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CURRENT FOREST RESOURCES AND FOREST DECLINE IN POLAND

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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.

The spatial limits of the Forest Study encompass the entire continent of Europe. For practical purposes, this means that the spatial resolution must be at the level of small countries, or provinces/regions in large countries. Yet there is much heterogeneity in forest-sector phenomena below this level of resolution. To examine the importance of this heterogeneity, in 1987 the Study entered into a research agreement with the Faculty of Agricultural and Forest Engineering at the Agricultural Academy of Warsaw. Under the terms of the agreement, the Polish collaborators are producing a series of technical background papers exploring the extent of forest decline in Poland, potential future courses for the decline, and various environmental and socio-economic consequences of continued forest decline. This paper, co-authored by A. Wylezinski (collaborator with the Forest Study first as a participant in the 1986 Young Scientists' Summer Program) and J. Wiesik (coordinator of the research agreement), describes the extent of forest decline in Poland in the context of the forest inventory. Other papers in the series will look at the effects of air pollutants on the quality of wood from pine stands, future wood-supply prospects, promising silvicultural regimes for stands under the influence of air pollutants, the harvest-machinery implications of continued forest decline, and the consequences of a changing wood supply on the forest-products industry.

Bo R. Döös
Leader, Environment Program

PREFACE

The main activities of the Forest Study of IIASA's Project on Ecologically Sustainable Development of the Biosphere are being carried out at IIASA, but many sub-projects are being undertaken by collaborators in different countries. Through the Polish Academy of Sciences, IIASA has commissioned a study on "Future Wood Supply and Utilization of Wood in Industry up to 2020 in Poland" to be undertaken by the Agricultural Academy of Warsaw.

Building a database on current forest resources and forest damages in Poland for simulation analysis of future wood supply has been one of several tasks within the Study. The purpose of this paper is to present a description of the resources on the basis of the constructed database.

In the English version of the paper, the term "forest decline" has been used to name the phenomenon of forest-stand damage caused by many different agents, among which air pollution is regarded as the most harmful. In this context, "forest decline" should be translated into Polish as "uszkodzenia drzewostanow".

We would like to thank Professor Sten Nilsson for initiating the collaboration between IIASA and the Agricultural Academy of Warsaw and for helpful comments on the first draft. Thanks are also due to Dr. Peter Duinker for his stimulating comments and for editing the paper.

ABSTRACT

Forests in Poland are very sensitive to stress factors. The total area of stands under different stress factors leading to forest decline, as well as the number of these factors, increases every year. There are some forest areas where decline has reached the extent of ecological catastrophe. In the so-called "chain disease" of Polish forests, air pollution is the first and the most harmful factor.

According to the latest estimates, visible symptoms of damage occur on 8% of the total forest area in Poland. It is estimated that hidden physiological damage can be found on 50% of the total forest area. The increment losses alone were assessed to be about 3 million m^3 annually, a volume having a value of approximately 25 milliard zlotys.

The present paper gives a description of forest resources and forest decline in Poland on the basis of a database constructed for wood supply simulation. The given information is valid for about 94% of Polish forests belonging to the State Forest Enterprise and for about 98% of private forests, thus constituting over 90% of the total forest area in Poland. In the first part of the paper, the source of information on forest resources and decline as well as forest inventory practice in Poland are described. Then, forest area, growing stock, division into natural regions and districts, age structure and species mixture of Polish forests are considered. Next, information on harvests in 1985 for State Forest Enterprise and private forests is reviewed. Finally, the phenomenon of forest decline in Poland as well as its very preliminary consequences are discussed.

CONTENTS

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1. INTRODUCTION

In recent years, the state of the forest environment in Poland has brought justified worry. The total area of stands under different stress factors leading to forest decline, as well as the number of these factors, increase every year. There are some forest areas where decline has reached the extent of ecological catastrophe (e.g., the Sudety Mountains).

Among others, the following damage-causing agents are regarded as the most harmful to the forests in Poland: (a) industrial atmospheric emissions, both gaseous and dusty, (b) other air pollutants, (c) massive outbreaks of pests, both primary and secondary, (d) pathogenic fungi, (e) frequent snowbreaks and hurricanes, (f) excessive rains and droughts occurring in turn, and (g) industrialization and urbanization of the country in general.

Forests in Poland seem to be especially sensitive to the above stress factors. This is partially the result of unfavorable site patterns (nutrient-poor dry sites prevail) and changeable climatic conditions (due to confrontation of two climates, i.e., the oceanic one from the West and the continental one from the East). The natural species composition of forests in the country was altered because of forest-management activities in the past aimed at introducing coniferous species for economic reasons. Now coniferous stands occupy over 80% of the total forest area. Therefore, a biased species composition of the Polish forests, along with their predominantly young, even-aged structure, make the situation rather complex. There is also a problem of harsh natural production conditions in many stands, resulting from the widespread afforestation of poor agricultural land after the Second World War.

In the so-called "chain disease" of our forests, air pollution is the first and most harmful element as it decreases the forests' natural resistance and makes them more vulnerable to biotic and abiotic diseases. Until the late 1960s, forest decline due to air pollution in Poland was only of a local character and limited to the nearest neighborhoods of industrial air-pollution emitters. For the last several years, forest decline on big areas has been found, with affected stands commonly located far from the source of emissions.

Inventories of forest decline attributed to air pollutants are being carried out by assessing changes in:

(a)   tree foliage;
(b)   tree height increment; and
(c)   general tree vitality.

Pine, spruce and fir trees are taken as bio-indicators for decline-zone assignment. However, morphological changes of trees, as well as changes in foliage, are the latest symptoms of the forest-decline phenomenon. Therefore, the results obtained from the successive decline inventories comprise only medium and serious forest decline, and that the actual forest decline occupies much larger areas.

According to the latest estimates (GUS 1987), visible symptoms of decline occur on 8% of the total forest area in Poland. It is estimated that hidden physiological damage can be found on 50% of the total forest area.

The forest-decline situation in Poland should be discussed in connection with forest decline in other European countries. The Forest Study within IIASA's Project on Ecologically Sustainable Development of the Biosphere aims to assess long-term economic, ecological and social consequences of forest decline in European forests. An important component of the Study is an analysis of future wood supply under different assumptions about the rate and extent of forest decline. A detailed database for each European country is being built to

document current conditions of Europe's forest resources. To forecast future wood supply under different assumptions about (a) forest decline rates and characteristics, and (b) management interventions such as harvest, regeneration, afforestation, thinning, and rotation-period adjustments, a stochastic simulation model will be used (Sallnaes et al. 1985). The purpose of this paper is to give a description of the current forest resources and the extent of forest decline in Poland on the basis of the constructed database.

2.   SOURCE OF INFORMATION ON FOREST RESOURCES AND FOREST DECLINE IN POLAND

The database on current forest resources in Poland for simulation analysis has been constructed by way of disaggregation, estimation and aggregation of data in the so-called "Data-bank on the state of forests in Poland". This Data-bank belongs to the Forest Management and Forest Geodesy Bureau of the National Board of the State Forest Enterprise, and is recorded on computer tapes at the Forestry and Wood Industry Informatics Center. It contains four basic data files:

(a)   state of the forests belonging to the State Forest Enterprise;
(b)   economic tasks in the State Forest Enterprise;
(c)   other forests; and
(d)   economic events and changes in ownership within state forests.

The first file comprises basic information on forest area and standing stock within each unitary area in forest management called "obreb" in Polish. The obreb-level data may easily be aggregated for the local forest management area, for the District Board of the State Forest Enterprise, and for the whole country. The second file "Economic tasks in the State Forest Enterprise" contains information on annual plans of different economic activities in forest management.

