CUTTING AND PROCESSING OF PEAT

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Summary

The world's peatlands cover an area of 3 995 000 km^2 and contain 5000 to 6000 Gt of peat. In addition to this, there are 2 428 000 km^2 of terrestrial wetlands where the amount of accumulated peat or other organic matter is not known. The amount of carbon bound in the peat, from 234 to 252 Gt, is 15 to 16% of the amount of carbon in the global soil pool. The carbon density of peatlands ranges from 58 700 to 63 000 t km^2.

Utilization of peat has a long history. The oldest documents on peat utilization are more than 2000 years old. The most reliable statistics concerning the use of peat come from Europe, where in many countries peat extraction has been an industrial activity for over 100 years. Today, in Europe, about 150 Mm^3 of air dried peat are produced annually,

both for energy generation and horticultural purposes. There are no detailed statistics on how much natural (*in situ*) peat is annually consumed to produce this amount of peat, but it can be estimated to be between around 350 and 370 Mm^3. Around 30% of this amount is utilised in energy generation and the remaining 70% for horticulture or agriculture. The use of peat for chemical or mechanical processing (e.g. activated carbon) is very limited. There are around 20 countries in Europe and more than 10 in other continents with a peat extraction and peat processing industry. For instance, in EU countries, the peat industry had around 15 000 employees in 1998. The multiplier effect of this industry grades up to more than 2 to 3 billion Euros annually.

1. Introduction

The global peatland area totals 3 995 000 km^2 (399.5 Mha). In addition to this, the area of other terrestrial wetland ecosystems, like littoral lagoons and shallow lakes with emergent vegetation, amounts to 2 428 000 km^2 (242.8 Mha). The majority of this is situated in temperate latitudes (see Table 1). On the other hand more than 60% of the world`s tropical peatland resources are estimated to be in Indonesia. The thickest known peat deposit in the world is the Philippi peatland in Greece. The 55 km^2 large mire is almost 190 m deep and the accumulation of peat started here during the Cromerian stage, around 700 000 years ago. Most of the Earth's peatlands are younger than 10 000 years. Deposits of peat as deep as 30 to 40 m have been reported from the tropics. In general, however, peat deposits are rather shallow, the global average being only about 1.5 m. On this basis, the total global peat resource is estimated to be between 5000 and 6000 Gm^3 .

	Peatlands	**Wetlands**	**Total**
North America	1,735,000	657,000	2,392,000
Asia	1,119,000	1,149,000	2,268,000
Europe	957,000	n.a	957,000
Africa	58,000	282,000	340,000
Central and South America	112,000	330,000	432,000
Australia and Oceania	14,000	10,000	24,000
Total	3,995,000	2,428,000	6,423,000

n.a.: not available

Table 1. The distribution of peatlands and other terrestrial wetland ecosystems in the world.

About 3% of the Earth's land area is covered by peatlands. They are very important to the global carbon cycle because their soil organic carbon content is high. Thus they are of great importance as stores of carbon. The amount of total carbon stored in the world's peatlands is at least 234 to 252 Gt. Additionally, the amount of carbon stored in the above-mentioned other terrestrial wetland ecosystems has to be estimated. The quantity of carbon stored in the peat layers of the world`s peatlands ranges from 587 to 630 t ha^{-1} (58 700 to 63 000 t km^{-2}). The carbon in the world's peatlands may constitute 15% or more of all carbon of the global soil pool. Distribution of global peat resources is shown in Figure 1.

