FOREST ECOLOGY

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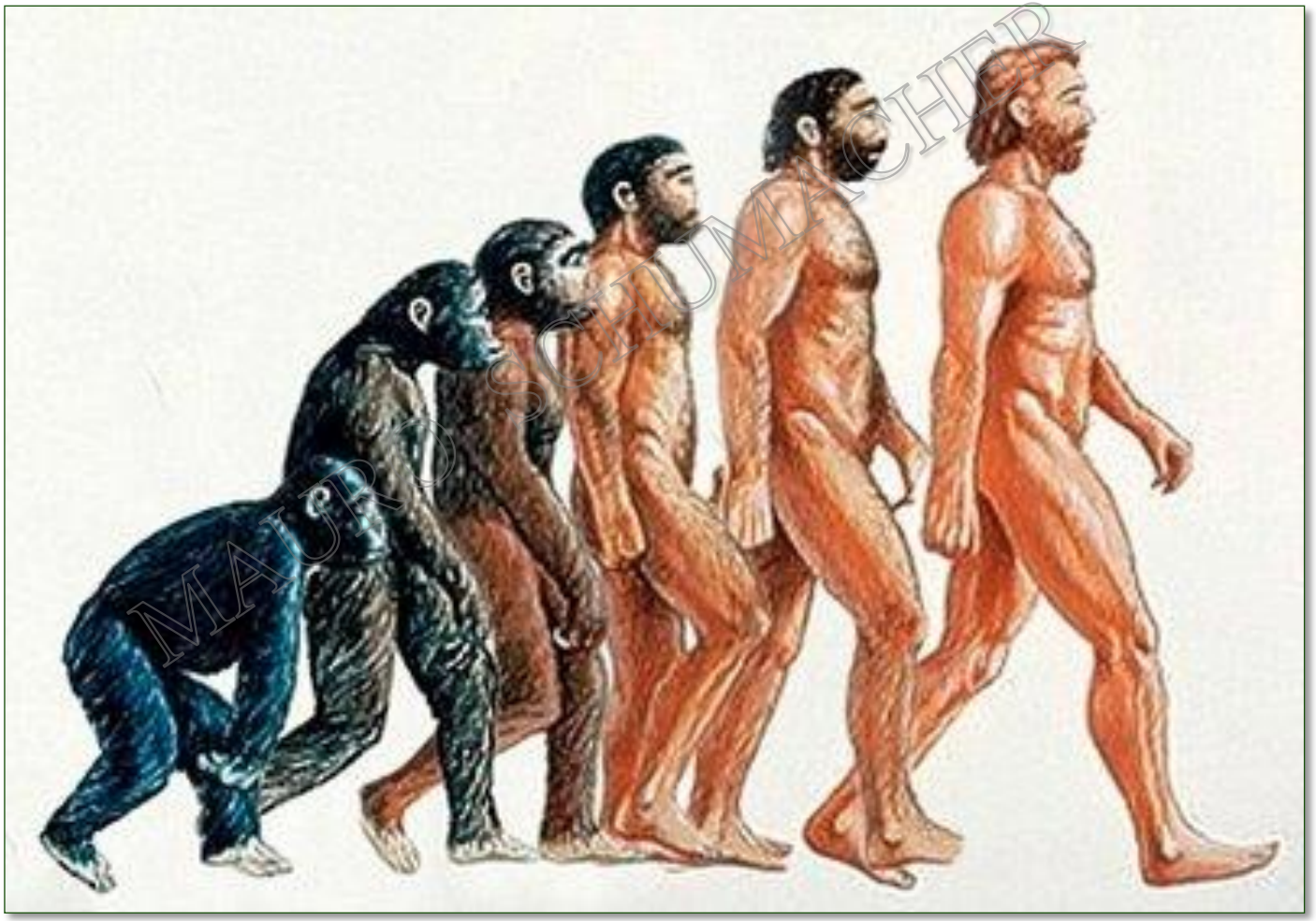
Evolution of Gratuation to Post-Graduation



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Unit 1 - Forest Ecosystems

1.1 - Concept;

1.2 - Characterization;

1.3 - Division of ecosystems.

