The declining forest volume in many European countries is already in the range of 5 to 20% of the growing stock, and these volumes may eventually exceed the level of annual fellings by 5 to 10 times (Nilsson and Duinker, 1987).

Forest decline will inevitably bring on numerous consequences ranging from the degradation of human environments to economic disturbances. In spite of serious scientific efforts, so far it has not been possible to isolate the ultimate reasons for the current destruction of forests. However, most of the evidence indicates that air pollution plays a major role in undermining the ecological balance of forests.

This study deals solely with potential economic outcomes of forest decline attributed to air pollutants. The basic question is: what happens to a forest economy if we assume specific intensities of future forest decline? Answers are sought here by means of scenario (or sensitivity) analysis. However, the economic interactions even within the forest sector alone are rather complicated. So far it has been possible for all but a few local markets in Europe to absorb the additional volumes harvested in sanitation fellings. Several short-term measures attainable within the next 5 to 10 years, such as gradual adjustments in the methods of "traditional" forest management and in felling plans, could also help avoid greater marketing problems.

In the long run of several decades, however, due to already observable changes in the growth and mortality of trees, these measures may prove to be insufficient. Continued salvage removals will first dump larger volumes of raw timber onto the markets. With the depressed price levels of saturated markets in excess supply, the local processing industries and exporters of timber may flourish; the pattern of international trade would already change. Then, some years later, a couple of species so vital for the given structure of the forest industry could even disappear from local supply and thus need to be substituted either by imported timber or by different grades available locally, or by new products. As always, traders will react first, but these consequences may finally invoke significant structural adjustments both from the producers and consumers of forest products.

This verbal scenario already indicates the complexity and simultaneity of interactions among the various economic agents. To assess the long-term consequences quantitatively, an 40-year horizon, covering the period from 1980 to 2020 with a temporal resolution of 5-year intervals, has been selected for this study.

The forest sectors of European countries cannot be studied independent of each other and the world economy, since traditional trading of various timber species, forest-industry products and production equipment links the national forest sectors to each other. Therefore, a "global" approach has been selected for this study, with Europe as the focus.

For an analysis addressing long-term issues there should be a consistently defined framework to relate forests to consumers, quantities supplied to those in demand, consumer prices to production costs, and capacities to investments. A quantitative model forms the consistent framework for this exercise. In this sectoral model a "full" world market with all its local sub-markets is simulated. There are forest owners who supply exporting agents and producers of various forest products. Other model agents import products from foreign markets and deliver those to domestic users. The producers in the model may deliver for other producers and traders, and may also supply consumers. In spite of the complexity of relationships built into the model, most model assumptions represent tremendous simplifications of reality. Partly for this reason, and partly because of the scenario-analytical framework of this study, model results presented here should not be interpreted as forecasts of "most likely" outcomes.

The model prepared for this study - the European Trade Model, or ETM - attempts to cover most phenomena within the forest sector of the global economy. Trees are harvested, logs are converted to pulpwood and sawnwood, pulpwood is processed into different grades of pulp from which papers are fabricated. The consumer - somebody outside the forest sector - enters at this final stage only. Both timber removals and consumption should be internal to the model, as they cover the first and the last act within the material flows of the forest economy. However, for this study external projections of these variables were used, thus further limiting the validity of model results as forecasts. The European Timber Assessment Simulation System (ETASS) (Attebring et al., 1987) provided time series on timber supply affected by air pollution, while the demand models of the FAO Outlook Study (FAO, 1986), and a series of forecasts based on those models (Baudin, 1988; Baudin and Lundberg, 1987; Baudin and Segerstedt, 1987) defined the time paths for consumer demand of forest products.

Each computer run of the ETM generates a scenario. The future development of demand for final products was projected by experts along the lines of the Chase-Manhattan Economic Outlook, where a moderate growth in the future levels of Gross Domestic Product (and thus consumption) is assumed. With no limitations on the structure and volume of timber removals, a base scenario was derived consisting of projections for production, trade and prices for each five-year period up to year 2020. Whatever outcomes the model produced in this base scenario, it was assumed to indicate the normal development of the forest sector. On the other hand, the forest-decline scenarios show, within the framework of the rather conditional model assumptions, how the forest sector might react to pollution-induced changes in the timber supply. For these scenarios, externally given time series of timber removals were used to indicate various intensities of both sanitary fellings and forest decline. These scenarios - four altogether - were then compared with each other to provide the basic conclusions of the paper.

2. THE EUROPEAN TRADE MODEL

The ETM is a somewhat simplified version of the Global Trade Model (GTM, or the Global Model of Consumption, Production and Trade in the Forest Sector) developed in the Forest Sector Project of IIASA between 1983 and 1985 (Kallio et al., 1987). In this short summary only those methodological assumptions of the GTM that are important for the basic understanding of how the ETM operates are presented.

2.1 Methods

The model combines a set of regional, forest-sector component models with a model of global trade networks, thus linking the supply locations to regions of final consumption. The ETM is a partial-market-equilibrium model cast in a nonlinear programming framework, with linear constraints and a partly nonlinear objective function. For any time period, the model finds the market-equilibrium solution for all regions and all forest products such that demand and supply are equal for each forest product in each region. For each such solution, regional material flows must balance, and limits to productive capacities and interregional trade flows are observed. The equilibrium solution thus obtained is then updated to form the initial assumptions for the subsequent period, considering changes in the timber supply, productive capacity, production technology and costs, demand, and trade-flow inertia. In this manner, sequential equilibrium solutions are determined for the whole projection horizon by five-year periods. Although the model is implemented over time, it cannot be considered a true dynamic equilibrium model as no backward influence of future time periods is used in the solution. In this sense, the ETM is a sequence of static sub-models interconnected by a set of dynamic assumptions.

The ETM consists of the following 7 composite regions (the 3-character code names are used in the tables):

1. "CEU" - Central Europe (Federal Republic of Germany, Italy, Austria);

2. "SKA" - Scandinavia (Norway, Sweden, Finland);

3. "WEU" - Rest of Western Europe (hereafter called Western Europe);

4. "EEU" - Eastern Europe (excluding the USSR);

5. "SOV" - the USSR;

6. "ROW" - Rest of the World; and

7. "NAM" - North America.

The first five regions cover Europe. The division of Europe into these regions was directed by the current availability of aggregated data for some European countries. (Unfortunately, this breakdown does not coincide with the regional divisions that would be "optimal" for this exercise, where the regionalization should have been driven by patterns of forest decline or the geographic distribution of future wood supplies). The region called "Rest of the World" is rather heterogeneous. It includes some highly developed countries like Japan and Australia, along with such least developed ones as Bangladesh and Ethiopia. The only common characteristic of the countries in this region is their relatively large distance from Europe. The region "North America" was separated from the Rest of the World because of its tremendous impact on the European forest sector, both as a trading partner and competitor.

The ETM works with the highly aggregated product categories listed below, together with an indication as to whether the commodity is considered a final product (F) or an intermediate product (I):

1. recycled paper (I);
2. coniferous logs (I);
3. non-coniferous logs (I);
4. coniferous pulpwood (I);
5. non-coniferous pulpwood (I);
6. mechanical pulp (I);
7. chemical pulp (I);
8. coniferous sawnwood (F);
9. non-coniferous sawnwood (F);
10. veneer and plywood (F);
11. boards (wood-based panels) (F);
12. newsprint and printing paper (F);
13. packaging and other paper and boards (F); and
14. fuelwood (F).

In each model region, each product has its own producer, consumer, and trade agent. These model actors are present even if a product is not produced, traded, or consumed in a region. All trade agents of a given commodity have contacts to each other so they form a large inter-regional trade-flow network.

It is assumed in the model that each producer and trade agent in the forest sector is a profit maximizer and that each consumer purchases from the producer or trader who offers the lowest price. Given the prices for each commodity in each region, profit maximization results in a certain supply (production plus imports less exports) of commodities in each region. If supply equals demand, then the price is an equilibrium price. In the ETM, the equilibrium prices of final products are given, since target demand levels (consumption) are projected outside the model.

The solution corresponding to the equilibrium prices and quantities of all intermediate products consumed in a particular period can be obtained by solving a global optimization problem. In this problem the objective function represents the sum of consumers' and producers' surplus (Samuelson and Nordhaus, 1985). The point at which this surplus is maximized defines the equilibrium point.

Constraints in the model ensure:

- the given level of final product consumption,
- limitations on available timber resources,
- production capacities,

- inertia of trade, and
- material balances (i.e., consumption is equal to production minus net exports).

Consumption is projected outside the model for final products 8 to 13 as listed above. Using these series instead of model-internal entities reduces greatly the simultaneities embedded in the original model. Externally given consumption levels hinder the adjustment of consumers to prices (e.g., to reduce consumption when the price is high), as prices are simply given here by the consumption levels. Thus, instead of gradual adjustments in consumption, production and trade, only the latter two should cope with the "externally forced" prices. The sharper the projected increase of demand is, the more unrealistic the model results may be, as the development of production and trade are far less elastic due to rather stiff capacity and inertia constraints. For fuelwood in each region and solution period, demand is defined by a consumption function. For all intermediate products, demand is derived internally according to the needs of production and trade.