For the third file, "Other forests", it has been planned to gather data on the state of forests and economic tasks in other forests not belonging to State Forest Enterprise, i.e.:

(a)   forests belonging to the other Ministries (i.e., other than the Ministry of Agriculture, Forestry and Food Economy);
(b)   National Parks; and
(c)   non-state forests.

Non-state forests comprise those belonging to:

(a)   private owners (e.g., farmers);
(b)   agriculture co-operatives;
(c)   local communities; and
(d)   land partnerships.

Only data on forests belonging to private owners within non-state forests constitute a complete and internally consistent file. The other information has not been collected yet or is being recorded at the moment. The smallest, unitary forest area in the private-forests file is the "local community".

The fourth file of the Data-bank under the title "Economic events and changes in ownership within State Forests" contains data on completed economic activities in forest management (e.g., regeneration, afforestation, site preparation and improvement, tendings, fellings) as well as data on changes of ownership in the State Forest Enterprise. The data have been collected for successive years since (a) introduction of new, obligatory forest-management documentation, or (b) since the last comprehensive forest inventory for the whole country completed in 1978.

The file entitled "State of the forests belonging to the State Forest Enterprise" has a wide range of information, including data on:

(a)   forest site classes;
(b)   forest types;
(c)   protection-function categories;
(d)   forests in special forestry;
(e)   special forest features (e.g., seed production, forest on former agricultural land, badly managed forests, research plots, reserve and protection forest);
(f)   dominant species;
(g)   age class;
(h)   site class; and
(i)   density class.

For each combination of two of the above-mentioned distinctions, the data possess information about forest area, total growing stock and the current growth. This information has been collected at the obreb level and can be aggregated for bigger units of administrative, economic or natural division, if the borders of the obreb fit the borders of the larger units.

The other three files in the Data-bank are characterized by a significantly narrower range of information.

3.   FOREST INVENTORIES IN POLAND

The Data-bank contains information from the last forest inventory, or from new, updated information from field measurements started in 1979 to supplement the present inventory. Since the end of the Second World War, three forest inventories have been carried out in Poland (Table 1). It is planned that the Second Revisionary Forest Inventory will be finished in 1990, and the Third Revisionary Inventory will start in 1991.

The following methods are used for inventorying forest resources while performing forest-management activities:

(a)   random sample plots;
(b)   selected sample plots;
(c)   estimation based on "Yield tables and capacity of tending cuttings for young pine stands" (Forest Research Institute 1978); and
(d)   visual assessment using the yield tables of Szymkiewicz (1971).

The method of random sample plots is applied in all stands older than 40 years (i.e., belonging to the third and older age classes). There are two kinds of random sample plots: relascopic plots, and circle plots. Circle sample plots are being established only in forest stands where it is impossible to introduce the relascopic plots due to poor visibility.

The method of selected relascopic sample plots is used to determine the volume of standing stock in forest stands of the first and second age class, only if it is possible to measure tree diameter at breast height (DBH). Otherwise the volume in young pine stands is estimated using the above-mentioned yield tables. The method of visual assessment based on the yield tables of Szymkiewicz (1971) is used for young stands of the other species. All the principles for establishing sample plots, using yield tables and performing the visual assessment are standardized and regulated by "Instructions for Forest Management", Part I (Ministry for Forestry and Wood Industry 1980).

4.   GENERAL CHARACTERISTICS OF FORESTS IN POLAND

4.1.   Total Forest Area, Division into Natural Regions, Growing Stock

The total forest area in Poland is equal to 8,666,545 ha, constituting 27.7% of the geographical surface (GUS 1987). The share of forest area per inhabitant is 0.23 ha. Since the end of the Second World War, the total forest area has increased by more than 2 million hectares (in 1946 it was only 6.5 million ha) due to a systematic afforestation of deteriorated

industrial waste-land and poor agricultural land. It was once planned to afforest up to 9.5 million hectares of forest land by the year 2000, but a lower rate of afforestation during the last decade has invalidated that plan.

For the simulation analysis of the IIASA Forest Study, precise information has been gained for a forest area of 7,758,503 ha. Forest areas not afforested and afforested forest areas smaller than 0.5 ha have been excluded. The ignored areas should not influence forest wood production for the nearest few decades. The database contains information about 94% of the forests belonging to the State Forest Enterprise and on about 98% of private forests this constitutes over 90% of the total forest area in Poland. Therefore, the constructed database can be regarded as a good representation of forest resources of the country.

A new division of the country into natural Regions and Districts has been elaborated by a research team at the Forest Research Institute in Warsaw under the guidance of Prof. T. Trampler (Figure 1). A mesoregion has been taken as a basic, unitary area (Trampler et al. 1986). As the main criteria for distinguishing and isolating the boundaries of a single mesoregion, geological formation and shape of the landscape have been used. The assumption was that, within a small area of a given mesoregion, climatic conditions as well as economic development are homogeneous.

Mesoregions have been joined into bigger hierarchical units called Districts. In creating Districts, afforestation rate of the areas, and the size and location of forest complexes have been taken into consideration because of the influence of these factors on production and other forest functions. Districts are made up only of entire mesoregions, not partial ones. The forests in two neighboring Districts differ one from another in terms of site structure and potential productivity. The District is a basic, natural, unitary area for planning silviculture activities.

The biggest hierarchical unit of natural division is the Region. Borders of the Regions have been established taking into consideration the natural ranges of forest tree species. Two stands of the same site class within two different Regions differ with respect to species mixture. Statistical analysis has demonstrated that the production conditions differ significantly within different Regions and Districts.

As shown in Figure 1, eight natural Regions have been distinguished and characterized (Table 2). The total volume of standing stock within the forest area accounted for in the database equals 1,274 million m^3 (i.e., 96.2% of the total growing stock in Poland), resulting in a mean volume per hectare of 164 m^3. There is a significant differentiation in mean volume per hectare within Regions. For both private forest holdings and those belonging to the State Forest Enterprise, mean volume per hectare varies from 148 m^3 in the Great-Poland/Pommorian Region to 232 m^3 in the Sudety-Mountains Region. This is mainly the result of the different species composition - in the former, Scotch pine is the dominant species, while in the latter it is spruce. (See Table 11 for data on areas, volumes, and growth by region and age class.)

4.2. Yearly Harvest

In 1985, 22,386,000 m^3 of wood was harvested from the forest areas accounted for in the database (both belonging to the State Forest Enterprise and private owners). 21,183,000 m^3 of this was harvested by the State Forest Enterprise alone. The high level of harvest in 1985 was the result of such calamities as pest damages and windthrow, resulting in heavy harvest pressure in young stands. Because of sanitary cuttings over big areas, planned harvesting of older age classes was restrained. The mean volume removed per hectare was then 2.89 m^3 for the whole country, and 3.31 m^3 for the State Forest Enterprise.