1.4 - Monitoring of Forest Ecosystems

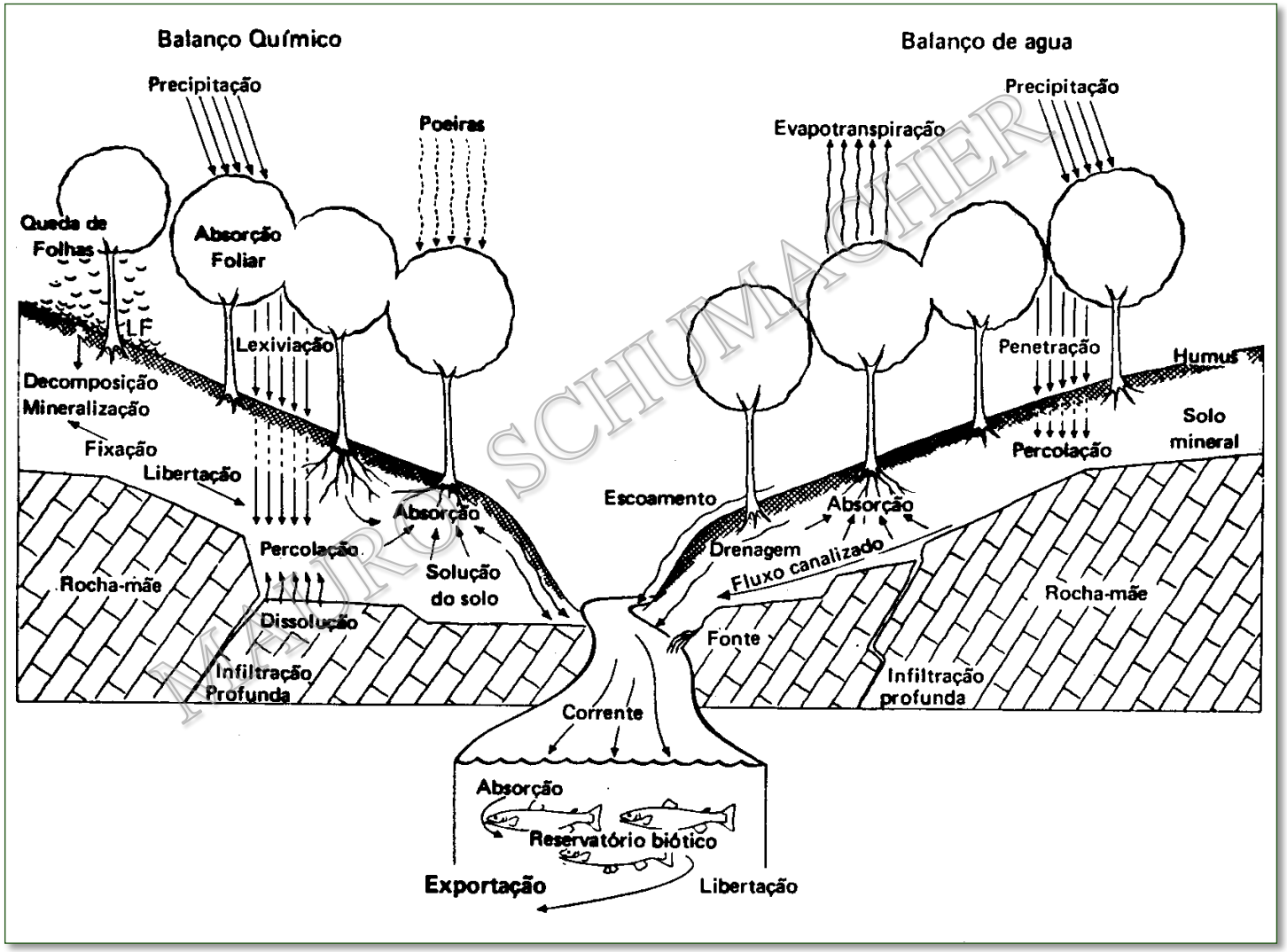
Forest Concept

Source: © Schumacher (2019)