Timber resources available for harvesting in the base scenario were derived from preliminary model solutions observing no limitations on removals. There are two timber types considered in the ETM, coniferous and non-coniferous species. The trees harvested are converted directly into various raw materials resulting in certain quantities of logs, pulpwood and fuelwood.

Production processes in the model are treated in an activity-analytical input-output framework. Mechanical and chemical pulp, sawnwood, panels, and paper are produced by two technologies each. The first technology represents the already available production capacities referred to as old technology. The second, newer technology stands for investments. Over a multi-period horizon, the old capacities are gradually depreciated and closed down, while the new capacity entering production gradually ages. Various technology- and region-specific input-output coefficients represent the efficiency of physical conversions from input materials to output products. Parallel to the change in capacities over time, these coefficients are also shifted towards a globally uniform "ideal" future technology. There is a cost (i.e., an objective coefficient) assigned to the production activities. These costs include labour, energy, and maintenance expenditures, but exclude wood costs. The cost of new investments also incorporates capital charges. A special activity is devoted to paper recycling, and there are two activities implemented in the model to allow for cost-free reclassification of logs into pulpwood, and pulpwood into fuelwood. These latter processes are needed to add flexibility to the model if, for example, there is an excess quantity of logs, but a shortage in pulpwood.

With the exception of fuelwood, which is not an internationally traded commodity, a full network of bilateral trade flows connects each region and producer of each product with each other. A set of so-called inertia constraints ensures that trade flows develop rather smoothly over time. To allow for assumptions on product homogeneity, only net flows are considered in the ETM. This by no means limits the potential direction of trade. To each trade flow there is assigned a trade cost which includes the tariffs imposed on the quantity traded plus the transportation costs.

The USSR is represented in the model by a regional component in which production development, consumption and timber resources are all given exogenously. This module is then linked to the global model via the trade-flows network.

2.2 Model Data

The ETM has been calibrated to statistical data of 1980, the base year of the model. Most of the data I used for the ETM was obtained from the data base of the Austrian Trade Model (Kornai and Schwarzbauer, 1987). Final-product consumption series (Table 1) for all model regions have been derived from the simulation model of the FAO Outlook Studies (Baudin and Segerstedt, 1987) along the lines of the Chase-Manhattan GDP projections. Although these forecasts represent so-called "moderate" growth assumptions as opposed to the "high" and "low" demand projections of FAO, the increase of demand over the 40-year projection period is very significant. It is especially so for the region Rest of the World, although the per-capita consumption of several forest products reaches current European standards only by the end of the time horizon, 2020. For most of the other already highly developed regions, there is no sign of demand saturation over the forecast horizon, in spite of such considerations as the adverse effects of a forthcoming "electronic age" making newspapers obsolete, or the on-going technological evolution of building and furniture materials requiring less and less wood. The recent propagation of using plastics, though, already appears in the consumption of both coniferous and non-coniferous sawnwood that is projected to increase at a much lower rate than any of the other commodities. On the other hand, the projection fails to take into consideration such unforseen tendencies as the rapidly shrinking softwood availability relative to the volume of hardwood reserves: there seems to be no shift assumed in the future share of hard- and softwood grades, as this forecast reveals a surprisingly parallel growth pattern for both. Similar observations can be made in the case of wood-based panels (veneer, plywood and boards).

The trends behind these forecasts may still be considered far too optimistic for such highly developed regions as Scandinavia and Western Europe with about four-fold demand growth. Even in this rather restrictive projection, the demand for newsprint and printing and writing papers is assumed to reach levels more than three times the current consumption. The most serious concern about these demand forecasts is embedded in the FAO Outlook methodology: (1) the GDP elasticities of consumption for any particular income bracket are constant over time, (2) there is no place for other than directly GDP-related explanatory variables, such as material or product substitutions, and (3) effects that are historically not observable but which may gain some importance in future decades cannot play any role in shaping future consumption levels. These three unfortunate long-term properties result in the much-too-solid growth of consumption even where and when demand may and probably should level off, or at least show some cyclical patterns. The overall and steady increase in the projected consumption of all final products brings dangerous tension to the ETM with its consequent reduced capabilities for adaptation.

The input-output coefficients used in the ETM were originally estimated from material balances based on FAO production, consumption and trade statistics. Wherever possible, country-by-country data sources were used to refine the numbers. It is assumed in the model that the efficiency of production processes converges toward a globally uniform "best" technology.

Although this means a relatively minor development - and sometimes even recursion - in highly developed regions (Central Europe, Western Europe, Scandinavia, and North America), a rather rapid technological change for Eastern Europe and the Rest of the World is assumed. The actual speed of implementing technologies of higher efficiency depends on the realized capacity investments; the more new investments are made, the higher will be the overall technological level of the industry.

Productive capacities were estimated from incidental statistical reports and observed production data. It is assumed in the ETM that one-tenth of the old machinery will be put out of production in each period due to physical depreciation, regardless what the actual profitability conditions of the industry were. All new investments become part of the "old" capacities by the next solution period, bringing along some technological improvements. Investments are limited by the financial assets of the industry generated in the model as a fixed fraction of total sectoral turnover.

Production costs were obtained from the original GTM, where returns to national questionnaires formed the basis of cost calculations. The original cost coefficients were then fine-tuned within the model to reflect the base-year production situation assuring a "normal" level of profits for the industry. During multi-period model runs, production costs are also updated, as new technologies bring along part of the increasing investment costs.

Transportation costs were derived from an ocean-shipping model incorporated in the ETM. These costs are modified over time only if the quantity shipped changes.

Trade flows for 1980 were obtained by aggregating the global country-by-country FAO trade matrix for each forest-sector product. These matrices then were aggregated over composite model products, and a netting of flows took place that resulted in a rather sparse trade network for the ETM. The full trade network of the model consists of 546 potential trade flows (13 products by 7 exporters by 6 importers). From statistical publications, only 145 of these flows can be verified as actual net trade connections. For the smooth future development of trade flows, a pair of uniform inertia constraints were set allowing a 20% decrease or an 80% increase of each flow over a five-year period. For example, a flow of 1,000 metric tons in 1980 may thus drop to 168 tons or reach over 110,000 tons by 2020.

The tariffs on trade for the whole 40-year simulation horizon are assumed to be the ones implemented by 1987 as specified in the Tokyo Round agreements, thus representing a significant reduction of 1985 tariffs.

The basic currency of the ETM is the 1980 US dollar; all prices and costs in the model are expressed in constant currency terms. To allow for different inflation and currency-exchange situations to develop over time, an exchange-rate module is implemented in the model. We assume that the US dollar first gains against the other currencies by 1985, but loses its value by 1990 when it stabilizes about half way between its 1980 and 1985 value. From 1990 on, the devaluation of the dollar against other currencies is kept at a steady but very low rate; there are no major currency devaluations assumed for the projection horizon. To illustrate the above, for example, a US dollar is assumed to equal 1.6 Deutsche Marks in 1980, it rises to 2.6 by 1985 and stays around 2 between 1990 and 2020.

3. SCENARIO VARIATIONS

The ETM permits adjustment of a number of variables for deriving various scenarios along different assumptions and projections. For example, tariffs, exchange rates, demand parameters, technological development, trade inertia, production costs, and timber-harvest levels can all be projected outside the model before generating an output scenario.

The only scenario variable in this analysis is the level of timber removals in the first four European model regions. These projections are implemented as constraints in the model. USSR timber harvests are fixed along the same external assumptions for all scenarios. Removals in North America and the Rest of the World are defined endogenously by "normal" market needs. All other assumptions and constraints mentioned above were kept unchanged in generating scenarios for this study.

For the base scenario, the model was solved period by period until a set of timber removals had been found which satisfied the material balances for all regions and products, observing the assumptions and constraints described in previous sections. At the same time, since the equilibrium prices for some of the products are given, at least some attention had to be paid in this model-calibration process to maintaining "rational" price-level differentials among the commodities. The timber-harvest series thus determined can be considered as "normal" market-driven removals, as if there would be no constraint on the harvestable amounts otherwise required for the sustainability of the growing stock. The model results obtained from this solution forms our reference case.

The first forest-decline scenario (denoted FDS-1; see Table 2) assumes that, due to extensive current forest decline, forest-management practices will change. Sanitation and salvage removals in European forests will bring forward the harvest levels of year 2005 to 1995 and 2000. For years beyond 2005 removals are kept at their "normal" level. This scenario is meant to simulate the case where extensive amounts of raw material are dumped onto the markets within 10 years. From a modelling point of view, a set of lower constraints on removals represents the obligatory fellings.

The second forest-decline scenario (FDS-2; see Table 2) includes the sanitation harvest of the previous scenario for 1995 and 2000, but also contains a steady 1% annual decline in potential harvests for all periods beyond year 2000, simulating the assumption of slowly but surely diminishing forest resources. These series were implemented as upper limits on harvests.