In the years 1950-1980, yearly harvest was usually higher than the allowable annual cut (Rykowski 1987). However, this excess resulted from the country's domestic demand for wood raw material. To some extent this practice contributed to the deterioration of the forests' age structure and deepened the deficit of older stands.
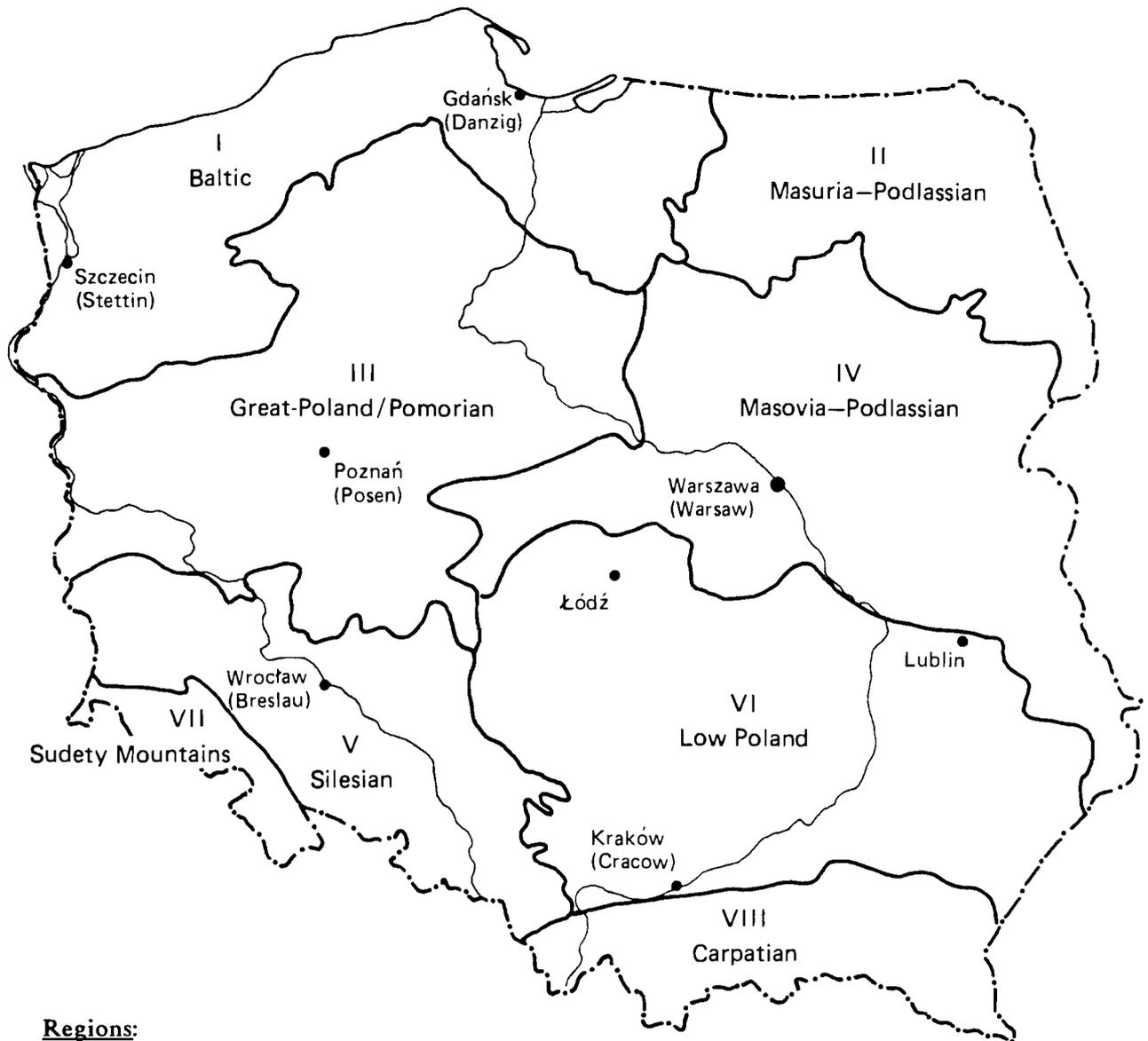
Figure 1. Forest regions of Poland according to Trampler et al. (1986).

It is estimated that during the period 1990-2000, only 17.3-18.5 million m^3 a year will be harvested. What is more, only half of it will be harvested in mature stands (Lonkiewicz et al. 1987).

Tending measures in young age classes will be included in regular forest-management activities. Clearings and sanitary cuttings, as well as thinnings, will supply 50% of all harvested wood. Much less favorable wood assortments will occur. There will be less of the more valuable wood assortments like sawn timber or veneer logs. It is planned to utilize so-called thinwood on a bigger scale. In 1986, 875,500 m^3 of this wood assortment was harvested, while in 1990 it is planned to harvest 1.7 million m^3 of thinwood and in 2000 about 3.0 million m^3 (Lonkiewicz et al. 1987). This, however, will require additional financial expense for suitable harvesting equipment. (See Tables 16-19 for harvest and regeneration data by age class, species, region, and damage threat zone.)

4.3. Age Structure

The comparatively low mean volume per hectare of Polish forests, as well as their actual productivity, are the result among other factors of a very unfavorable forest age structure. Although the mean age has risen by 5 years for the last 20 years, Polish forests are mainly young forests (Tables 3, 9 and 10). The mean age of all stands is now 52 years. Stands of age up to 40 years comprise 41.5% of all forest areas belonging to State Forests, from 41 to 80 years 39.3%, and older than 80 years only 19.2% (Table 3). A more balanced structure would require equal shares among these age groups. The age structure in private forests is even worse. Stands of age up to 40 years comprise 63.5% of total forest area in private forestry, from 41 to 80 years 31.5%, and older than 80 years only 5.0% (Table 3).

4.4. Species Composition

Scotch pine (Pinus sylvestris L.) is the main species in the country. In the forest area accounted for in the database, pine dominates on 5,471,708 ha, i.e., 70.5% of the total area under investigation. The second most common species from the point of view of area occupied is spruce - 504,131 ha (6.5%). Regarding hardwood, birch covers the biggest area - 424,453 ha (5.5%), and oak is second with 395,124 ha (5.1%). Coniferous species comprise 6,184,508 ha in total, i.e., 79.7% of the total area under investigation. (See Tables 12 and 13 for data on areas, volumes, and growth by species and age class.)

5. OWNERSHIP CATEGORIES OF FORESTS IN POLAND

From the point of view of ownership categories, forests in Poland can be divided into (Table 4):

(a)   state forests; and
(b)   non-state forests.

State forests comprise :

(a)   forests under the management of the Ministry for Agriculture, Forestry and Food Economy, which are divided into:

(i)   forests belonging to the State Forest Enterprise;
(ii)   National Parks; and
(iii)   other forests;

(b)   forests under the management of other Ministries.

Non-state forests are those belonging to:

(a)   private individuals;
(b)   production co-operatives;
(c)   local communities; and
(d)   land partnerships.

Within the state forests a decisive role is played by the State Forests Enterprise, while within the non-state forests by private farmers (Table 4). Forests in Poland are considerably dispersed; the State Forest Enterprise manages over 23,000 separate forest complexes, and in private forests the total number of owners exceeds 1,375,000. Therefore, the mean area of private forest holding is 0.99 ha. Such small areas are not conducive to effective owner efforts to intensify forest production. Thus, the mean volume per hectare for the State Forest Enterprise within some Regions is more than twice the volume per hectare in private forests. Taking the country as a whole, mean volume per hectare for the State Forest Enterprise is 178 m^3, while for the private forests only 101 m^3.

Forests belonging to the State Forest Enterprise are characterized by a significantly higher current growth, which is about 6 m^3/ha/year; for private forests it is only about 4 m^3/ha/year (Table 2). The mean harvested wood volume per hectare per year in private forests is also small, amounting only to 0.89 m^3/ha, while for the State Forest Enterprise it is over 3.3 m^3/ha (Table 2). Better management of private forests constitutes a real possibility for improving production of wood raw material in Poland.

6.   FOREST DECLINE IN POLAND

Recently, air pollutants have been significantly affecting forest production in Poland. They are considered to be the main case of forest decline in the country. In some regions, e.g., the Sudety-Mountains Region, they have resulted in ecological catastrophe (Dzialuk 1987).

Forest-decline inventories in Poland assign forest stands to three industrial-damage threat zones and a threat-free zone (Table 5). All stands have been assigned to a zone on the basis of decline indexes determined at sample plots. The sample plots were established in pine, spruce and fir stands of ages of 40, 80 and 100 years respectively. Only stands that had not been affected by calamities of other abiotic and biotic factors for the last five years were chosen. Sample plots were situated inside stands. Ten living trees were chosen to represent different social classes in the stand.