Plantation Concept

Source: © Schumacher (2019)

Biogeochemical cycling in Forest Ecosystems



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Source : Adapted from DUVIGNEAUD (1974)

Watersheds

Unit 2 – ENVIRONMENTAL FACTORS AND THE PRODUCTION OF FORESTS

2.1 - Solar radiation;

2.2 - Temperature;

2.3 - Atmospheric humidity and other factors;

2.4 - Climate;

2.5 - Soils;

2.6 - Water cycle in soil and plant;

2.7 - Fire

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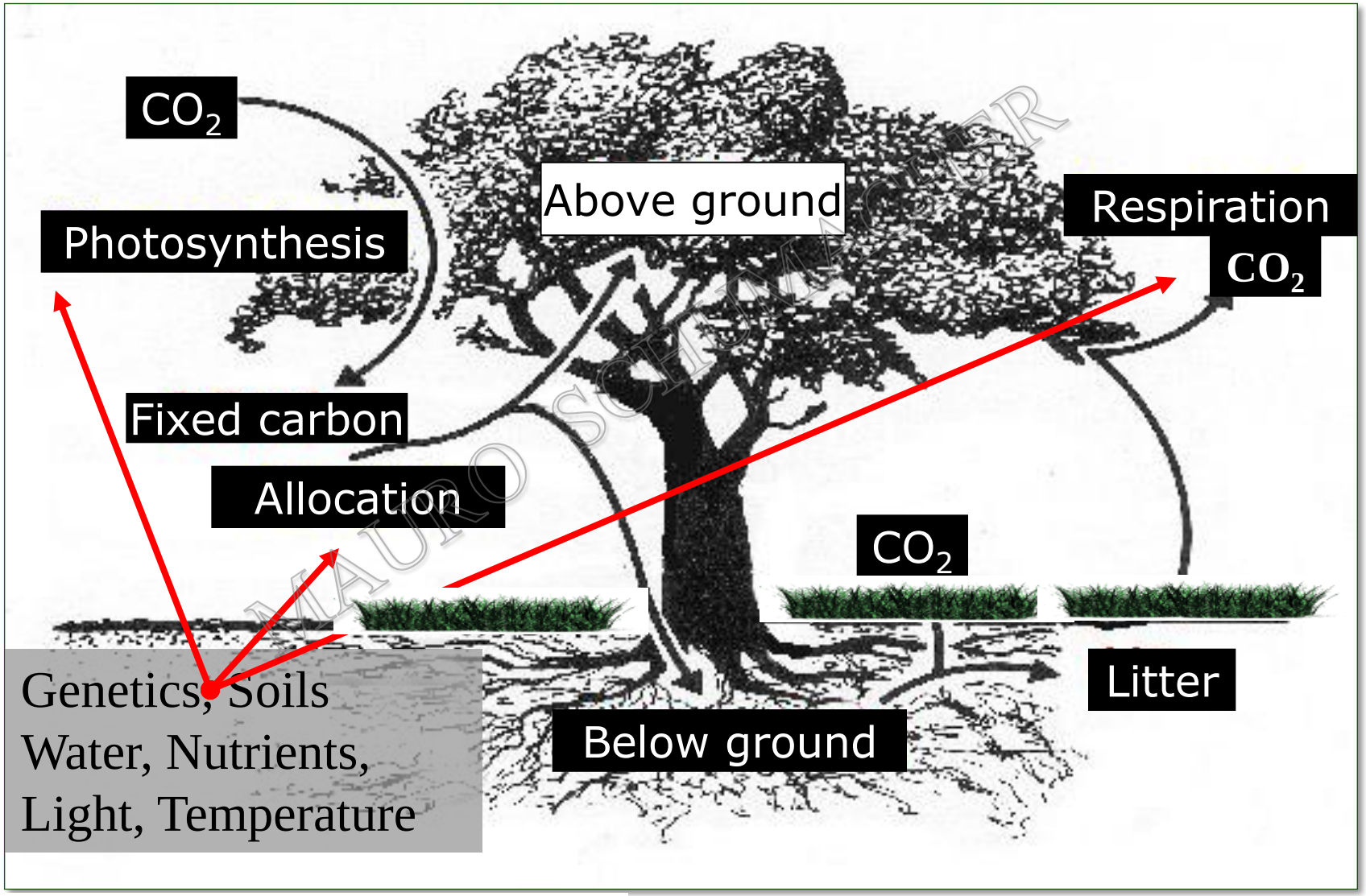