For the third forest-decline scenario (FDS-3; see Table 2), the potential harvest levels obtained from ETASS (Attebring et al., 1987) were used. These series were generated at IIASA for a Forest-Study meeting late in 1987. It is important to note that this scenario is not necessarily consistent either with the ETASS model or with the ETM, since the simultaneous interdependency of the two models could not be fully secured: (a) the harvest-level responses of the ETM were not taken into account when obtaining the potential harvest levels for the subsequent period from ETASS; and (b) the temporal and regional aggregation of the two models could not be fully reconciled. In spite of these problems, the resulting harvest series of the two models were close enough to risk running this scenario.

The timber removals of FDS-3 do not show as strict a set of decline patterns as the "automatic" scenarios FDS-1 and FDS-2 (Table 2). The coniferous timber available for harvest in Central Europe is assumed to be even more in FDS-3 than the "normal" market requirements of the base scenario for years 1990 through 2000. For Scandinavia and Western Europe, FDS-3 projections are always significantly higher than for the "market-driven" BASE. For Eastern Europe, though, FDS-3 assumes a much more dramatic decline than does FDS-2. For the non-coniferous species in all European model regions but Western Europe, there is a tremendous decline in timber availability derived from the ETASS model for FDS-3. For Western Europe, the reduction is a little less than in scenario FDS-2, and for the period 1990 to 2000 there is somewhat more timber than in the BASE case.

4. RESULTS AND DISCUSSION

Each solution of the ETM generates a rather large amount of information for each region, product, period and activity. From among the wide array of projections, I have selected a limited number of results to be presented here. The development of wood costs, prices, trade flows, and investments is discussed for selected major products in years 1990, 2000, 2010 and 2020 among the four scenarios. It should be stressed again at this point that model results are predicated on both semi-statistical and semi-hypothetical data, as well as on assumptions embedded in the given model framework. Therefore, care should be taken that such extremely conditional results are not interpreted as forecasts. To avoid the dangers of direct interpretation, no prices and costs are presented as absolute numbers in the tables. The derived secondary statistics, I think, still show what the model can actually "predict", i.e., some likely tendencies and courses of future development.

4.1 Prices

Given the commodity prices from the model solution and the input-output coefficients, "implied" wood costs can be calculated. These implied raw-material prices, i.e., wood costs (Table 3) start to escalate beyond year 2000 for all scenarios. Although a minor part of this cost increase may be considered as intentional, since the costs of forest operations will inevitably rise in the future due to improved forest-management practices (e.g., forest regeneration, selection harvesting), there may be several, mostly methodologically bound shortcomings in model calibration responsible for this phenomenon:

1. International trade plays a price-balancing role. In the framework of this model, cost structures tend to follow the most severe bottleneck, one of which is to be found in the Eastern-European wood-supply situation.

2. There is a sharp increase in some product prices toward the end of the time horizon. Wherever shortages appear, the implied wood costs tend to increase, too. Due to some extremes in the external demand projections for final products, several bottlenecks appear for intermediate commodities and push prices upward.

3. In the ETM there is no substitution possible between coniferous and non-coniferous timber, since all production processes make and use fixed proportions of the species.

Wood costs not only escalate in absolute terms, but most of the values obtained in the forest-decline scenarios differ significantly from the cost levels of the base scenario (Table 3). The forced sanitation of FDS-1 does not seem to play a role in coniferous timber costs, although for year 2000 in Western Europe there is a minor drop. The increased harvests in FDS-1 and FDS-2, however, significantly reduce the cost of non-coniferous materials. In the forest-decline cases, coniferous timber costs are often some 20-40% higher than for the base case in 2020. For non-coniferous species, some cases even reveal a doubling of costs, an indication of intense shortages in most regions.

Relaxing the constraints on new investments and trade to an unrealistic level should have resulted in a somewhat reduced cost structure for the base scenario. A finer "tuning" of future material-use coefficients may have resulted in less striking differences between the cost structures of coniferous and non-coniferous species. But the forest-decline cases would still have the same relative characteristics.

Product prices obtained from the various scenarios show rapid and straightforward adjustments to the changing wood-supply situation, as normally assumed in a market-equilibrium framework. The series, compared among the scenarios, reveal decreasing price levels whenever there is more material available, while prices tend to increase in the case of shortages.

The track of the price series for all products may be considered as basically identical. Though absolute (i.e., US dollar) prices do differ significantly among the various products, there are only minor numerical differences in the price development of individual commodities relative to their base-scenario values (e.g., Tables 4 and 5). Raw-material prices (e.g., coniferous logs; see Table 4) fell dramatically below the base-scenario levels in all European regions due to increased sanitation harvest for scenarios FDS-1 and FDS-2 in year 1995, but there is an eventual over-reacting readjustment by 2000.

In 1995, log prices, expressed in US dollars, in Central Europe and Eastern Europe drop to the level of wood residues (in this model considered useless), indicating an enormous supply surplus. Less shocking but still significant is the related price fall in Scandinavia and Western Europe. Regions not directly affected by the assumption of forced sanitation (i.e., the USSR, the Rest of the World and North America) face a lower price increase due to their losses in export-market shares only.

By year 2000, following the production and trade adjustments to this entirely new situation, prices recover to a level similar to 1990. Surprisingly enough, raw-material prices gain about seven percentage points over the base scenario in Central Europe and Eastern Europe. This can be explained by the over-reactions in capacity expansion and a heavier export orientation of these regions between 1995 and 2000.

While raw materials in scenario FDS-1 become marginally cheaper by 2020 than in the base case, scenario FDS-2 indicates major market disturbances as timber gets scarcer. Following some periods of more-than- sufficient supply, even tighter bottlenecks appear in scenario FDS-3, resulting in a higher price level.

Final-product prices (e.g, newsprint, and printing and writing papers; see Table 5) show similar patterns over time. However, price reactions are somewhat sharper here than for raw materials. The most important reason may be that for the European regions, consumption levels are fixed exogenously, and the adjustment process is further limited by several model-internal factors. Thus, final products are less directly linked to the regional forests than any raw materials alone (but depend more on the available capacities), the given technological structure of production, and the fixed mix of inputs. In the model, should any of these factors be negatively affected by forest decline, prices for final products will inevitably rise sharper than those of raw materials.

4.2 Trade Flows

Total world trade (Table 6) develops unevenly among the various products. Sawnwood remains the most traded commodity, and pulpwood retains its second position. In value terms, however, newsprint and printing and writing papers gain a leading role. Trade in logs increases only until year 2000, followed by a steady decline, while there is basically no change in the trade of wood-based panels (veneer and plywood). It seems that these latter two commodities are more sensitive to scenario variations than pulpwood, sawnwood and the paper grades. All in all, world trade reveals a gradual shift from trading raw materials towards trade in commodities.

For coniferous logs (Table 7), North-American exports to the Rest of the World (in reality, US exports to Japan) constitute the most important trade link. In all scenarios, there is a peak in this flow around year 2000, when the European over-supply drives down world market prices. As log prices recover due to forest decline by 2020, this flow begins to diminish. In the forest-decline scenarios, Scandinavia emerges as the major European importer of coniferous timber. Both the rather high demand forecasts and the pessimistic cost structure assumed for Scandinavia can be held responsible for this surprising result. Eastern Europe, while in general delivering less timber, dumps a significant amount of wood to Scandinavia between 2000 and 2020, with the exception of FDS-3 where Eastern European logs are delivered rather to Central Europe. Parallel to this, Western Europe, least disturbed in scenario FDS-3, conquers a major share of the Scandinavian market by 2020. The USSR, probably under pressure to meet rapidly expanding domestic demand within the given, extremely tight production and technology constraints in the model, is forced to lose markets all around the world. Trading of coniferous logs among the European regions seems to gain only in its relative importance over the time perspective of the ETM.

Within the four-fold growth of coniferous pulpwood trade (Table 8), imports to Scandinavia - also due to the above reasoning - are boosted by about seven times over the 40-year model horizon. The import market share of this region also expands from ca. 40% in 1980 to over 60% by 2020. The imported pulpwood is processed into various grades of paper, which will then be partly exported, partly used domestically. The second importing region is Western Europe, followed by Central Europe. These three European regions account for essentially all pulpwood imports. As far as exporters are concerned, North America overtakes the USSR and Eastern Europe on all markets. The North-American export flow to Scandinavia is 40 times bigger in 2020 than in 1980, while the Western-European import flow from the same region increases tenfold over these 40 years! Due to the European forest-decline situation, a large proportion of logs harvested in North America is sold as pulpwood. There may be two explanations for this phenomenon:

(1) North America does not face forest decline in this model, and thus gains simply by having virtually unlimited resources, while in Europe wood costs are escalating; and

(2) a very favourable cost structure of the North-American region has initially been assumed and built into the data for the region, especially in comparison with that of the Scandinavian costs.