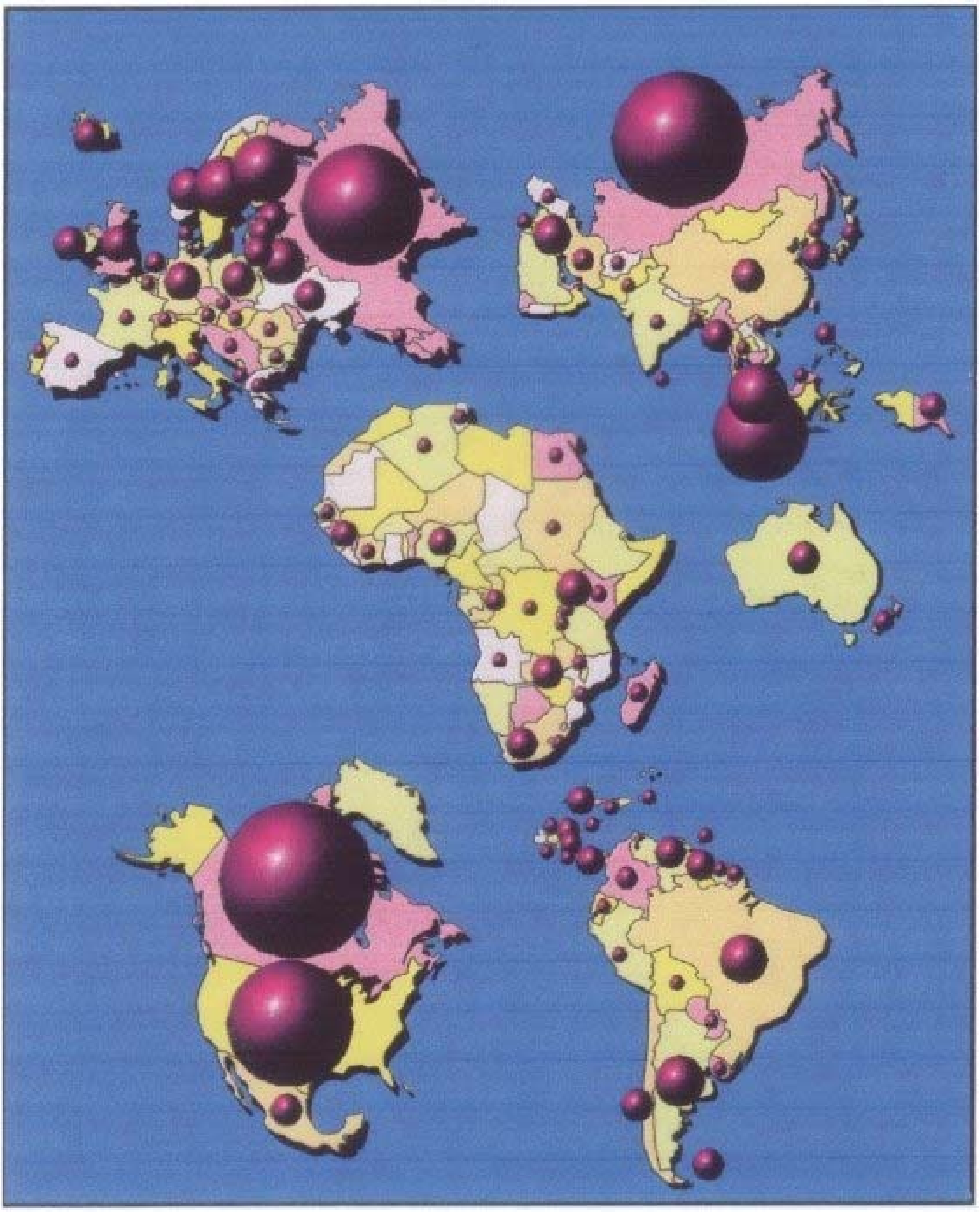

Figure 1. Distribution of global peat resources.

In the world, the total area of peatlands utilized by the peat industry is rather small compared to that used for agriculture, forestry, urban development and conservation.

Most of the world's peat production is in Europe, where the peat industry operates on an area of 350 000 ha (3500 km^2) annually. Peat production is a temporary phase in the land-use, after which many alternatives remain for further utilization of the cutaway areas, including peat regeneration. Industrial use of peat is mainly concentrated in Europe and North America.

The earliest citations on the use of peat in Europe can be traced back to the time around 2000 years ago when Cajus Plinius Secundus, in History of Natural Sciences, quoted the use of peat in the village of Delmenhorst in Germany. The way peat was used at that time was remarkably advanced; extracted peat was mixed with a suitable amount of water after which peat blocks were left to dry. In the Netherlands, peat cutting for fuel was initiated in connection with the establishment of monasteries some one thousand years ago. During the seventeenth century, the city of Groeningen and its surroundings developed into a peat cutting centre, from where techniques spread over to Germany. In Austria, the Archbishop Count von Firmian allocated the large Wildmoos mire in the vicinity of Salzburg to a Scotsman Bernard Stuart who later, when abbot at St. James monastery, was reputed to be a man of great peat expertise. In the late nineteenth century, hundreds of Dutch peat cutters worked on the peat fields of Yorkshire and Lancashire in England, extracting peat.

