INTERNATIONAL SYMPOSIUM ON GLOBAL CHANGES
IN SOUTH AMERICA DURING THE QUATERNARY:
PAST - PRESENT - FUTURE

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SOUTH AMERICA: A RESERVOIR OF CONTINENTAL CARBON FIRST ESTIMATE OF CHANGES SINCE 18,000 YEARS

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The Amazonian forest makes of South America an important continental reservoir of carbon for the planet Earth.

This continent represents consequently a key zone for the research and konwledge of changes in the biogeochemical cycle of carbon. In order to evaluate more precisely the role it plays we estimated the approximate quantities of carbon in the total phytomass and the carbon in soils, for each of the ecosystems represented in Fig. 1, both for present landscapes and those of the last glacial maximum.

A map of the eight principal biomes or ecosystems of South America was organized (H. FAURE, L. FAURE, A. RUELLAN, 1985) based upon the palaeobioclimatic maps of HUEK (1972), AB'SABER (1977), BROWN & AB'SÁBER (1979) and palaeopedological and geochemical maps of PEDRO & VOLKOFF (1984). Two representantions are given: one for the "actual" state (before the great deforestations), and another for a probable state during the end of the last glacial maximum (18,000 - 15,000 yr BP), according to palaeoclimatic data of the authors. Areas of principal ecosystems have been measured and the most probable biomass value has been calculated for each ecosystem using the mean density values compiled for the Earth by AJJAY, KETNER & DUVIGNEAUD (1979).

Results in Table I allow to propose a first estimate of total biomass and organic matter of soils for Sout America, calculated in carbon, for two opposite climatic states. The lack of precision about the actual areas occupied by the principal ecosystems, and about their mean biomass, causes a standard deviation of 30-40%. Considering the palaeogeographic documents and densities of carbon/m^2 we used for this preliminary estimate, the model for the "actual" situation gives a value of 214 Gt (Gt= Gigaton= 10^{15} g) of vegetal biomass, and 140 Gt for the glacial maximum; reduction of vegetal carbon would amount to one third during a glacial

phase. It would be useful to recalculate these data with other palaeogeographic models and other biomass values to obtain a more precise standard deviation.

About soils as carbon reservoirs a first continental estimate can be proposed. Considering timescales between 100-1000 years, it could be considered that soil carbon content between 0-100 cm beneath the surface balances with the vegetation supported by that soil. Considering SANCHES et al. (1982) data and measures by CERRI & VOLKOFF (1987)the carbon stock for the upper meter of soil has been calculated for each ecosystem. Table I shows that this stock represents today about 180 Gt; during the last glacial maximum its value was probably about 120 Gt. A fluctuation of about 60 Gt could be estimated for this soil-reservoir.

These approximations show important variations and should be improved. Therefore it is necessary to augment biomass and soil carbon evaluations, to continue with ecosystems cartography and dated palaeoclimatic studies in order to corroborate or to reconsider the role played by South America as carbon reservoir and the role it can play in the future to contribute to the maintenance of an adequate atmosphere for man (Fig. 2).

