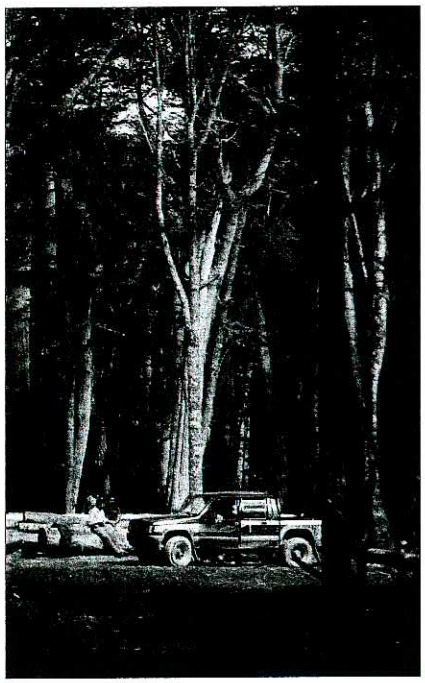
285

The Clothes-cupboard as a Carbon Reservoir

What happens when primaeval forest is transformed into a "commercial" forest? Scientists have been studying the effects on the atmosphere

In as far as mankind is contributing to the rise in the concentration of atmospheric carbon dioxide gas (CO_2), and thus to the likelihood of a change in the global climate, scientists have been turning their attention to the forests, which act as reservoirs for this greenhouse gas. Whenever a change in the extent or the biomass density of forests takes place it induces an exchange of CO_2 between forest and atmosphere: when the area occupied by the forest expands, or the stocks of biomass in existing forests increase, CO_2 "flows" into the forest. Conversely, should the forest be destroyed, or its wood content reduced, then the concentration of CO_2 in the atmosphere increases.

In its 1995 report, the Intergovernmental Panel on Climate Change (IPCC) stated that between 1980 and 1989, human activities, mainly tree-felling in the tropics, had led to forests releasing an approximate annual amount of 1.6 billion tonnes of carbon (C), whereas, in the same period, approximately half a billion tonnes of the element were taken up by the forests in the northern hemisphere. Both figures are subject to fluctuations of up to 100 per cent; the lack of any reliable regional data leads to a considerable degree of uncertainty when estimating global carbon stocks and flows. Moreover, a transformation in the utilization of a forest which involves a complex change in the carbon cycle is difficult to quantify due to the problems presented by the measurement of the extent of the change in area. Changes often take place over a very great number of areas, each of which is in itself small. And, finally, ignorance also often prevails concerning the original state of the forest before the change took place.



Rotten wood in forests (above) also provides a major reservoir for atmospheric greenhouse gases. Below: On opening up a primaeval forest for commercial use the first task is to build vehicle tracks through it.

It was against this background that a DFG-supported study of the transition from primaeval to commercial forest was undertaken. The actual case in point was the proposed commercial exploitation of several hundred thousand hectares of completely untouched forest in Tierra del Fuego. If the Chilean parts of Patagonia are also included,

then this figure rises to over a million hectares! The aim of the study was to measure the carbon stocks in these forests and to estimate the effects of commercial exploitation on the carbon balance.