In volume terms, the most traded commodity is coniferous sawnwood (Table 9). More than 70% of total trade is concentrated in the single flow between North America and the Rest of the World. The volume of European trade within world trade remains virtually constant over the forecast horizon; thus, the market share of Europe continuously drops both in imports and exports. Scandinavia, traditionally the most important supplier of Western Europe, gradually loses this market to North America. In the most severe forest-decline scenarios FDS-1 and FDS-2, exports from the Rest of the World to both the USSR and Scandinavia are partly re-directed to Central Europe.

Trade in veneer and plywood (Table 10), in spite of the tremendous rise in demand, remains marginal throughout the scenarios. In forest-decline situations, where Western-European consumption needs cannot be met by domestic production, Scandinavian and North-American exports can easily fill the gap. It seems that local production capacities will substitute international trade of this commodity.

North America and Scandinavia share the world market of the most valuable commodity of this model, newsprint and printing and writing papers (Table 11). In spite of Scandinavian efforts to keep two-thirds of all markets, North America seems to conquer a similar portion by 2020. Moreover, Eastern Europe takes over the Scandinavian markets in the Rest of the World. In the forest-decline scenarios, the market dominance of North America is even bigger. The major importers of paper grades are the Rest of the World and Western Europe. These tendencies seem to be driven by both extreme demand forecasts and the unlucky evolution of European cost competitiveness rather than by the lack of raw material in Europe.

Summarizing the geographic development of world trade in the model, to the disadvantage of most European regions, North America emerges as the basic future winner - and sometimes sole ruler - of most forest-product markets even in the "normal" base scenario. These trends are then further amplified by the European forest decline. Scandinavia also seems to gain in most cases, at least in absolute volume terms, though loses vital markets all around the world to North America. Traditional exporters, the USSR and Eastern Europe, gradually disappear from most of the markets. The major importer region, Rest of the World, provides North America with a steadily growing market. Central and Western Europe become much more dependent on imports than in year 1980. Forest decline may, though, eventually slow imports down.

4.3 Investments

The structure of the ETM prevents consideration of investments to forest land and new plantations. Only production assets bound to particular technologies are treated in the model. As mentioned earlier, the expansion of such productive capacities is calculated fully internally by the model. It is important to note, however, that there is no possibility in the model to suspend and later re-start capacities, as the depreciation of assets is automatic. Investments are generated partly to substitute the depreciated equipment and partly to increase production. New capacities are generally more expensive but also more efficient than old ones.

This section provides a brief overview of the projected pulp-, saw-, and papermill capacity formation. Regarding the geographic distribution of pulpmill capacities (Table 12), the only region which could enhance its relative position is the Rest of the World, while all others weaken to some extent. Forest-decline presumptions (scenarios FDS-1 and FDS-2) even worsen the circumstances of European regions to the benefit of North America. In scenario FDS-3 there is only a minor redistribution of capacities from Central Europe, the Rest of Western Europe and Eastern Europe to Scandinavia. Since pulp is not traded in large quantities, local production assets should keep up with the changing wood supply. The Rest of the World and North America can increase their processing capacities in line with the pulpwood supply (Table 3). European regions, however, experience a rather erratic adaptation of capacities for this crucial intermediate product; a period of capacity expansions (positive entries, Table 13) is usually followed by severe divestment (negative numbers) leading to even more intensive investments (e.g., Scandinavia, scenario FDS-2). There may be several explanations for this behaviour. In this model the most plausible reason is that unused logs are always sold and utilized as pulpwood, without any extra production costs involved. For the profit-maximizing buyer of pulpwood, (i.e., the pulpmill), there are periods of cheap and periods of expensive pulpwood, depending on the world market situation. Large forced sanitation harvests make pulpwood virtually free, and therefore pulpmill investments look promising. As timber becomes scarcer, a considerable amount of slack (unused) capacity is automatically closed down by the model. These assets then should be re-invested as the market improves and paper demand refuses to adjust to these higher prices, which is the case in the ETM with externally given (i.e., completely inelastic) paper consumption.

The geographic distribution of sawmilling capacities (Table 14) is virtually the same for all four scenarios tested. European regions, in spite of the improved raw-material supply situation under forest-decline assumptions, become increasingly marginal. The relative loss of importance of both the USSR and the Rest of the World is rather remarkable, as well as the overall and ever strengthening dominance of North America.

In contrast to these global tendencies, the development of net annual investments indicates how forest decline could modify "normal" investment behavior (Table 15), at least in the framework of model assumptions. In Central Europe, simple substitution of depreciated capacities seems to be sufficient to process the timber harvested in forced sanitation (FDS-1). Should the amount of timber decline (FDS-2 and FDS-3), a number of mills would be closed down. In Scandinavia, cheap sawlogs first make investments rather attractive by year 2000, but the forest decline beyond year 2000, together with the most efficient production lines brought into existence by this time, result in a very significant premature divestment of (most likely old) capacities. In Western Europe, "normal" divestments are rescheduled: forest decline first virtually keeps the sawmilling industry above water before it finally sinks at a greater speed. Eastern European sawmilling collapses much faster in scenarios FDS-1 and FDS-2 than it would in the "normal" case; however, forest decline does not seem to induce further recession here. In the Rest of the World, in spite of tremendous demand, assets are continuously put out of production. The pace of this process slows down as forests in Europe undergo further declines (FDS-3). In North America, the "normal" expansion of the industry is delayed by the lower prices until European forests begin to decline.

In 1980, more than 80% of all veneer- and plywood-producing capacities were equally shared between the Rest of the World and North America. By 2020, the Rest of the World has 73% of all assets, while North America holds its number two position with only a 13% share. Beside this major structural rearrangement, over the 40-year long simulation period of the model, production multiplies by a factor of 2 in North America, 3 in Eastern Europe, 4 in Central Europe and USSR, 5 in Scandinavia, 9 in Western Europe, and 12 in the Rest of the World (Table 16). Model results indicate that forest decline has no significant effect here due to the marginal role Europe plays in the production of and investments in this commodity.

In year 2020, capacities for newsprint and printing and writing paper are distributed throughout the world in about the same proportions as in 1980 (Table 17). North America and the Rest of the World take over what Western Europe and the USSR lost. Most European regions gain larger shares in the cheap pulpwood era until about year 2000, but lose later on. Model results on net annual investments give the basic impression of a solid capacity growth. However, a deeper look at the output data (Table 18) reveals that it is again North America alone making good use of the European forest decline. It also seems that papermill investments are somewhat lagged behind the capacity expansions in sawmills, since some of the peaks for the forest-decline scenarios occur in 2010 only (e.g., in Central Europe and the Rest of the World), and the investments under forced sanitation projections stay below "normal" base-scenario levels (e.g., in Central Europe, Scandinavia and Western Europe).

5. CONCLUSIONS

There is no doubt that intensified forest decline and the related increased timber-salvage harvests can have significant economic impacts both in the short and the long run. These impacts, though, are unlikely to be very sudden or dramatic. As even the above rather conditional model conclusions indicate, there is still sufficient time to look for possible ways of adaptation to avoid collapse of the forests and the forest economy.

The results obtained from the ETM underline the importance of such analyses, as scenario comparisons do reveal some main lines of potential futures. At the same time, however, some unfortunate properties of the model and its data are disclosed, too.

The ETM-results may be considered somewhat superior to the conclusions of an earlier GTM-based analysis (Dykstra and Kallio, 1986). Since the forest-decline scenarios here were applied to all European regions, the undesirable consequences do not bypass Scandinavia, Eastern Europe and Central Europe. On the other hand, this analysis could not take into account the adjustments in final consumption and the second- and higher-order effects (e.g., on investments, production, timber removals) of such model-internal demand shifts. For further analyses, demand projections should be reinstated in the model.

In comparison with the GTM, it seems that even the improved geographical resolution of Europe in the ETM is insufficient if one needs more sensitive conclusions. The regions Central Europe and Western Europe combine countries far too heterogenous to be considered satisfactorily together. Another aggregation of Europe, separating the Southern parts from the Central regions and from the North-Western countries may have been healthier. The regions Rest of the World and North America are far too big within the ETM compared to the other zones. There is always a chance that these two big regions, especially with fewer constraints on resources, investments and consumption, can acquire an unrealistically decisive role.

The low number of competing technologies for each production process (namely, two) makes it virtually impossible to find rational substitutions among various production inputs now given as fixed proportions. Technological adjustment thus could not be used in the scenarios as a flexible means of adaptation.

The current treatment of investments cannot be considered as sufficient; depreciation and capacity termination should not be automatic but should also depend on profitability circumstances. Even such national economic criteria as employment may be worth taking into account in specifying investment policies within the model.

Closer, fully simultaneous links should be defined to elaborate timber-supply models such as the ETASS model. As mentioned earlier, the ETM and ETASS had not been fully reconciled for the purposes of this exercise.

A related issue is the statistical reliability of the model. In the current version, each model region has the very same structural set-up and data requirement. In cases of lack of real data, several figures were based on "educated guesses" rather than observations. A more flexible definition of individually shaped component models would allow for a better statistics-to-data ratio and thus improved model reliability. Considering that available data sets are rather depauperate, it is only intensive international co-operation on data and methodology that could improve the statistical representation of regions in the model.