Close observations of the sample trees with field glasses were performed. For each tree the condition of its foliage, height increment and general vitality were visually estimated. A decline index was assigned to each sample tree. Then the arithmetic mean for all the trees was used to assign the whole stand to a threat zone. Criteria for assigning Scotch-pine stands under the influence of SO_2 and other pollutants excluding NO_x to threat zones (Table 6) differ from those for assigning the same stands under the influence of NO_x (Table 7), which in turn differ from the criteria for assigning spruce and fir stands under the influence of all air pollutants (Table 8).

Within the State Forests, decline zone I covers 5.8% of the total forest area, zone II 1.8% and zone III 0.2% (Table 5). In private forests, these figures are, respectively, 6.1%, 1.7% and 0.04% (Table 5). The absolute extent of these zone areas is not as alarming as their dynamic increase. If we take 1967, only 180,000 hectares of forest area were under the stress of air pollutants, while at the moment the number is equal to 605,385 hectares (Dzialuk 1987). If this high rate of increase continues, the decrease in forest production will be significant. We note that the mean volume per hectare in the State Forests is equal to 179 m^3/ha for the stands in zone "0" with no decline threat, in zone I still 178 m^3/ha, but in zone II 137 m^3/ha and only 102 m^3/ha in zone III. This means that volume per hectare in zone III constitutes only 57% of the growing stock on areas with no threat. What is more, there is a change in quality of wood taken from decline zones (Splawa-Neyman et al. 1988).

Results of research done at the Forest Research Institute in Warsaw have shown that the growth of stands is reduced in zone I by 25%, in zone II by 50%, and in zone III by 75%.

At the same time, natural mortality was estimated at 10% (Trampler 1972). (See Tables 14 and 15 for data on areas, volumes and growth by age class and damage class.)

The methods for assignment of decline threat zones are not very precise. Scientists suggest that hidden physiological damage can be found on 50% of the total forest area, and might result in lower production in as little as 10 to 15 years. The increment losses alone were assessed to be about 3 million m^3 annually, which is equivalent to approximately 25 milliard zlotys.

7.   FINAL STATEMENTS

(a)   The current state of forests in Poland, especially the dynamic increase of damage zones areas, have brought justified worry. The phenomenon of forest decline has the attention not only of foresters and scientists but also of the public and the central administration.

(b)   It is a common belief that the consequences of forest decline will affect not only forestry and the wood industry but also the whole national economy and social life of the country in general.

(c)   It is obvious that only by means of reducing the atmospheric emissions in this country as well as in neighboring European countries can the extent of forest decline can be controlled.

(d)   Forestry is rather limited in its efforts to reduce the consequences of the damage to forests due to air pollution, as there are no effective ways to increase the resistance of trees and stands against the polluting agents.

(e)   For the last few years the following measures, among others, have been taken within Polish forestry to diminish the extent of forest decline:

   i)   reconstruction of completely damaged stands (e.g., in Sudety Mountains);

   ii)   early rebuilding of the stands in the third damage threat zone by replacing the pure coniferous stands by broadleaf mixed stands;

   iii)   counteracting the insect pest outbreaks on all affected areas;

   iv)   intensification of the tending and sanitation cuttings in order to improve the sanitary condition of the forests; and finally

   v)   afforestation of waste and poor agriculture land - up to the year 2000 it is planned to increase the proportion of forested land in the country up to 30%.

f)   To gather information on the spatial distribution and dynamics of air pollution, a network of measurement plots has been established (technical monitoring). At the same time a system for measuring deposition in forests is being organized (forest monitoring).

g)   Still new research should be carried out on the forest-decline phenomenon itself as well as on its consequences here in Poland and in cooperation with other countries.

h)   A platform for effective information exchange among foresters, policy-makers and scientists should be established. This would serve as a basis for structuring future strategies to cope with forest decline.

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Table 1. Forest inventories in Poland after the Second World War.

Forest Inventory	Period
Provisionary	1946 - 1956
Decisive	1957 - 1966
Revisionary 1	1967 - 1978
Revisionary 2	started in 1979

Table 2. General characteristics of forests in Poland.

Natural Region	Percentage of Total Area Forested	Number of Districts	Forest Area in 1,000 ha		Total Volume in million m3	
			State Forest Enterprise	Private forests	State Forest Enterprise	Private forests
Baltic	30.5	8	1188.1	32.2	212.5	2.9
Masuria-Podlassian	31.6	6	696.1	113.2	136.3	10.2
Great-Poland/Pomorian	30.3	9	1651.8	126.6	255.4	7.8
Masovia-Podlassian	19.6	7	564.4	423.8	94.0	34.7
Silesian	26.3	6	711.9	25.8	124.6	2.7
Low-Poland	24.2	11	958.1	401.2	171.2	37.9
Sudety Mountains	38.1	3	153.4	4.8	36.0	0.7
Carpatian	41.4	9	468.2	234.9	106.8	40.4

Natural Region	Volume per ha in m3/ha		Current Growth in m3/ha/year		Total Harvest in 1985 State Forest Enterprise	
	State Forest Enterprise	Private forests	State Forest Enterprise	Private forests	in million m3	mean, m3/ha
Baltic	179	90	6	4	4.98	4.19
Masuria-Podlassian	196	90	6	4	2.22	3.18
Great-Poland/Pomorian	155	62	5	3	5.03	3.05
Masovia-Podlassian	165	82	6	3	1.55	2.73
Silesian	175	103	6	4	2.22	3.12
Low-Poland	179	95	6	4	2.55	2.65
Sudety Mountains	235	149	8	5	0.88	5.74
Carpatian	228	172	7	6	1.73	3.69

Table 3. Age structure of Polish forests (1985).

Ownership Category	Forest Area in ha	Percentage Shares of Age Classes				
		I*	II	III	IV	V and other
State Forest Enterprise	6395915	17.9	23.6	22.4	16.9	19.2
Private Forests	1362588	27.6	35.9	21.8	9.7	5

*Age classes are 20-year classes.

Table 4. Area percentage shares of ownership categories of forests in Poland.

Ownership Category	Area Percentage Share of the Total Forest Area	
STATE FORESTS:	82.33	
Ministry for Agriculture, Forestry & Food Economy:	81.55	
- State Forest Enterprise		78.48
- National Parks		0.97
- Other		2.10
Other Ministries	0.78	
NON-STATE FORESTS:	17.67	
Private Forests	16.01	
Production Co-operatives	0.31	
Local Communities	0.50	
Land Partnerships	0.85	

Table 5. Forest area, volume and current growth of forests in the three industrial-damage threat zones.

Ownership Category	Threat Zone	Forest Area in hectares	Growing Stock in m3	Volume per ha in m3/ha	Current Growth in m3/ha/year
State Forest Enterprise	"O"	5898217	1053960721	179	6
	I	370984	65974045	178	6
	II	113271	15533874	137	4
	III	13443	1366702	102	3
Private forests	"O"	1254901	127439796	102	4
	I	83478	7842627	94	4
	II	23728	1986776	84	3
	III	481	42362	88	3

Table 6. Criteria for assignment of the industrial-damage threat zone for Scotch pine stands under the influence of SO2 and other pollutants excluding NOx.

Criteria	Damage Zones			
	"0"	I	II	III
Loss of needles (%)	0	from 1 to 30	from 31 to 60	> 60
Percentage of shortened or distorted needles	0	from 1 to 20	from 21 to 50	> 50
Number of needle age classes	4	3	2	1
Increment of the top shoot	normal	retarded	very retarded	stunted
Tree vitality	good to very good	moderate	weak	dying
Tree crown shape	normal	lightened	flattened	flat

Table 7. Criteria for assignment of the industrial-damage threat zone for Scotch pine stands under the influence of NOx pollutants.