In many countries mires are very important as versatile and unique ecological natural habitats, of great significance from the point of view of environmental protection. The most important and representative mire areas in many countries have been protected by law. In recent years also the formulation of an agreement concerning the wise use of peatlands has been under active discussion. According to this agreement, *wise use* is a use of peatlands that is balanced between providing an economic benefit for an extented period of time without adversely affecting future generations by its present use. Because of this, peat production must be carefully managed and the environmental impacts of peat mining must strictly be controlled by public authorities and peat producers. Much attention must also be focused on the careful and appropriate after-use of cutaway areas.

2. Peat accumulation

Peatlands are initially defined as vegetation units which form peat, so that mire plants grow on a biomass created by themselves. In general, an increase in the thickness of peat means that the nutrient status of the peatland (mire) depends more and more on rainwater and the nutrients within the peat itself. Under these circumstances the development of a peatland will be controlled by climate, nutrient supply, topography of the surrounding ground, geological history, etc. Surface inflow and nutrient supply decrease as a peatland develops, and regional differencies in peatland properties reflect to a large extent changes in climatic conditions.

Peat is a heterogenous mixture of more or less decomposed plant material and inorganic minerals that have accumulated in a water-saturated environment and in the absence of air. Its structure ranges from nearly pure plant remains to a fine amorphic, colloidal mass. Organic matter accumulates in wet places where the annual input of dead organic matter exceeds the annual breakdown. The rate at which peat accumulates is always much less than the rate of primary production by the vegetation. In boreal mires 2 to

16% of yearly produced plant biomass accumulates in the form of peat. Recent research has shown that the carbon accumulation rate calculated for tropical peats exceeds the range of values attributed to temperate and boreal peats by a factor of between 3 and 6. The decomposition degree means the physicochemical state to which the fibrous content of plant material has decomposed into an amorphous (non-fibrous) mass. During decomposition its carbon and nitrogen contents increase while oxygen and hydrogen decrease. Peat also contains inorganic substances. Both the quantity and quality of these substances vary greatly in different peat types, depending on the environmental, climatic and hydrological conditions during the growth and accumulation of plant material.

3. Assessment of peat layers

There can be great variations between different peat layers and peat types, so an essential stage in the development of a plan for peat utilization, is the assessment of available resources. It is necessary to assess not only the amount of useful peat resources, but also the quality and variability of the peat deposit, the relationship between the deposit and the surrounding mineral terrain (topography), the density and type of tree cover, floristic and phytosociological analyses of the surface vegetation, surface contours, distribution of tree stems in the peat, bottom soil type, water regime and origin of water, general drainage conditions, and wildlife. Depending on the final use of the peat, analyses of various physical and chemical characteristics are needed. These are pH, heating value, bulk density, nutrient content, permeability, decomposition degree, water content, ash content and its softening and melting points, composition of ash, trace elements and engineering properties such as the shear strength of the peat.

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Biographical Sketch

State geologist, **Dr. Eino Lappalainen** was born in 1939. He graduated in geology and paleontology in 1965 at the university of Helsinki, and obtained a Ph.D in 1970 at the University of Turku. He was appointed as Guest Professor of the Changchun Institute of Geography, Chinese Academy of Sciences, in 1996.

State geologist Eino Lappalainen worked from 1962 to 1997 in the Geological Survey of Finland. For over 20 years he was in charge of peat geological surveys. His research was directed towards the survey, classification and utilization of peat resources. He has published about 150 scientific papers as well as investigations on the use of peat and peatlands, published in Finnish as well as in international bulletins and journals. His latest accomplishment is the book Global Peat Resources, released by the International Peat Society in 1996.

The author has been actively involved in national and international co-operation projects and acts as member and chairman in numerous scientific and technical societies and committees. He has also worked as a consultant in peat geology in Sweden, Brazil, P.R.China, USA, Canada, Sri Lanka, Indonesia, Estonia and the former Soviet Union.