From the technical point of view, the ETM is a very computer-intensive model. Efforts to cut the computer run times may pay off directly in terms of research budget and human nerves. Of course, these tasks are all very laborious, but would greatly improve the ETM (and the GTM) as a convenient policy-analytical tool.

REFERENCES

Attebring, J., S. Nilsson, and O. Sallnaes. 1987. A Model for Long-Term Forecasting of Timber Yield - A Description with Special Reference to the Forest Study at IIASA. Manuscript, Swedish University of Agricultural Sciences, Garpenberg.

Baudin, A. 1988. Long-term Economic Development and Demand for Forest Products. WP-88-05, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Baudin, A. and L. Lundberg. 1987. A world model of the demand for paper and paperboard. Forest Science 33:185-196.

Baudin, A. and B. Segerstedt. 1987. User's Guide for a Global Model of Future Demand for Forest Products. Manuscript prepared for the Project on Ecologically Sustainable Development of the Biosphere, International Institute for Applied Systems Analysis, Laxenburg, Austria.

FAO. 1986. The Outlook for Pulp and Paper to 1995. Food and Agriculture Organization of the United Nations, Rome.

Kallio, M. and D.P. Dykstra. 1986. Economic Impacts of Atmospheric Pollution on Timber Supply and Forest-Product Markets in Western Europe. Manuscript prepared for the Timber Committee of the United Nations Economic Commission for Europe, Geneva.

Kallio, M., D.P. Dykstra, and C.S. Binkley (editors). 1987. The Global Forest Sector: An Analytical Perspective. John Wiley and Sons, Chichester. 706 pp.

Kornai, G. and P. Schwarzbauer. 1987. The Austrian model of production, consumption and trade in forest products (ATM). Pp. 71-78 In: Forest Sector and Trade Models: Theory and Application. Proceedings of an International Symposium. College of Forest Resources, University of Washington, Seattle, Washington, USA.

Nilsson, S. and P. Duinker. 1987. Extent of forest decline in Europe: a synthesis of survey results. Environment 29:4-9,30-31.

Samuelson, P.A. and W.D. Nordhaus. 1985. Economics. McGraw-Hill, New York.

GLOSSARY OF TERMS

The following definitions do not necessarily apply beyond this paper.

Constraint: a mathematical entity (value or formula) limiting the validity of a given variable or relationship.

Demand: a theoretical (non-observable, non-statistical) notion, not necessarily equal to (observable, statistical) consumption.

Economic Agent: see Model Agent.

Equilibrium: an imaginary state of the market when supply and demand are equal for each product in each region considered.

ETM: European Model of Consumption, Production and Trade in the Forest Sector (also referred as European Trade Model).

Final Product: consumed outside the forest sector.

Forest Product: derived from forest resources by the forest sector. Logs, solid-wood products, pulp, and paper are typical forest products.

Forest Sector: a set of activities related to the use of wood, the production and distribution of forest products.

Intermediate Product: consumed within the forest sector in the production of other intermediate or final products.

Market Actor: see Model Agent.

Material Balance: [Consumption] + [Exports] = [Production] + [Imports]

Model Agent: an abstract notion of consumers, producers and trade agents represented in the model by various behavioral assumptions.

Net Investment: = [Gross Investment] - [Substitution of depreciated capacities] = [Absolute Change in Total Capacity]

Objective Function: a mathematical definition or criterion of a target.

Partial Equilibrium Model: where the equilibrium solution is limited to a given economic sector (e.g., the forest economy) only.

Programming Model: a common type of mathematical method, also referred as optimization, to find the 'best' solution for systems of inequalities (see Constraints) along an objective function.

Scenario: a consistent set of conditional forecasts or projections on, for example, forest resources, technological progress, investments, final-product demand, exchange-rate development.

Scenario Analysis: a procedure for investigating the implications of an assumed policy. In the context of this paper, it also means the comparison of two or more scenarios (sensitivity analysis).

Supply: = [Production] + [Imports] - [Exports].

Table 1. Projections for consumption of final forest products used for all scenarios generated in this study. Figures are percentages of 1980 data.

REGION*	CONSUMPTION			
	1990	2000	2010	2020
	CONIFEROUS SAWNWOOD			
CEU	105.9	111.6	118.2	124.7
SKA	113.1	128.6	146.4	165.5
WEU	104.8	113.6	123.0	133.6
EEU	106.6	113.2	121.0	125.7
SOV	103.2	106.6	110.0	113.5
ROW	132.4	180.2	253.0	364.5
NAM	112.3	120.3	128.0	136.4
	NON-CONIFEROUS SAWNWOOD			
CEU	105.9	111.8	119.1	122.1
SKA	120.0	140.0	140.0	160.0
WEU	103.8	113.5	122.1	132.7
EEU	107.1	114.3	121.4	128.6
SOV	103.4	106.7	110.1	113.4
ROW	132.6	180.5	253.3	364.9
NAM	112.2	120.6	128.3	136.7
	VENEER & PLYWOOD			
CEU	136.4	181.8	250.0	318.2
SKA	160.0	200.0	300.0	420.0
WEU	135.9	200.0	289.7	428.2
EEU	146.2	215.4	307.7	384.6
SOV	143.5	208.7	304.3	439.1
ROW	173.6	325.2	638.0	1309.2
NAM	118.5	141.3	169.0	202.7
	BOARDS (WOOD-BASED PANELS)			
CEU	135.4	183.8	250.5	303.0
SKA	140.7	196.3	270.4	381.5
WEU	138.6	202.0	294.1	431.7
EEU	145.5	210.6	304.5	409.1
SOV	144.9	211.5	307.7	447.4
ROW	173.6	326.4	640.3	1313.9
NAM	118.1	141.0	168.1	202.1

Table 1. (continued)

REGION*	CONSUMPTION			
	1990	2000	2010	2020
	NEWSPRINT and PRINTING & WRITING PAPER			
CEU	136.6	188.7	260.6	352.1
SKA	147.1	217.6	323.5	482.4
WEU	135.2	189.5	264.8	373.3
EEU	133.3	175.0	241.7	316.7
SOV	131.5	172.2	225.9	300.0
ROW	162.7	268.1	449.2	764.3
NAM	134.5	174.5	225.5	292.9
	PACKAGING and OTHER PAPER & PAPERBOARDS			
CEU	105.6	115.5	126.8	140.8
SKA	110.0	120.0	130.0	140.0
WEU	110.5	129.8	150.9	176.3
EEU	113.9	127.8	147.2	163.9
SOV	112.5	127.5	142.5	162.5
ROW	144.7	222.1	356.2	596.2
NAM	112.5	118.1	123.4	128.7

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 2. Timber-harvest assumptions by regions and scenarios. Figures are in millions of cubic metres.

REGION*	SCENARIO	TIMBER HARVESTS				
		1980	1990	2000	2010	2020
		CONIFEROUS SPECIES				
CEU	BASE	34.6	47.5	54.0	59.0	70.0
	FDS-1	34.6	47.5	57.0	59.0	70.0
	FDS-2	34.6	47.5	57.0	51.5	46.4
	FDS-3	34.6	53.5	56.2	51.6	49.9
SKA	BASE	89.6	107.0	111.0	120.0	128.0
	FDS-1	89.6	107.0	116.0	120.0	128.0
	FDS-2	89.6	107.0	116.0	104.7	94.5
	FDS-3	89.6	121.1	133.4	128.2	130.3
WEU	BASE	58.0	66.0	68.0	74.0	78.0
	FDS-1	58.0	66.0	71.0	74.0	78.0
	FDS-2	58.0	66.0	71.0	64.0	57.8
	FDS-3	58.0	74.5	95.8	94.0	97.1
EEU	BASE	56.9	85.1	116.0	127.0	136.0
	FDS-1	56.9	85.1	121.0	127.0	136.0
	FDS-2	56.9	85.1	121.0	109.2	98.6
	FDS-3	56.9	67.9	72.8	86.7	85.5
		NON-CONIFEROUS SPECIES				
CEU	BASE	18.9	27.9	31.0	35.0	41.0
	FDS-1	18.9	27.9	33.0	35.0	41.0
	FDS-2	18.9	27.9	33.0	29.8	26.9
	FDS-3	18.9	27.6	21.8	19.6	19.0
SKA	BASE	11.2	18.0	24.0	31.0	38.0
	FDS-1	11.2	18.0	27.0	31.0	38.0
	FDS-2	11.2	18.0	27.0	24.3	22.0
	FDS-3	11.2	17.5	18.2	17.7	18.0
WEU	BASE	50.3	53.6	59.0	63.0	67.0
	FDS-1	50.3	53.6	61.0	63.0	67.0
	FDS-2	50.3	53.6	61.0	55.1	49.7
	FDS-3	50.3	58.4	62.6	55.7	57.6
EEU	BASE	55.0	75.0	93.0	104.0	118.0
	FDS-1	55.0	75.0	98.0	104.0	118.0
	FDS-2	55.0	75.0	98.0	88.4	79.8
	FDS-3	55.0	62.3	64.6	76.6	75.2

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 3. Implied wood costs projected by the ETM. Figures are percentages of 1980 data.