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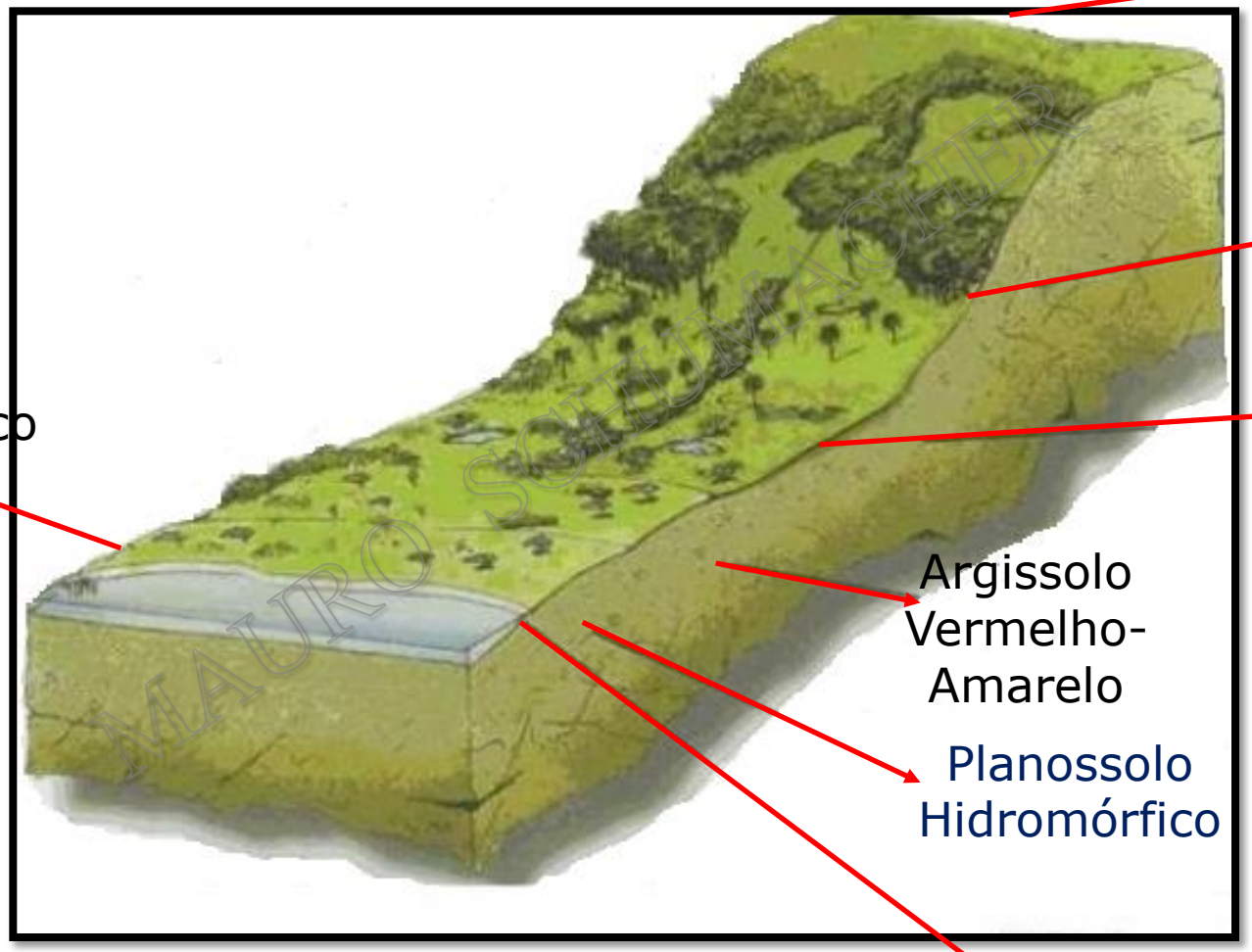