Criteria	Damage Zones			
	"0"	I	II	III
Loss of needles (%)	0	from 1 to 30	from 31 to 60	> 60
Percentage of shortened or distorted needles	all needles longer than normal		about 50	> 50
Number of needle age classes	4	3	2	1
Increment of the top shoot	normal	retarded	very retarded	stunted
Tree vitality	good to very good	moderate	weak	dying
Tree crown shape	normal	lightened	flattened	flat

Table 8. Criteria for assignment of the industrial-damage threat zone for spruce and fir stands under the influence of all kinds of air pollutants.

Criteria	Damage / Zones			
	"O"	I	II	III
Loss of needles (%)	0	from 1 to 30	from 31 to 60	> 60
Percentage of shortened or distorted needles	0	from 1 to 20	from 21 to 50	> 50
Number of needle age classes	4	3	2	1
Discoloration of foliage	none	none	visible	strong
Increment of the top shoot	normal	retarded	very retarded	stunted
Tree vitality	good to very good	moderate	weak	dying
Tree crown shape	normal	small branches in the lower and middle part of crown	many dry shoots	branches bent down tree top isolated from the rest of the crown

TABLE 9. Summary data by age class for the forests of the State Forest Enterprise.

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	6395915.00 100.00	17.90	23.60	22.40	16.90	11.00	3.50	1.80	2.10	0.80	0.00
Volume	m3 %	1136835342.00 100.00	0.90	14.80	27.70	25.60	18.30	6.10	3.10	2.40	1.10	0.00
Volume/Area	m3/ha	178.00	9.00	112.00	219.00	268.00	296.00	308.00	314.00	203.00	252.00	312.00
Growth	m3/ha/yr	6.00	1.00	8.00	8.00	6.00	5.00	4.00	4.00	3.00	3.00	4.00

TABLE 10. Summary data by age class for private forests in Poland.

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS					
			I	II	III	IV	V	KO
Area	ha	1362588.00						
	%	100.00	27.60	35.90	21.80	9.70	3.40	1.60
Volume	m3	137311561.00						
	%	100.00	0.90	14.80	27.70	25.60	18.30	3.20
Volume/Area	m3/ha	101.00	10.00	92.00	161.00	201.00	215.00	201.00
Growth	m3/ha/yr	4.00	1.00	5.00	5.00	5.00	4.00	4.00

TABLE 11. Summary data by age class and region for forests of the State Forest Enterprise.

BALTIC REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	1188043.00										
	%	100.00	22.10	21.30	19.40	16.60	12.10	3.70	1.90	1.90	1.00	0.00
Volume	m3	212523580.00										
	%	100.00	1.20	13.80	24.60	25.90	20.90	6.60	3.30	2.20	1.50	0.00
Volume/Area	m3/ha	179.00	10.00	116.00	226.00	278.00	309.00	319.00	313.00	208.00	260.00	349.00
Growth	m3/ha/yr	6.00	1.00	9.00	8.00	6.00	5.00	4.00	4.00	3.00	4.00	4.00

MASURIA - PODLASSIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	696065.00										
	%	100.00	19.30	23.90	21.50	15.90	10.10	4.50	4.30	0.40	0.10	0.00
Volume	m3	136345623.00										
	%	100.00	1.20	15.80	27.30	23.40	16.20	7.90	7.70	0.40	0.10	0.00
Volume/Area	m3/ha	196.00	12.00	130.00	247.00	289.00	315.00	343.00	351.00	231.00	243.00	25.00
Growth	m3/ha/yr	6.00	1.00	9.00	8.00	6.00	5.00	4.00	4.00	3.00	3.00	1.00

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Table 11. Continued

GREAT POLAND - POMORIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	1651833.00 100.00	19.80	23.80	23.90	16.60	11.20	3.10	1.00	0.40	0.20	0.00
Volume	m3 %	255390045.00 100.00	1.00	15.40	30.40	25.30	19.20	5.80	2.00	0.60	0.30	0.00
Volume/Area	m3/ha	155.00	7.00	100.00	197.00	237.00	265.00	289.00	300.00	205.00	250.00	297.00
Growth	m3/ha/yr	5.00	1.00	8.00	7.00	5.00	4.00	3.00	4.00	3.00	3.00	4.00

MASOVIA - PODLASSIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	568380.00 100.00	17.80	29.40	26.60	16.10	7.00	1.70	1.10	0.20	0.10	0.00
Volume	m3 %	93981880.00 100.00	1.10	20.90	34.90	25.60	12.30	3.10	1.80	0.20	0.10	0.00
Volume/Area	m3/ha	165.00	10.00	117.00	218.00	263.00	289.00	304.00	284.00	195.00	214.00	
Growth	m3/ha/yr	6.00	1.00	9.00	7.00	5.00	5.00	4.00	3.00	2.00	3.00	

Table 11. Continued

SILESIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	711919.00	21.50	22.50	19.10	15.80	12.50	5.40	2.20	0.60	0.40	0.00
	%	100.00										
Volume	m3	124598752.00	1.00	14.90	25.80	24.50	20.20	8.80	3.60	0.70	0.50	0.00
	%	100.00										
Volume/Area	m3/ha	175.00	8.00	115.00	237.00	271.00	284.00	284.00	286.00	198.00	219.00	
Growth	m3/ha/yr	6.00	1.00	9.00	8.00	6.00	5.00	3.00	4.00	3.00	3.00	

LOW POLAND REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	958172.00	12.50	24.40	27.10	19.30	10.30	2.30	0.90	2.80	0.40	0.00
	%	100.00										
Volume	m3	1712227955.00	0.70	15.60	32.40	27.40	16.00	3.40	1.30	2.80	0.40	0.00
	%	100.00										
Volume/Area	m3/ha	179.00	9.00	115.00	212.00	253.00	279.00	263.00	260.00	184.00	178.00	338.00
Growth	m3/ha/yr	6.00	1.00	8.00	7.00	5.00	5.00	3.00	3.00	2.00	2.00	4.00

Table 11. Continued

SUDETY MOUNTAINS REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	153389.00 100.00	13.90	14.30	23.00	21.30	13.90	4.70	2.70	3.50	2.70	0.00
Volume	m3 %	35998678.00 100.00	0.20	4.70	24.20	31.60	21.90	7.10	3.60	3.60	3.10	0.00
Volume/Area	m3/ha	235.00	4.00	77.00	246.00	350.00	369.00	355.00	308.00	244.00	270.00	
Growth	m3/ha/yr	8.00	1.00	6.00	13.00	10.00	7.00	5.00	4.00	3.00	4.00	

CARPATIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	468214.00 100.00	5.90	24.70	15.50	17.10	11.80	4.10	1.90	13.70	5.30	0.00
Volume	m3 %	10676829.00 100.00	0.40	11.10	16.70	24.70	19.30	6.60	2.80	12.30	6.10	0.00
Volume/Area	m3/ha	228.00	14.00	103.00	246.00	329.00	374.00	368.00	339.00	204.00	262.00	119.00
Growth	m3/ha/yr	7.00	1.00	8.00	12.00	10.00	8.00	6.00	5.00	3.00	3.00	2.00

TABLE 12. Summary data by age class and species for forests of the State Forest Enterprise.