REGION*	SCENARIO	WOOD COSTS 1990	2000	2010	2020
		CONIFEROUS TIMBERS			
CEU	BASE	132.9	133.0	218.4	387.1
	FDS-1	132.9	141.9	229.7	384.2
	FDS-2	132.9	141.9	245.3	463.7
	FDS-3	103.1	134.8	279.8	489.4
SKA	BASE	145.5	164.8	230.5	401.5
	FDS-1	145.5	165.4	228.2	396.2
	FDS-2	145.5	165.4	242.7	459.9
	FDS-3	121.6	165.2	290.8	535.7
WEU	BASE	135.0	132.5	171.8	326.9
	FDS-1	135.0	125.9	171.6	321.1
	FDS-2	135.0	125.9	196.4	375.4
	FDS-3	100.8	114.9	215.8	310.9
EEU	BASE	111.0	206.7	356.4	651.7
	FDS-1	111.0	222.1	359.0	646.8
	FDS-2	111.0	222.1	380.8	784.6
	FDS-3	130.2	215.4	436.3	902.0
		NON-CONIFEROUS TIMBERS			
CEU	BASE	124.0	136.2	278.8	532.7
	FDS-1	124.0	127.6	290.7	544.7
	FDS-2	124.0	127.6	475.7	890.8
	FDS-3	172.7	290.5	407.4	1064.9
SKA	BASE	200.6	153.9	409.9	1067.7
	FDS-1	200.6	132.3	427.7	988.8
	FDS-2	200.6	132.3	768.5	1856.9
	FDS-3	271.3	343.1	671.2	1770.0
WEU	BASE	127.1	113.6	198.5	388.4
	FDS-1	127.1	103.1	212.1	401.4
	FDS-2	127.1	103.1	315.7	673.0
	FDS-3	136.4	173.9	288.7	758.8
EEU	BASE	109.7	126.0	292.2	597.3
	FDS-1	109.7	100.2	305.6	622.1
	FDS-2	109.7	100.2	529.7	1277.4
	FDS-3	158.6	284.2	430.9	1227.0

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 4. Prices of coniferous logs projected by the ETM. Figures are percentages of prices from the base scenario.

REGION*	SCENARIO	RELATIVE PRICES				
		1990	1995	2000	2010	2020
CEU	FDS-1	100.0	27.8	107.6	107.2	99.3
	FDS-2	100.0	27.8	107.6	115.1	120.1
	FDS-3	79.3	77.8	102.2	128.3	126.4
SKA	FDS-1	100.0	78.6	98.4	98.2	99.3
	FDS-2	100.0	78.6	98.4	105.3	114.2
	FDS-3	80.9	74.1	99.2	120.0	133.7
WEU	FDS-1	100.0	81.5	99.1	100.0	98.1
	FDS-2	100.0	81.5	99.1	112.9	111.7
	FDS-3	75.5	73.9	88.8	130.7	102.7
EEU	FDS-1	100.0	12.8	107.3	100.7	99.2
	FDS-2	100.0	12.8	107.3	107.1	120.5
	FDS-3	115.9	141.0	103.7	122.7	138.6
SOV	FDS-1	100.0	93.8	89.3	98.0	98.1
	FDS-2	100.0	93.8	89.3	106.1	114.8
	FDS-3	102.5	72.8	90.3	130.6	135.2
ROW	FDS-1	100.0	98.9	98.1	98.6	99.6
	FDS-2	100.0	98.9	98.1	106.2	110.7
	FDS-3	100.8	104.2	98.1	104.9	109.9
NAM	FDS-1	100.0	94.4	95.3	99.1	98.8
	FDS-2	100.0	94.4	95.3	106.1	115.2
	FDS-3	95.3	92.6	96.9	98.2	106.6

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 5. Prices of newsprint and printing and writing paper projected by the ETM. Figures are percentages of prices from the base scenario.

REGION*	SCENARIO	RELATIVE PRICES				
		1990	1995	2000	2010	2020
CEU	FDS-1	100.0	85.3	108.2	100.5	100.1
	FDS-2	100.0	85.3	108.2	110.6	125.1
	FDS-3	98.5	103.3	107.9	114.1	131.3
SKA	FDS-1	100.0	95.9	102.3	100.3	97.6
	FDS-2	100.0	95.9	102.3	111.0	124.2
	FDS-3	98.9	97.8	107.9	118.4	126.1
WEU	FDS-1	100.0	93.7	103.9	100.8	97.8
	FDS-2	100.0	93.7	103.9	108.0	127.1
	FDS-3	99.2	101.5	106.4	114.7	125.1
EEU	FDS-1	100.0	81.0	100.7	100.3	100.0
	FDS-2	100.0	81.0	100.7	111.8	129.6
	FDS-3	104.7	110.3	109.3	113.8	136.5
SOV	FDS-1	100.0	94.9	95.7	96.6	100.0
	FDS-2	100.0	94.9	95.7	106.7	100.0
	FDS-3	104.0	100.0	108.0	112.2	100.0
ROW	FDS-1	100.0	96.4	101.9	100.4	100.0
	FDS-2	100.0	96.4	101.9	110.9	121.5
	FDS-3	98.8	98.0	107.2	117.0	122.5
NAM	FDS-1	100.0	97.8	99.3	100.4	100.0
	FDS-2	100.0	97.8	99.3	106.3	123.0
	FDS-3	100.0	102.2	103.9	110.4	124.0

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 6. World trade of selected products projected by the ETM.

SCENARIO	TRADED QUANTITIES			
	1990	2000	2010	2020
Coniferous Logs (million cubic metres)				
BASE	25.99	41.75	26.44	12.97
FDS-1	25.99	52.92	41.49	20.33
FDS-2	25.99	52.92	37.55	19.81
FDS-3	27.85	51.28	36.46	28.03
Coniferous Pulpwood (million cubic metres)				
BASE	28.06	47.19	71.72	127.69
FDS-1	28.06	42.00	57.65	125.22
FDS-2	28.06	42.00	60.43	125.23
FDS-3	19.02	19.08	43.16	79.27
Coniferous Sawnwood (million cubic metres)				
BASE	40.27	72.03	140.24	255.64
FDS-1	40.27	70.69	139.41	254.60
FDS-2	40.27	70.69	134.83	245.72
FDS-3	36.38	59.99	126.19	238.51
Veneer and Plywood (million cubic metres)				
BASE	2.76	1.58	0.82	0.47
FDS-1	2.76	2.62	2.32	1.77
FDS-2	2.76	2.62	2.20	4.47
FDS-3	2.86	1.53	0.81	2.13
Newsprint and Printing & Writing Paper (million metric tons)				
BASE	13.32	28.78	52.28	90.43
FDS-1	13.32	28.43	50.27	87.75
FDS-2	13.32	28.43	45.13	90.94
FDS-3	11.95	22.68	47.45	101.02

Table 7. Trade in coniferous logs projected by the ETM. Figures are millions of cubic metres.

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
WEU --> CEU	BASE, FDS-1, FDS-2	0.15	0.07	0.04	0.02
	FDS-3	0.15	0.07	0.04	0.08
WEU --> SKA	BASE, FDS-1, FDS-2	0.07	0.03	0.02	0.01
	FDS-3	0.07	0.03	0.02	5.14
EEU --> CEU	BASE	2.97	3.74	1.83	0.90
	FDS-1	2.97	1.46	1.28	0.63
	FDS-2	2.97	1.46	0.71	0.35
	FDS-3	2.27	1.11	3.36	1.65
EEU --> SKA	BASE, FDS-3	0.00	0.00	0.00	0.00
	FDS-1	0.00	9.16	12.28	6.02
	FDS-2	0.00	9.16	4.49	2.20
SOV --> CEU	ALL	0.50	0.25	0.12	0.06
SOV --> SKA	BASE	0.41	2.45	3.50	1.72
	FDS-1, FDS-2	0.41	1.13	2.19	1.07
	FDS-3	0.41	1.52	1.69	0.83
SOV --> ROW	BASE, FDS-1, FDS-2	3.35	1.64	0.80	0.39
	FDS-3	5.21	2.55	1.25	0.61
NAM --> SKA	BASE, FDS-1	0.00	0.00	0.00	0.00
	FDS-2	0.00	0.00	0.00	1.41
	FDS-3	0.00	0.00	0.00	4.97
NAM --> ROW	BASE	19.24	33.57	20.13	9.87
	FDS-1	19.24	38.91	24.76	12.13
	FDS-2	19.24	38.91	29.18	14.30
	FDS-3	19.24	45.47	29.98	14.69
WORLD TRADE	BASE	25.99	41.75	26.44	12.97
	FDS-1	25.99	52.92	41.49	20.33
	FDS-2	25.99	52.92	37.55	19.81
	FDS-3	27.85	51.28	36.46	28.03

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 8. Trade in coniferous pulpwood projected by the ETM. Figures are millions of cubic metres.