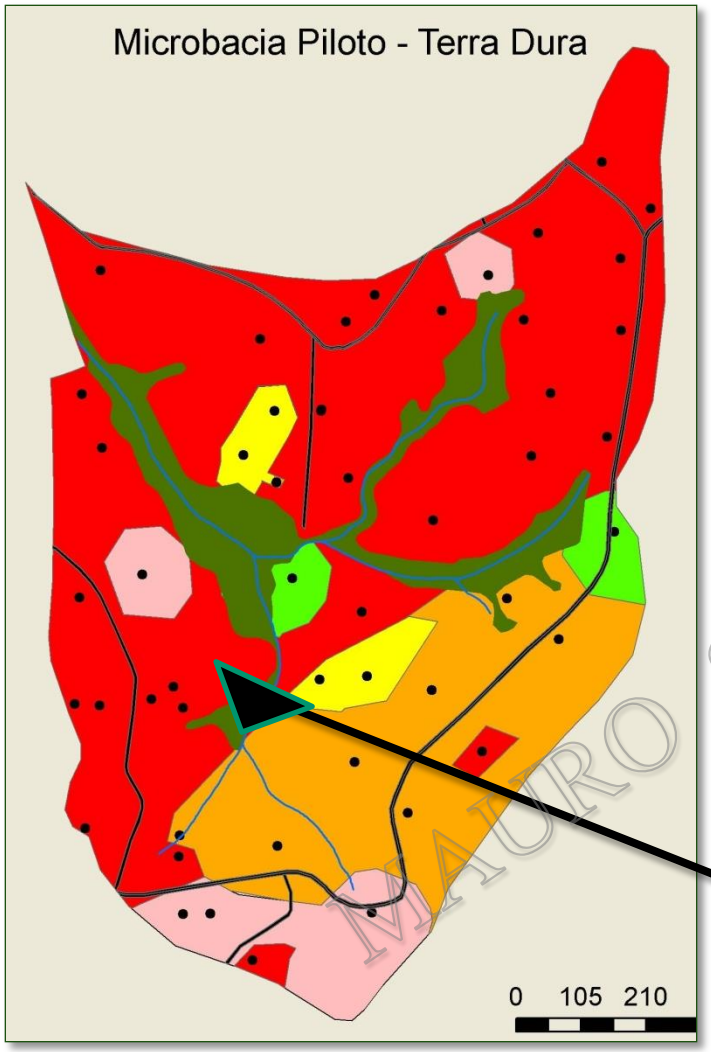
Source: Adapted from STAPE (2006)