PINE

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
						DATA BY AGE CLASS						
Area	ha	4582209.00										
	%	100.00	19.80	24.80	22.70	16.70	10.90	3.00	1.40	0.60	0.10	0.00
Volume	m3	7541424559.00										
	%	100.00	0.90	16.90	29.70	25.60	18.30	5.20	2.50	0.70	0.20	0.00
Volume/Area	m3/ha	165.00	7.00	112.00	215.00	253.00	277.00	286.00	299.00	188.00	216.00	294.00
Growth	m3/ha/yr	6.00	1.00	9.00	7.00	5.00	4.00	3.00	3.00	2.00	3.00	4.00

SPRUCE

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
						DATA BY AGE CLASS						
Area	ha	428586.00										
	%	100.00	16.20	9.70	24.70	24.30	13.60	4.40	2.10	2.80	2.20	0.00
Volume	m3	114344876.00										
	%	100.00	0.30	4.00	26.80	34.00	20.50	6.40	2.80	2.50	2.70	0.00
Volume/Area	m3/ha	267.00	4.00	109.00	293.00	374.00	401.00	388.00	347.00	235.00	319.00	
Growth	m3/ha/yr	9.00	1.00	11.00	15.00	10.00	8.00	5.00	5.00	3.00	4.00	

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Table 12. Continued

FIR

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	147498.00 100.00	12.50	24.40	27.10	19.30	10.30	2.30	0.90	2.80	0.40	0.00
Volume	m3 %	36448367.00 100.00	0.70	15.60	32.40	27.40	16.00	3.40	1.30	2.80	0.40	0.00
Volume/Area	m3/ha	247.00	8.00	53.00	234.00	322.00	354.00	350.00	337.00	216.00	247.00	348.00
Growth	m3/ha/yr	8.00	1.00	5.00	15.00	12.00	9.00	6.00	4.00	3.00	3.00	4.00

BEECH

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha %	275278.00 100.00	2.80	9.80	14.90	18.50	16.40	8.60	5.20	17.10	6.70	0.00
Volume	m3 %	69149674.00 100.00	0.10	2.40	12.90	22.50	22.10	11.70	6.80	14.70	6.80	0.00
Volume/Area	m3/ha	251.00	8.00	61.00	218.00	302.00	340.00	342.00	330.00	216.00	257.00	202.00
Growth	m3/ha/yr	7.00	1.00	6.00	12.00	8.00	7.00	5.00	5.00	3.00	4.00	3.00

Table 12. Continued

OAK

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	349713.00	16.60	17.60	16.40	14.30	15.90	9.10	6.50	2.40	1.20	0.00
	%	100.00										
Volume	m3	68076371.00	0.60	7.80	17.10	19.50	24.90	15.30	10.90	2.40	1.40	0.10
	%	100.00										
Volume/Area	m3/ha	195.00	7.00	87.00	203.00	266.00	305.00	326.00	328.00	193.00	224.00	319.00
Growth	m3/ha/yr	5.00	1.00	7.00	8.00	6.00	5.00	4.00	4.00	3.00	3.00	34.00

HORNBEAM

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	22532.00	1.60	23.30	35.90	20.50	6.00	2.80	1.60	6.20	2.10	0.00
	%	100.00										
Volume	m3	3769019.00	0.20	12.40	38.00	26.80	8.60	4.50	2.60	5.10	1.80	0.00
	%	100.00										
Volume/Area	m3/ha	167.00	25.00	89.00	177.00	218.00	240.00	263.00	272.00	137.00	148.00	102.00
Growth	m3/ha/yr	8.00	2.00	8.00	12.00	7.00	5.00	4.00	4.00	2.00	2.00	2.00

Table 12. Continued

BIRCH

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	311922.00	10.90	45.40	28.60	12.20	1.70	0.10	0.00	0.90	0.20	0.00
	%	100.00										
Volume	m3	45798053.00	1.90	38.40	37.70	18.30	2.60	0.10	0.00	0.80	0.20	0.00
	%	100.00										
Volume/Area	m3/ha	147.00	26.00	124.00	193.00	220.00	217.00	213.00	194.00	123.00	167.00	186.00
Growth	m3/ha/yr	4.00	2.00	6.00	5.00	3.00	2.00	2.00	2.00	1.00	1.00	1.00

ALDER

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	247778.00	20.60	28.90	26.20	16.00	4.40	0.70	0.10	2.50	0.60	0.00
	%	100.00										
Volume	m3	40946936.00	3.40	23.00	35.70	26.30	7.70	1.40	0.30	1.70	0.50	0.00
	%	100.00										
Volume/Area	m3/ha	165.00	27.00	132.00	225.00	271.00	293.00	318.00	342.00	113.00	118.00	87.00
Growth	m3/ha/yr	4.00	1.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	2.00	2.00

Table 12. Continued

POPLAR

			DATA BY AGE CLASS									
VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	15536.00	75.40	19.70	3.30	0.90	0.20	0.00	0.10	0.20	0.20	0.00
	%	100.00										
Volume	m3	136592.00	50.10	36.90	9.00	2.30	0.50	0.10	0.50	0.30	0.30	0.00
	%	100.00										
Volume/Area	m3/ha	88.00	59.00	165.00	237.00	219.00	202.00	254.00	360.00	132.00	128.00	
Growth	m3/ha/yr	7.00	7.00	7.00	3.00	2.00	2.00	2.00	4.00	1.00	1.00	

ASPEN

			DATA BY AGE CLASS									
VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	14863.00	6.10	28.90	40.50	11.10	5.00	2.00	1.10	3.60	1.70	0.00
	%	100.00										
Volume	m3	2793667.00	1.10	21.10	44.60	15.30	7.90	3.20	1.90	3.00	1.90	0.10
	%	100.00										
Volume/Area	m3/ha	188.00	32.00	137.00	207.00	260.00	298.00	301.00	316.00	156.00	200.00	
Growth	m3/ha/yr	5.00	2.00	6.00	5.00	3.00	2.00	2.00	2.00	1.00	1.00	

TABLE 13. Summary data by age class and species for private forests in Poland.

PINE

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS					
			I	II	III	IV	V	KO
Area	ha %	889499.00 100.00	34.10	34.40	18.80	8.90	3.00	0.80
Volume	m3 %	72315659.00 100.00	2.60	36.20	34.70	18.70	6.40	1.40
Volume/Area	m3/ha	81.00	6.00	86.00	150.00	170.00	173.00	149.00
Growth	m3/ha/yr	3.00	1.00	5.00	4.00	3.00	2.00	2.00

SPRUCE

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS					
			I	II	III	IV	V	KO
Area	ha %	75544.00 100.00	9.40	20.90	38.00	20.30	6.20	5.20
Volume	m3 %	14343404.00 100.00	0.30	11.60	42.50	30.00	9.90	5.70
Volume/Area	m3/ha	190.0	7.00	105.00	212.00	281.00	306.00	208.00
Growth	m3/ha/yr	7.00	1.00	11.00	8.00	6.00	5.00	3.00

Table 13. Continued

FIR

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS					
			I	II	III	IV	V	KO
Area	ha	61172.00	1.80	11.40	35.20	27.40	11.00	13.20
	%	100.00						
Volume	m3	14899517.00	0.00	4.90	33.50	32.80	15.20	13.60
	%	100.00						
Volume/Area	m3/ha	244.00	5.00	105.00	231.00	292.00	338.00	251.00
Growth	m3/ha/yr	10.00	1.00	9.00	13.00	10.00	8.00	6.00

BEECH

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS					
			I	II	III	IV	V	KO
Area	ha	35697.00	1.60	21.30	36.60	23.60	11.00	5.90
	%	100.00						
Volume	m3	5556859.00	0.10	11.90	35.10	30.50	15.40	7.00
	%	100.00						
Volume/Area	m3/ha	156.00	9.00	87.00	150.00	201.00	217.00	185.00
Growth	m3/ha/yr	.6.00	1.00	7.00	7.00	5.00	4.00	3.00

Table 13. Continued

OAK

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS					
			I	II	III	IV	V	KO
Area	ha	45411.00						
	%	100.00	10.00	33.60	31.60	14.90	9.40	0.50
Volume	m3	5088878.00						
	%	100.00	0.80	23.80	37.50	21.70	15.50	0.70
Volume/Area	m3/ha	112.00	9.00	79.00	133.00	163.00	185.00	141.00
Growth	m3/ha/yr	5.00	1.00	7.00	4.00	4.00	3.00	2.00