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
EEU --> CEU	BASE	3.33	8.00	10.35	15.01
	FDS-1	3.33	5.01	8.56	19.56
	FDS-2	3.33	5.01	8.15	7.84
	FDS-3	2.14	1.05	2.86	1.43
EEU --> SKA	BASE	2.22	7.20	3.53	12.44
	FDS-1	2.22	5.08	2.49	7.01
	FDS-2	2.22	5.08	2.49	1.22
	FDS-3	1.59	1.86	6.02	4.53
EEU --> WEU	BASE, FDS-1, FDS-2	2.22	2.80	1.37	0.67
	FDS-3	0.07	0.04	0.02	0.01
SOV --> CEU	BASE	0.29	0.14	0.65	0.32
	FDS-1	0.29	0.14	2.14	1.05
	FDS-2	0.29	0.14	4.18	3.34
	FDS-3	0.29	0.14	0.07	0.03
SOV --> SKA	BASE	7.09	7.79	7.61	10.56
	FDS-1	7.09	9.10	7.43	10.48
	FDS-2	7.09	9.10	5.39	8.19
	FDS-3	5.23	7.80	9.56	11.52
SOV --> WEU	ALL	0.51	0.25	0.12	0.06
SOV --> ROW	ALL	0.42	0.21	0.10	0.05
NAM --> CEU	BASE, FDS-1	0.01	0.01	0.00	0.00
	FDS-2	0.01	0.01	0.00	3.75
	FDS-3	0.01	0.01	0.00	1.37
NAM --> SKA	BASE	1.62	8.42	20.56	51.61
	FDS-1	1.62	8.21	19.20	57.90
	FDS-2	1.62	8.21	22.52	65.81
	FDS-3	0.36	2.59	15.43	50.00
NAM --> WEU	BASE	2.65	8.60	25.58	36.06
	FDS-1	2.65	7.42	14.39	27.53
	FDS-2	2.65	7.42	14.26	33.39
	FDS-3	2.72	2.35	7.62	9.60
NAM --> ROW	BASE, FDS-1, FDS-2	7.70	3.77	1.85	0.91
	FDS-3	5.68	2.78	1.36	0.67

Table 8. (continued)

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
WORLD TRADE	BASE	28.06	47.19	71.72	127.69
	FDS-1	28.06	42.00	57.65	125.22
	FDS-2	28.06	42.00	60.43	125.23
	FDS-3	19.02	19.08	43.16	79.27

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 9. Trade in coniferous sawnwood projected by the ETM. Figures are millions of cubic metres.

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
SKA --> CEU	BASE, FDS-1, FDS-3	0.89	0.44	0.21	0.11
	FDS-2	0.89	0.44	1.26	4.21
SKA --> WEU	BASE	10.22	5.01	2.45	7.95
	FDS-1	10.22	10.14	6.90	16.82
	FDS-2	10.22	10.14	8.68	5.77
	FDS-3	13.49	7.87	8.11	3.97
SKA --> ROW	BASE	6.10	13.46	18.63	14.25
	FDS-1	6.10	13.24	19.19	9.40
	FDS-2	6.10	13.24	8.20	4.02
	FDS-3	6.10	16.47	12.54	6.14
EEU --> CEU	BASE, FDS-1, FDS-2	1.79	0.88	0.43	0.21
	FDS-3	0.33	0.16	0.08	0.04
EEU --> WEU	BASE	1.79	2.59	1.27	0.62
	FDS-1, FDS-2	1.79	2.37	1.16	0.57
	FDS-3	0.15	0.07	0.04	0.02
EEU --> ROW	BASE	1.79	5.81	3.82	1.87
	FDS-1, FDS-2	1.79	5.81	2.85	1.40
	FDS-3	0.01	0.01	0.00	0.00
SOV --> CEU	BASE, FDS-1	0.44	0.21	0.10	0.05
	FDS-2	0.44	0.21	0.10	2.83
	FDS-3	0.44	0.21	0.64	3.09
SOV --> WEU	ALL	0.80	0.39	0.19	0.09
SOV --> ROW	BASE, FDS-1	4.21	4.84	5.15	5.30
	FDS-2	4.21	4.84	5.15	2.52
	FDS-3	4.21	4.84	4.61	2.26
NAM --> CEU	BASE, FDS-1	0.22	0.11	0.05	0.03
	FDS-2	0.22	0.11	2.27	3.13
	FDS-3	0.22	0.11	2.27	7.37
NAM --> WEU	BASE	3.38	10.29	17.20	18.01
	FDS-1	3.38	4.26	12.44	8.63
	FDS-2	3.38	4.26	13.80	23.94
	FDS-3	1.10	1.42	6.76	18.00
NAM --> ROW	BASE	8.64	28.00	90.74	207.15
	FDS-1	8.64	28.00	90.74	211.99
	FDS-2	8.64	28.00	90.74	197.03
	FDS-3	8.64	28.00	90.74	197.42

Table 9. (continued)

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
WORLD TRADE	BASE	40.27	72.03	140.24	255.64
	FDS-1	40.27	70.69	139.41	254.60
	FDS-2	40.27	70.69	134.83	245.72
	FDS-3	36.38	59.99	126.19	238.51

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 10. Trade in veneer and plywood projected by the ETM. Figures are millions of cubic metres.

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
SKA --> CEU	BASE	0.00	0.00	0.00	0.00
	FDS-1	0.00	0.46	0.33	0.16
	FDS-2	0.00	0.46	0.23	0.11
	FDS-3	0.09	0.04	0.02	0.01
SKA --> WEU	BASE	0.70	0.57	0.28	0.14
	FDS-1	0.70	1.15	1.45	1.29
	FDS-2	0.70	1.15	0.56	1.03
	FDS-3	0.58	0.37	0.18	0.42
EEU --> WEU	ALL	0.50	0.24	0.12	0.06
SOV --> CEU	BASE	0.07	0.03	0.07	0.03
	FDS-1	0.07	0.03	0.07	0.05
	FDS-2	0.07	0.03	0.04	0.02
	FDS-3	0.07	0.08	0.08	0.11
SOV --> WEU	BASE	0.13	0.06	0.03	0.07
	FDS-1	0.13	0.06	0.03	0.04
	FDS-2	0.13	0.06	0.06	0.08
	FDS-3	0.13	0.06	0.06	0.03
ROW --> CEU	ALL	0.21	0.11	0.05	0.03
ROW --> WEU	ALL	0.85	0.42	0.20	0.10
NAM --> WEU	BASE, FDS-1	0.30	0.15	0.07	0.04
	FDS-2	0.30	0.15	0.94	3.04
	FDS-3	0.43	0.21	0.10	1.37
WORLD TRADE	BASE	2.76	1.58	0.82	0.47
	FDS-1	2.76	2.62	2.32	1.77
	FDS-2	2.76	2.62	2.20	4.47
	FDS-3	2.86	1.53	0.81	2.13

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 11. Trade in newsprint and printing and writing paper projected by the ETM. Figures are millions of metric tons.

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
SKA --> CEU	BASE	0.22	0.11	0.05	0.03
	FDS-1	0.22	1.14	2.58	1.26
	FDS-2	0.22	1.14	2.08	1.02
	FDS-3	0.56	1.81	1.94	0.95
SKA --> WEU	BASE	1.73	2.18	7.07	20.85
	FDS-1	1.73	2.18	7.07	20.90
	FDS-2	1.73	2.18	6.10	19.78
	FDS-3	3.13	4.87	12.77	28.33
SKA --> SOV	ALL	0.07	0.03	0.02	0.01
SKA --> ROW	BASE	7.00	14.13	9.55	4.68
	FDS-1	7.00	11.83	7.23	3.54
	FDS-2	7.00	11.83	5.80	2.84
	FDS-3	5.24	6.82	3.34	1.64
EEU --> CEU	BASE	0.50	1.62	3.20	1.57
	FDS-1	0.50	1.62	1.10	0.54
	FDS-2	0.50	1.62	1.56	0.77
	FDS-3	0.00	0.50	0.24	0.12
EEU --> WEU	BASE	0.36	0.45	0.22	0.11
	FDS-1, FDS-2	0.36	1.16	0.57	0.28
	FDS-3	0.00	0.00	0.00	0.00
EEU --> SOV	BASE, FDS-3	0.00	0.00	0.00	0.00
	FDS-1, FDS-2	0.00	0.21	0.11	0.05
EEU --> ROW	BASE	0.50	1.62	4.62	5.77
	FDS-1	0.50	1.62	4.04	3.82
	FDS-2	0.50	1.62	1.34	0.66
	FDS-3	0.01	0.01	0.00	0.00
NAM --> CEU	ALL	0.02	0.01	0.01	0.00
NAM --> WEU	BASE, FDS-1, FDS-2	0.30	0.15	0.07	0.04
	FDS-3	0.30	0.15	1.66	4.92
NAM --> ROW	BASE	2.62	8.48	27.47	57.37
	FDS-1	2.62	8.48	27.47	57.31
	FDS-2	2.62	8.48	27.47	65.49
	FDS-3	2.62	8.48	27.47	65.05

Table 11. (continued)

REGIONS* From --> To	SCENARIOS	TRADED QUANTITY 1990	2000	2010	2020
WORLD TRADE	BASE	13.32	28.78	52.28	90.43
	FDS-1	13.32	28.43	50.27	87.75
	FDS-2	13.32	28.43	45.13	90.94
	FDS-3	11.95	22.68	47.45	101.02

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 12. Geographic distribution of pulpmill capacities projected by the ETM. Figures are percentages of the world total.