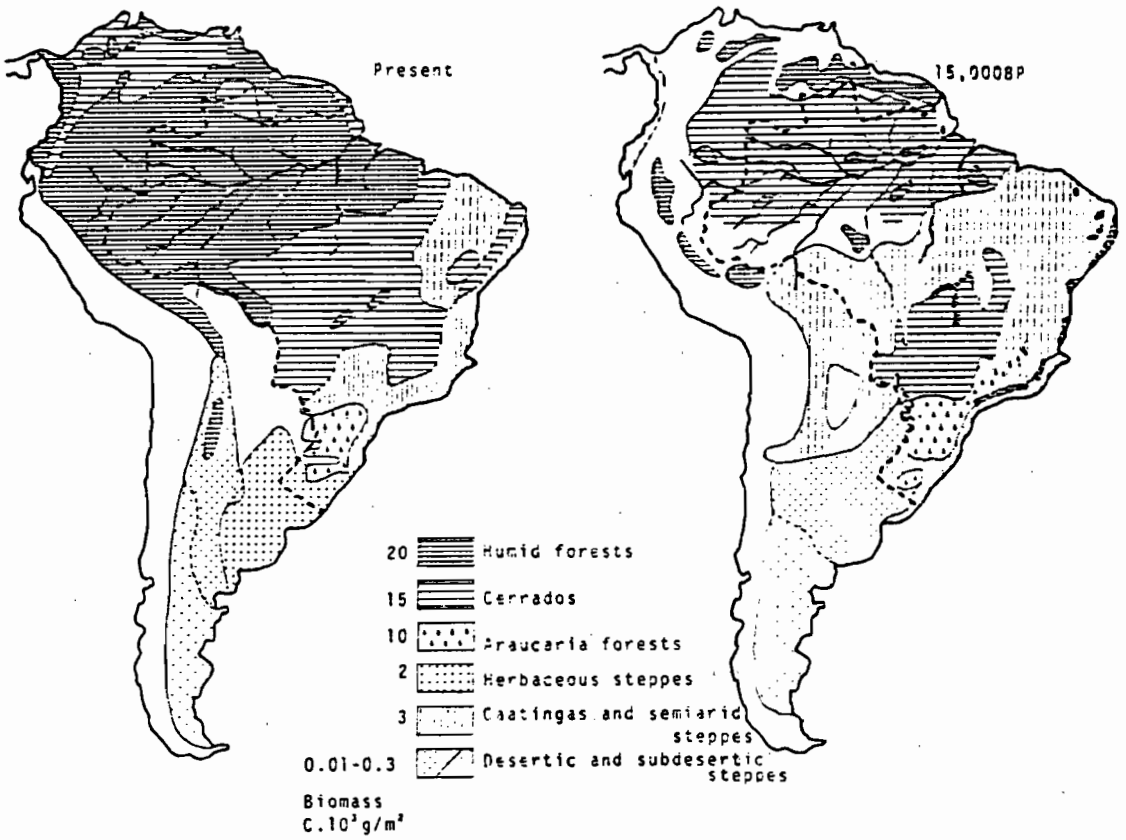

Fig. 1 - Simplified map of the principal ecosystems in South America for a glacial maximum and for "Present".

	Mean composition		Actual situation			Glacial situation (18,000BP)		
	Biomass	Soil	Surface	Biomass	Soil	Surface	Biomass	Soil
	CKg/m²		Mkm²	CGt		Mkm²	CGt	
Humid forests	20	15	6.4	128.0	96.0	1.7	34.0	25.5
Humid forests(E coasts)	20	15	0.4	8.0	6.0	0.2	4.0	3
Cerrados	15	7	3.7	55.5	25.9	5.3	79.5	37.1
Araucaria foret	10	15	1	10.0	15.0	0.9	9.0	13.5
Caatinga	3	7	0.8	2.4	5.6	4.0	12.0	28
Herbaceous steppe	2	12	1	2.0	12.0	0.0	0.0	0
Subdesertic steppe	0.3	6	0.9	0.3	5.4	1.3	0.4	7.8
Desertic steppe	0.01	1	0.8	0.0	0.8	1.1	0.0	1.1
Flooded,etc.	8	10	0.9	7.2	9.0	0.2	1.6	2
Mountains, coastal deposits	0.1	0.5	2	0.2	1.0	3.8	0.4	1.9
Total.....			17.9	213.6	176.7	18.5	140.9	119.9

Biomass variation	73GT	34%
Soil variation	57	32%
Biomass+soil variation	129	33%

Table 1 - South America biomass.
From left to right: ecosystem, carbon density/m² (biomass in the soil upper meter), area (millions of km²), total biomass, total weight of soil carbon (carbon GT) for Present and for 18,000 yr BP).