HORNBEAM

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS					
			I	II	III	IV	V	KO
Area	ha	7627.00						
	%	100.00	3.60	57.90	34.20	2.70	0.20	1.40
Volume	m3	824643.00						
	%	100.00	0.80	50.00	43.30	3.80	0.30	1.80
Volume/Area	m3/ha	108.00	25.00	93.00	137.00	151.00	176.00	135.00
Growth	m3/ha/yr	7.00	2.00	8.00	7.00	4.00	4.00	3.00

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Table 13. Continued

BIRCH

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	KO
Area	ha	112531.00	23.40	55.80	18.50	2.00	0.10	0.20
	%	100.00						
Volume	m3	10081573.00	6.40	61.40	28.30	3.40	0.20	0.30
	%	100.00						
Volume/Area	m3/ha	90.00	24.00	98.00	137.00	156.00	148.00	134.00
Growth	m3/ha/yr	3.00	2.00	4.00	3.00	2.00	1.00	1.00

ALDER

DATA AGE BY CLASS

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	KO
Area	ha	121838.00	24.40	51.40	21.70	2.30	0.10	0.10
	%	100.00						
Volume	m3	12886007.00	8.10	54.40	33.20	4.10	0.10	0.10
	%	100.00						
Volume/Area	m3/ha	106.00	35.00	112.00	162.00	192.00	211.00	112.00
Growth	m3/ha/yr	3.00	2.00	4.00	3.00	3.00	4.00	2.00

Table 13. Continued

POPLAR

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	KO
					DATA AGE BY CLASS			
Area	ha	516.00	55.60	29.50	11.80	2.50	0.60	0.00
	%	100.00						
Volume	m3	50234.00	28.80	42.10	21.80	6.20	1.10	0.00
	%	100.00						
Volume/Area	m3/ha	97.00	50.00	139.00	180.00	239.00	177.00	
Growth	m3/ha/yr	5.00	7.00	4.00	2.00	3.00	1.00	

ASPEN

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	KO
					DATA AGE BY CLASS			
Area	ha	12753.00	26.00	54.10	19.10	0.50	0.20	0.10
	%	100.00						
Volume	m3	1264787.00	9.40	60.00	29.20	0.90	0.40	0.10
	%	100.00						
Volume/Area	m3/ha	99.00	36.00	110.00	152.00	171.00	231.00	106.00
Growth	m3/ha/yr	4.00	2.00	5.00	3.00	2.00	2.00	1.00

TABLE 14. Summary data by age class and damage class for forests of the State Forest Enterprise.

ZONE "0" - WITHOUT DAMAGE

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	5898217.00	18.20	23.80	22.20	16.90	10.90	3.40	1.70	2.10	0.80	0.00
	%	100.00										
Volume	m3	1053960721.00	0.90	14.80	27.70	25.60	18.30	6.00	3.10	2.40	1.20	0.00
	%	100.00										
Volume/Area	m3/ha	179.00	9.00	112.00	221.00	271.00	300.00	315.00	321.00	207.00	256.00	315.00
Growth	m3/ha/yr	6.00	1.00	8.00	8.00	6.00	5.00	4.00	4.00	3.00	3.00	4.00

ZONE 1

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	370984.00	14.00	24.30	24.30	18.00	12.10	4.10	2.00	0.80	0.40	0.00
	%	100.00										
Volume	m3	65974045.00	0.80	15.40	29.60	25.40	18.60	6.00	2.80	0.90	0.50	0.00
	%	100.00										
Volume/Area	m3/ha	178.00	10.00	113.00	215.00	252.00	274.00	264.00	259.00	199.00	211.00	60.00
Growth	m3/ha/yr	6.00	1.00	8.00	7.00	5.00	4.00	3.00	3.00	3.00	3.00	1.00

Table 14. Continued

ZONE II

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	113271.00	14.80	21.10	24.30	16.60	10.90	4.90	1.80	4.70	0.90	0.00
	%	100.00										
Volume	m³	15533874.00	0.90	14.00	30.00	13.90	16.70	7.00	2.50	4.00	1.00	0.00
	%	100.00										
Volume/Area	m3/ha	137.00	8.00	91.00	169.00	198.00	210.00	199.00	186.00	116.00	146.00	348.00
Growth	m3/ha/yr	4.00	1.00	7.00	6.00	5.00	4.00	2.00	2.00	1.00	2.00	

ZONE III

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
Area	ha	13463.00	20.30	23.50	21.80	13.80	6.30	3.20	2.70	7.20	1.20	0.00
	%	100.00										
Volume	m³	1366702.00	1.60	16.30	30.20	23.30	11.90	6.10	3.30	6.30	1.00	0.00
	%	100.00										
Volume/Area	m3/ha	102.00	8.00	70.00	141.00	172.00	193.00	197.00	126.00	88.00	84.00	
Growth	m3/ha/yr	3.00	1.00	5.00	5.00	4.00	3.00	3.00	2.00	1.00	1.00	

TABLE 15. Summary data by age class and damage class for private forests in Poland.

ZONE "0" - WITHOUT DAMAGE

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS					
			I	II	III	IV	V	KO
Area	ha %	1254901.00 100.00	27.80	36.20	21.60	9.50	3.30	1.60
Volume	m3 %	127439796.00 100.00	2.80	32.90	34.70	19.10	7.20	3.30
Volume/Area	m3/ha	102.00	10.00	92.00	163.00	204.00	220.00	204.00
Growth	m3/ha/yr	4.00	1.00	5.00	5.00	5.00	4.00	4.00

ZONE I

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS					
			I	II	III	IV	V	KO
Area	ha %	83478.00 100.00	26.20	34.60	23.90	10.90	3.40	1.00
Volume	m3 %	7842627.00 100.00	2.30	31.20	37.60	19.90	7.00	2.00
Volume/Area	m3/ha	94.00	8.00	85.00	148.00	172.00	193.00	181.00
Growth	m3/ha/yr	4.00	1.00	5.00	5.00	4.00	3.00	3.00

Table 15. Continued

ZONE II

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS					
			I	II	III	IV	V	KO
Area	ha %	23728.00 100.00	22.50	28.70	25.60	14.10	7.20	1.90
Volume	m3 %	1986776.00 100.00	2.10	23.70	37.90	23.40	11.00	1.90
Volume/Area	m3/ha	84.00	8.00	69.00	124.00	139.00	128.00	88.00
Growth	m3/ha/yr	3.00	1.00	5.00	4.00	3.00	2.00	1.00

ZONE III

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS					
			I	II	III	IV	V	KO
Area	ha %	481.00 100.00	28.40	20.60	23.10	20.40	7.30	0.20
Volume	m3 %	42362.00 100.00	1.20	20.60	31.90	33.20	13.00	0.10
Volume/Area	m3/ha	88.00	4.00	88.00	122.00	144.00	157.00	43.00
Growth	m3/ha/yr	3.00	1.00	5.00	4.00	3.00	2.00	1.00

TABLE 16. Harvest and regeneration data by age class for forests of the State Forest Enterprise.

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	21182889.00										
	%	100.00	0.80	12.80	24.20	24.20	20.40	8.00	3.70	4.40	1.50	
REGENERATION	ha	35970.39										
	%	100.00	99.90	0.10								
AFFORESTATION	ha	3159.83										
	%	100.00	99.80	0.10	0.10							

TABLE 17. Harvest and regeneration data by age class and species for forests of the State Forest Enterprise.