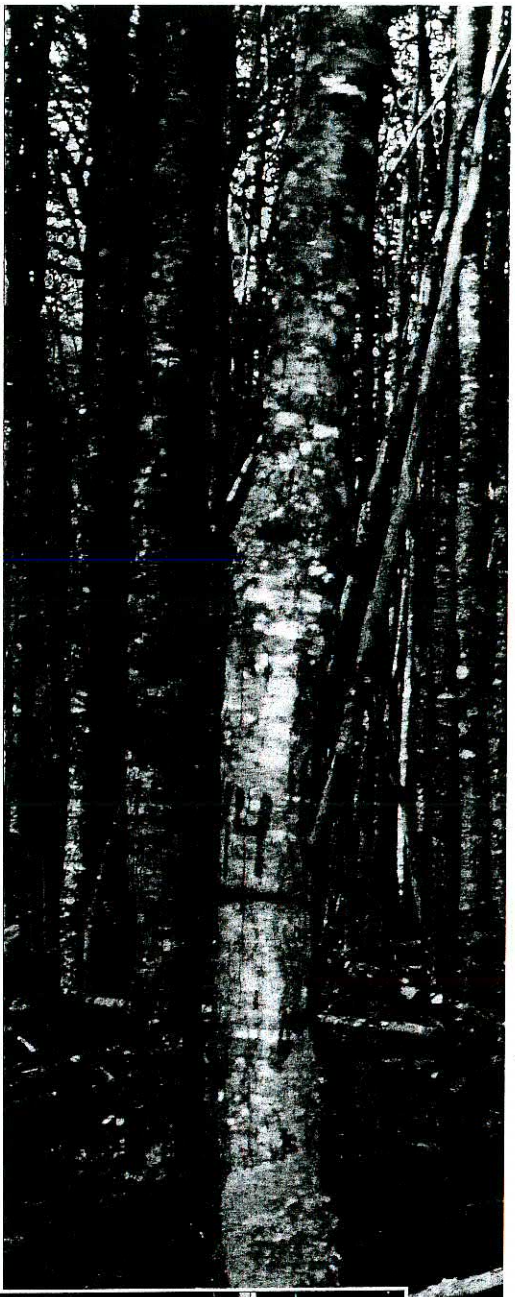
The study was based on an area of 49 hectares of virgin forest in the Argentinian part of the region. In order to discover how much carbon was bound up in it, the amounts present in the soil, above-ground vegetation, deadwood and the living tree mass had to be calculated. The data relating to the trees, deadwood and soil were gained by sampling. The below- and above-ground biomasses were estimated on the basis of the experience gained from analysing individual trees. Chemical analyses revealed the carbon content of the soil and wood.

304 tonnes of carbon per hectare were found in the area of forest under study, of which two thirds were stored in the living tree mass, in other words, in the trunks, branches, roots and leaves of the trees. Nevertheless, a good 20 per cent of the carbon was stored in the soil.

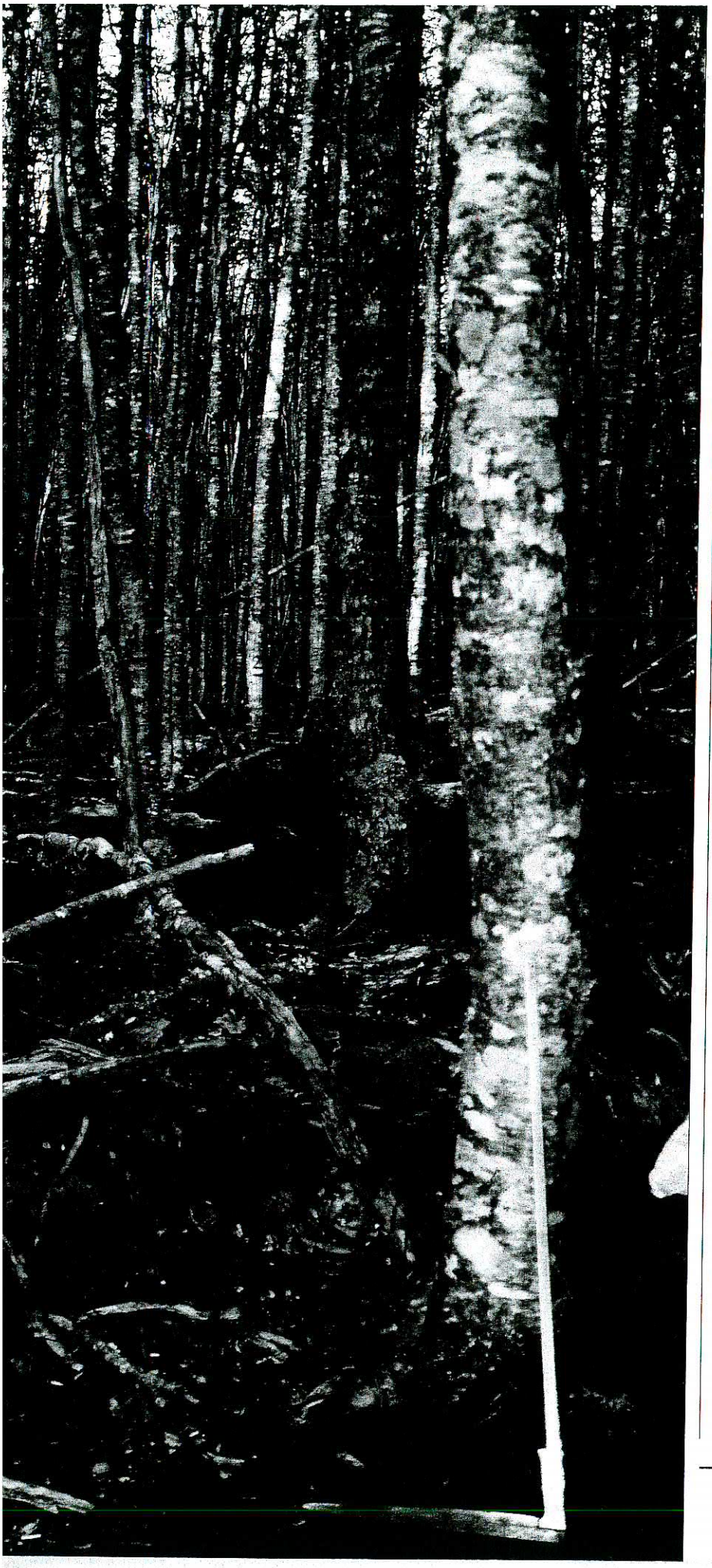
In the area of virgin forest under study, the deadwood, which in commercial forests is of little significance, is of great importance – after all, it does account for eleven per cent of the total carbon stored, since in natural forests all the deadwood remains in situ, where it is subjected to more or less rapid natural decomposition. Commercial forests, in contrast, are thinned out, which ensures that trees are removed before they die, thus practically eliminating the presence of deadwood. Compared to that contained in the primaeval forest under study, the amount of carbon stored in commercial forests is considerably smaller. Stands of beeches in Bavaria store just on two thirds of the amount found in the primaeval forest in Tierra del Fuego. This underscores the significance of natural forests as major carbon reservoirs. If they were to be commercialised we should have to expect a marked reduction in storage capacity. However, before any final judgement can be made on the global carbon balance, a number of other counterproductive aspects have to be taken into account.