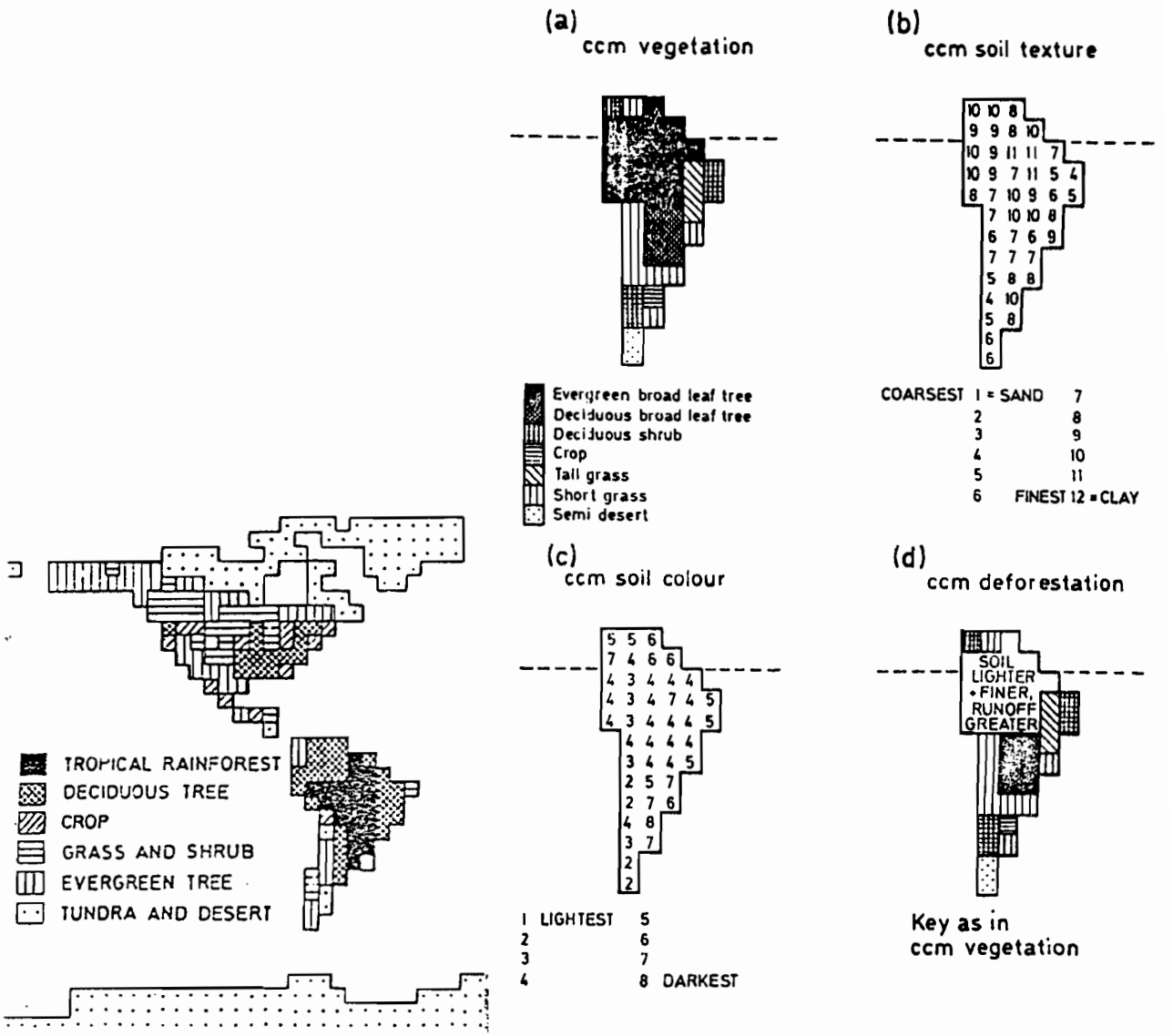

Fig. 2 - There is an urgent need for maps giving the distributions of major ecotypes at precise dates in the Quaternary (from HENDERSON-SELLERS et al., 1986, 1988).

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