PINE

VARIABLE	UNIT	TOTAL	DATA AGE BY CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	13792427.00										
	%	100.00	0.90	15.50	26.10	22.50	21.60	8.30	3.50	1.30	0.30	
REGENERATION	ha	24235.13										
	%	100.00	99.90	0.10								
AFFORESTATION	ha	2046.55										
	%	100.00	100.00									

SPRUCE

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	3588562.00										
	%	100.00	0.50	4.00	25.10	34.80	19.70	6.80	3.20	3.30	2.60	
REGENERATION	ha	2701.83										
	%	100.00	100.00									
AFFORESTATION	ha	194.76										
	%	100.00	100.00									

Table 17. Continued

FIR

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	3	593280.00										
	%	100.00	0.30	2.80	7.50	20.40	23.10	7.50	2.50	27.80	8.00	0.10
REGENERATION	ha	84.95										
	%	100.00	100.00									
AFFORESTATION	ha	12.17										
	%	100.00	100.00									

BEECH

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	1190834.00										
	%	100.00	0.20	2.50	8.20	14.40	17.40	18.80	5.90	31.00	9.30	
REGENERATION	ha	884.98										
	%	100.00	99.90	0.10								
AFFORESTATION	ha	5.66										
	%	100.00	100.00									

Table 17. Continued

OAK

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
						DATA BY AGE CLASS						
YEARLY HARVEST	m3	820852.00	0.90	7.80	13.80	18.20	23.10	14.90	13.10	6.60	1.60	
	%	100.00										
REGENERATION	ha	6048.09	100.00									
	%	100.00										
AFFORESTATION	ha	154.82	100.00									
	%	100.00										

HORNBEAM

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
						DATA BY AGE CLASS						
YEARLY HARVEST	m3	59152.00	0.90	11.30	31.20	28.80	10.70	4.90	1.40	8.70	2.10	
	%	100.00										
REGENERATION	ha	1.68	100.00	0.10								
	%	100.00										
AFFORESTATION	ha	0.00										
	%	100.00										

Table 17. Continued

BIRCH

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	567984.00										
	%	100.00	1.00	30.20	36.40	25.00	5.40	0.40	1.40	1.00	0.60	
REGENERATION	ha	411.76										
	%	100.00	98.00	1.80	0.20							
AFFORESTATION	ha	227.76										
	%	100.00	99.90	0.10								

ALDER

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	480581.00										
	%	100.00	1.80	20.50	25.60	32.80	12.90	1.80	0.20	3.60	0.80	
REGENERATION	ha	1551.70										
	%	100.00	99.90	0.10								
AFFORESTATION	ha	511.04										
	%	100.00	99.30	0.20	0.50							

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Table 17. Continued

POPLAR

VARIABLE	UNIT	TOTAL				DATA BY AGE CLASS					
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	30975.00										
	%	100.00	39.50	44.80	13.70	2.00						
REGENERATION	ha	48.60										
	%	100.00	100.00									
AFFORESTATION	ha	7.06										
	%	100.00	100.00									

ASPEN

VARIABLE	UNIT	TOTAL				DATA BY AGE CLASS					
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	58242.00										
	%	100.00	2.20	29.70	46.80	13.80	2.10	2.20	1.80	1.20	0.20	
REGENERATION	ha	1.67										
	%	100.00	100.00									
AFFORESTATION	ha	0.00										
	%	100.00	100.00									

TABLE 18. Harvest and regeneration data by age class and region for forests of the State Forest Enterprise.

BALTIC REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	4980533.00										
	%	100.00	0.7	10.00	24.70	26.50	20.90	7.60	3.00	4.70	1.90	
REGENERATION	ha	9404.52										
	%	100.00	99.90	0.10								
AFFORESTATION	ha	579.01										
	%	100.00	99.50	0.10	0.40							

MASURIA - PODLASSIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	2214755.00										
	%	100.00	0.70	13.80	23.40	22.90	20.10	9.90	8.50	0.60	0.10	
REGENERATION	ha	3587.75										
	%	100.00	100.00									
AFFORESTATION	ha	668.48										
	%	100.00	100.00									

Table 18. Continued

GREAT POLAND - POMORIAN REGION

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
							DATA BY AGE CLASS					
YEARLY HARVEST	m3	5034991.00										
	%	100.00	0.80	14.50	28.50	24.00	20.20	7.80	2.60	1.10	0.50	
REGENERATION	ha	10234.35										
	%	100.00	99.90	0.10								
AFFORESTATION	ha	749.56										
	%	100.00	99.90	0.10								

MASOVIA - PODLASSIAN REGION

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
							DATA BY AGE CLASS					
YEARLY HARVEST	m3	1549603.00										
	%	100.00	1.20	18.50	30.30	23.10	17.40	6.00	2.90	0.50	0.10	
REGENERATION	ha	3225.41										
	%	100.00	100.00									
AFFORESTATION	ha	536.59										
	%	100.00	100.00									

Table 18. Continued

SILESIAN REGION

			DATA BY AGE CLASS									
VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	2217071.00										
	%	100.00	1.50	12.20	23.20	26.00	20.20	10.30	5.10	1.00	0.50	
REGENERATION	ha	4658.20										
	%	100.00	99.80	0.20								
AFFORESTATION	ha	251.59										
	%	100.00	99.80	0.20								

LOW POLAND REGION

			DATA BY AGE CLASS									
VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	2579544.00										
	%	100.00	0.80	12.80	23.60	21.80	23.80	7.80	2.20	6.40	0.70	0.10
REGENERATION	ha	3523.25										
	%	100.00	100.00									
AFFORESTATION	ha	308.14										
	%	100.00	100.00									

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Table 18. Continued

SUDETY MOUNTAINS REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	878501.00										
	%	100.00	0.60	3.30	18.80	29.50	22.20	9.80	6.90	4.60	4.30	
REGENERATION	ha	1146.53										
	%	100.00	100.00									
AFFORESTATION	ha	47.05										
	%	100.00	100.00									

CARPATIAN REGION

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	1727891.00										
	%	100.00	0.50	14.60	10.80	19.30	16.70	6.20	2.30	22.30	7.30	
REGENERATION	ha	190.38										
	%	100.00	100.00									
AFFORESTATION	ha	19.40										
	%	100.00	100.00									

TABLE 19. Harvest and regeneration data by age class for forests of the State Forest Enterprise.

ZONE "0" - NO DAMAGE THREAT

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	19906968.00										
	%	100.00	0.80	12.80	24.10	24.30	20.30	8.00	3.70	4.50	1.50	
REGENERATION	ha	33694.23										
	%	100.00	99.90									
AFFORESTATION	ha	3042.53										
	%	100.00	99.80	0.10	0.10							

ZONE I

VARIABLE	UNIT	TOTAL	DATA BY AGE CLASS									
			I	II	III	IV	V	VI	VII	KO	KDO	SP
YEARLY HARVEST	m3	1081574.00										
	%	100.00	0.80	12.40	25.00	24.70	23.10	8.20	3.40	1.70	0.70	
REGENERATION	ha	1736.58										
	%	100.00	100.00									
AFFORESTATION	ha	107.17										
	%	100.00	100.00									

Table 19. Continued

ZONE II

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
						DATA BY AGE CLASS						
YEARLY HARVEST	m3	174806.00										
	%	100.00	1.90	11.60	27.00	25.00	19.70	7.10	3.00	4.00	0.70	
REGENERATION	ha	446.22										
	%	100.00	100.00									
AFFORESTATION	ha	8.67										
	%	100.00	100.00									

ZONE III

VARIABLE	UNIT	TOTAL	I	II	III	IV	V	VI	VII	KO	KDO	SP
						DATA BY AGE CLASS						
YEARLY HARVEST	m3	19541.00										
	%	100.00	6.00	12.30	240.60	26.50	12.60	6.10	6.20	6.70	3.00	
REGENERATION	ha	446.22										
	%	100.00	100.00									
AFFORESTATION	ha	8.67										
	%	100.00	100.00									