Due to the fact that the CO_2 they bind equates roughly to that which they release, the huge amounts of carbon present in primaeval forests have no impact on the global cycle. Moreover, the wood in natural forests rots unused, whereas in the case of commercial exploitation a large proportion of the wood produced is harvested and worked as timber, ensuring that the carbon remains stored in the wood – of a clothes-cupboard, for example.

Wood can even be used to replace fossil fuels, thus avoiding the emission of fossil carbon into the atmosphere. Direct substitution here implies that fossil energy sources such as coal or oil are directly replaced by the combustion of wood. In contrast to fossil energy sources, the combustion of wood produced by sustainable forest management is CO_2-neutral when it is burnt as the CO_2 released into the atmosphere on combustion is offset by that bound by regenerat-



"Virgin" forests in Tierra del Fuego cover several hundred thousand hectares, with much deadwood lying on the forest floor. In commercially used woodland, in contrast, dying trees are felled and worked in sawmills (below).



ed forest. This substitution is also possible in an indirect manner: if products, whose extraction, manufacture or final disposal demand large amounts of fossil energy (for example, aluminium or steel) are replaced by equally good products made of wood, which require only very little fossil energy, no CO_2 is even released in the first place, and the avoidance of emissions – the great goal of climate policy – has thus been achieved!

It is against this background that the question is constantly being raised as to whether it is more economical to transform "unproductive" natural forests, which, however, form vast reserves of carbon, into highly productive commercial woodland. Model calculations show how the carbon balance develops with different forms of use: the direct or indirect replacement of fossil forms of energy by wood has a long-term and cumulative effect, whereas the storage effect from wood products is time-limited depending on their useful life and the amount stored. The conversion of wood from one hectare of virgin forest would make it possible in this way to avoid the emission of 267 tonnes of fossil carbon over a period of 200 years, in other words, half a tonne per year. However, should this potential not be exploited consistently, the conversion of primaeval into commercial forest would produce a negative carbon balance extending over several centuries. Since the wood in Tierra del Fuego cannot be utilised for energy production at the moment, model calculations show that commercialisation could be expected to release some 70 tonnes of carbon per hectare on average over the next 190 years. This highlights the need for the protection of primaeval forests as carbon reservoirs. Quite apart from this concrete situation, the calculation provides an idea of the enormous potential for reducing the rise in atmospheric CO_2 achievable by the purposeful utilisation of wood from sustained commercial forestry.

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