REGION*	SCENARIO	PROPORTION OF WORLD CAPACITY				
		1980	1990	2000	2010	2020
CEU	BASE	3	4	4	2	2
	FDS-1	3	4	4	2	3
	FDS-2	3	4	4	2	1
	FDS-3	3	4	3	1	1
SKA	BASE	13	14	13	10	10
	FDS-1	13	14	13	10	10
	FDS-2	13	14	13	9	9
	FDS-3	13	14	13	10	11
WEU	BASE	4	4	4	5	4
	FDS-1	4	4	4	3	3
	FDS-2	4	4	4	3	3
	FDS-3	4	5	4	3	2
EEU	BASE	3	4	4	5	4
	FDS-1	3	4	5	4	3
	FDS-2	3	4	5	3	2
	FDS-3	3	3	3	2	2
SOV	ALL	7	7	7	6	5
ROW	BASE	21	21	24	29	36
	FDS-1	21	21	24	30	37
	FDS-2	21	21	24	31	36
	FDS-3	21	20	25	31	36
NAM	BASE	49	46	44	42	40
	FDS-1	49	46	43	45	40
	FDS-2	49	46	43	46	44
	FDS-3	49	47	46	46	43

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 13. Net annual investments in pulp production projected by the ETM. Figures are millions of tons of output capacity per year.

REGION*	SCENARIO	NET ANNUAL INVESTMENT			
		1990	2000	2010	2020
CEU	BASE	0.22	0.21	-0.15	0.11
	FDS-1	0.22	0.13	-0.07	0.39
	FDS-2	0.22	0.13	-0.12	-0.11
	FDS-3	0.25	-0.12	-0.21	0.00
SKA	BASE	0.43	0.37	0.11	1.11
	FDS-1	0.43	0.51	0.05	1.18
	FDS-2	0.43	0.51	-0.30	1.15
	FDS-3	0.55	0.22	0.26	1.56
WEU	BASE	0.20	0.17	0.53	0.24
	FDS-1	0.20	0.16	0.08	0.34
	FDS-2	0.20	0.16	-0.05	0.45
	FDS-3	0.24	0.15	-0.01	-0.09
EEU	BASE	0.20	0.25	0.46	0.08
	FDS-1	0.20	0.33	0.07	0.10
	FDS-2	0.20	0.33	-0.11	-0.01
	FDS-3	0.07	0.11	0.06	0.13
SOV	ALL	0.20	0.23	0.26	0.31
ROW	BASE	0.73	1.43	3.24	6.28
	FDS-1	0.73	1.50	3.27	6.36
	FDS-2	0.73	1.50	3.50	5.75
	FDS-3	0.57	1.82	3.31	5.79
NAM	BASE	1.04	1.39	2.74	4.07
	FDS-1	1.04	1.21	3.51	3.51
	FDS-2	1.04	1.21	3.90	4.61
	FDS-3	1.03	1.71	3.44	4.46

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 14. Geographic distribution of sawmill capacities for coniferous sawnwood in the base scenario projected by the ETM. Figures are percentages of world totals.

REGION*	PROPORTION OF WORLD CAPACITY				
	1980	1990	2000	2010	2020
CEU	5	5	5	5	4
SKA	7	7	7	7	6
WEU	6	5	5	4	3
EEU	5	6	7	5	4
SOV	26	23	22	19	16
ROW	20	22	19	14	8
NAM	31	32	35	46	59
WORLD	100	100	100	100	100

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 15. Net annual coniferous sawmill investments projected by the ETM. Figures are millions of cubic metres of output capacity per year.

REGION*	SCENARIO	ANNUAL CAPACITY INVESTMENTS			
		1990	2000	2010	2020
CEU	BASE	0.40	0.06	0.20	0.17
	FDS-1	0.40	0.07	0.20	0.17
	FDS-2	0.40	0.07	-0.13	-0.50
	FDS-3	0.63	-0.11	-0.10	-0.61
SKA	BASE	0.39	0.25	0.39	0.27
	FDS-1	0.39	0.74	0.40	0.17
	FDS-2	0.39	0.74	-0.42	-0.24
	FDS-3	0.77	0.46	-0.25	-0.89
WEU	BASE	0.16	-0.08	0.03	-0.21
	FDS-1	0.16	0.03	-0.04	-0.20
	FDS-2	0.16	0.03	-0.36	-0.31
	FDS-3	0.42	0.51	-0.22	-0.35
EEU	BASE	0.63	0.42	-0.25	-0.21
	FDS-1	0.63	0.40	-0.33	-0.15
	FDS-2	0.63	0.40	-0.33	-0.15
	FDS-3	0.11	0.04	0.12	0.07
SOV	ALL	0.26	0.27	0.28	0.29
ROW	BASE	1.88	-0.08	-1.21	-2.73
	FDS-1	1.88	-0.06	-1.19	-2.72
	FDS-2	1.88	-0.06	-0.10	-1.51
	FDS-3	1.88	0.20	-0.45	-1.50
NAM	BASE	1.62	3.35	7.68	12.50
	FDS-1	1.62	2.74	7.81	12.52
	FDS-2	1.62	2.74	8.17	12.51
	FDS-3	1.39	2.69	7.75	13.08

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 16. Production of veneer and plywood in the BASE scenario projected by the ETM. Figures are millions of cubic metres.

REGION*	ANNUAL PRODUCTION				
	1980	1990	2000	2010	2020
CEU	1.6	3.4	4.0	5.3	6.9
SKA	0.7	1.6	2.7	3.2	3.5
WEU	1.7	3.4	6.6	10.6	16.3
EEU	1.5	2.7	3.0	4.1	5.1
SOV	2.5	3.5	4.9	7.1	10.2
ROW	18.2	29.6	53.6	104.3	213.6
NAM	18.7	22.1	26.1	31.1	37.4

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 17. Geographic distribution of production capacities for newsprint and printing and writing paper projected by the ETM. Figures are percentages of world totals.

REGION*	PROPORTION OF WORLD CAPACITY				
	1980	1990	2000	2010	2020
CEU	9	9	8	7	8
SKA	11	12	14	11	11
WEU	10	13	12	10	6
EEU	2	3	4	5	4
SOV	8	7	6	6	5
ROW	20	19	18	20	23
NAM	40	37	38	41	43
WORLD	100	100	100	100	100

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.

Table 18. Net annual investments in production of newsprint and printing and writing paper projected by the ETM. Figures are millions of metric tons of output capacity per year.

REGION*	SCENARIO	ANNUAL CAPACITY INVESTMENTS			
		1990	2000	2010	2020
CEU	BASE	0.26	0.23	0.36	0.82
	FDS-1	0.26	0.13	0.42	0.84
	FDS-2	0.26	0.13	0.42	0.84
	FDS-3	0.28	0.16	0.52	0.76
SKA	BASE	0.43	0.84	0.20	1.16
	FDS-1	0.43	0.72	0.35	1.15
	FDS-2	0.43	0.72	0.06	1.24
	FDS-3	0.43	0.55	0.63	1.56
WEU	BASE	0.57	0.44	0.33	-0.23
	FDS-1	0.57	0.37	0.37	-0.21
	FDS-2	0.57	0.37	0.47	-0.20
	FDS-3	0.48	0.31	-0.15	-0.74
EEU	BASE	0.17	0.29	0.51	0.04
	FDS-1	0.17	0.38	0.19	-0.02
	FDS-2	0.17	0.38	-0.03	-0.09
	FDS-3	0.03	0.10	0.05	0.08
SOV	ALL	0.17	0.22	0.30	0.40
ROW	BASE	0.57	0.54	1.61	3.21
	FDS-1	0.57	0.77	1.67	3.23
	FDS-2	0.57	0.77	2.08	2.39
	FDS-3	0.79	1.21	1.80	2.24
NAM	BASE	0.90	1.58	3.20	4.70
	FDS-1	0.90	1.58	3.20	4.70
	FDS-2	0.90	1.58	3.20	5.51
	FDS-3	0.90	1.58	3.36	5.80

* Region definitions are: CEU - Central Europe (Federal Republic of Germany, Italy, Austria); SKA - Scandinavia (Norway, Sweden, Finland); WEU - Rest of Western Europe; EEU - Eastern Europe (excluding the USSR); SOV - the USSR; ROW - Rest of the World; and NAM - North America.