Main soils in the landscape



Source: Adapted from CURI (2008)



Water yield in Watersheds

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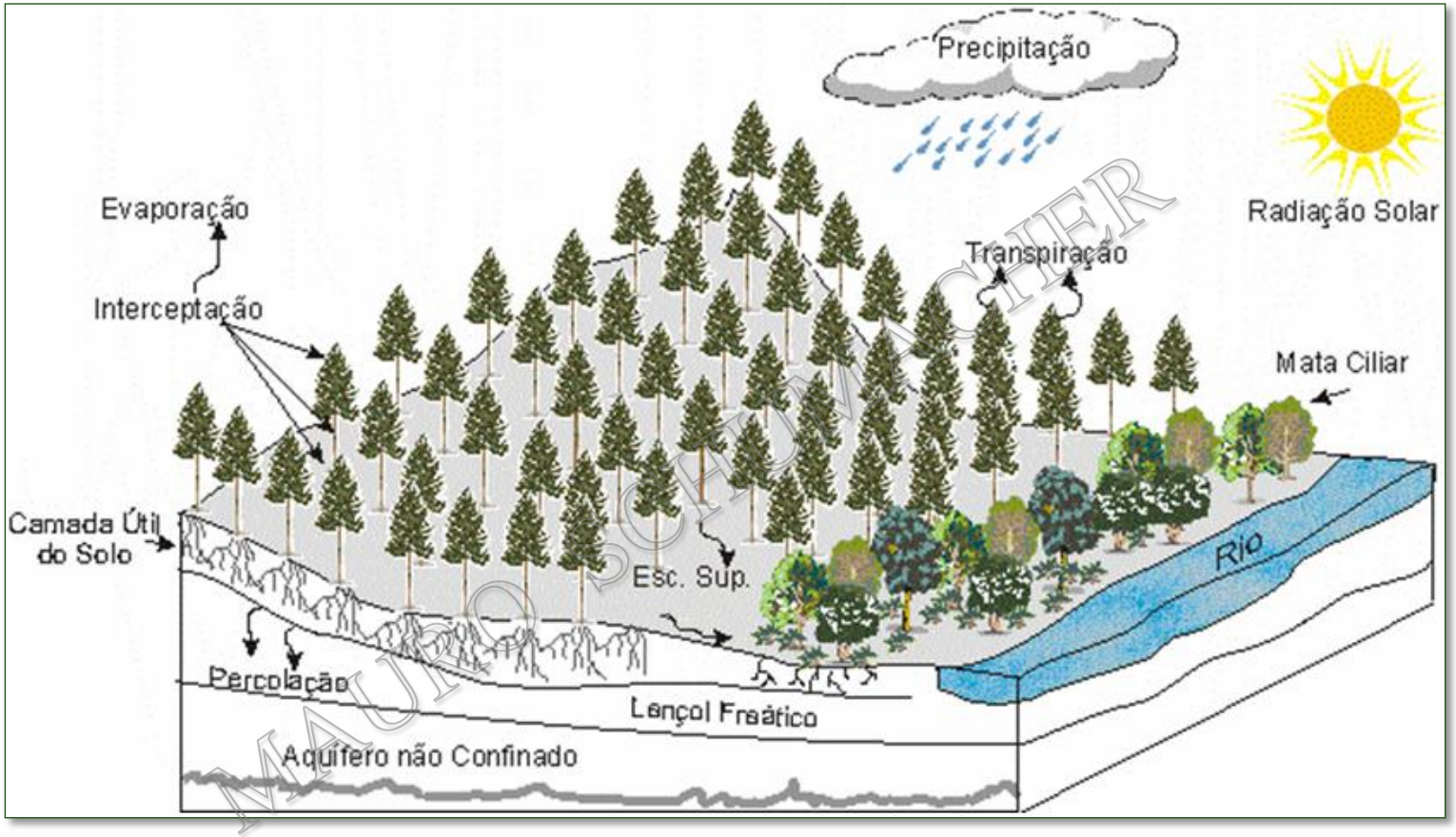

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Use of Water $\mathbf{f} = \}$

- Leaf area index (LAI);
- Species: Genetic material;
- Soil-climatic characteristics;
- % of B.H occupancy;
- Solar radiation

Water balance in 11-year-old Pinus radiata plantation in New Zealand before and after thinning (Whitehead & Kelliher, 1991).

Component of BH	Before	After
Precipitation (P)	*1623 mm (100%)*	*1623 mm (100%)*
Transpiration (Et)	*636 mm (39%)*	*410 mm (25%)*
Interception (Ei)	*268 mm (17%)*	*195 mm (12%)*
Direct Evap. of Soil (Eo)	*93 mm (6%)*	*191 mm (12%)*
Effective Precipitation(PE)	*626 mm (38%)*	*827 mm (51%)*

Variable	Before thinning	After thinning
Num. of trees ha^{-1}	754	334
Height (m)	17,0	21,0
LAI (m^2 m^2)	15,5	9,0

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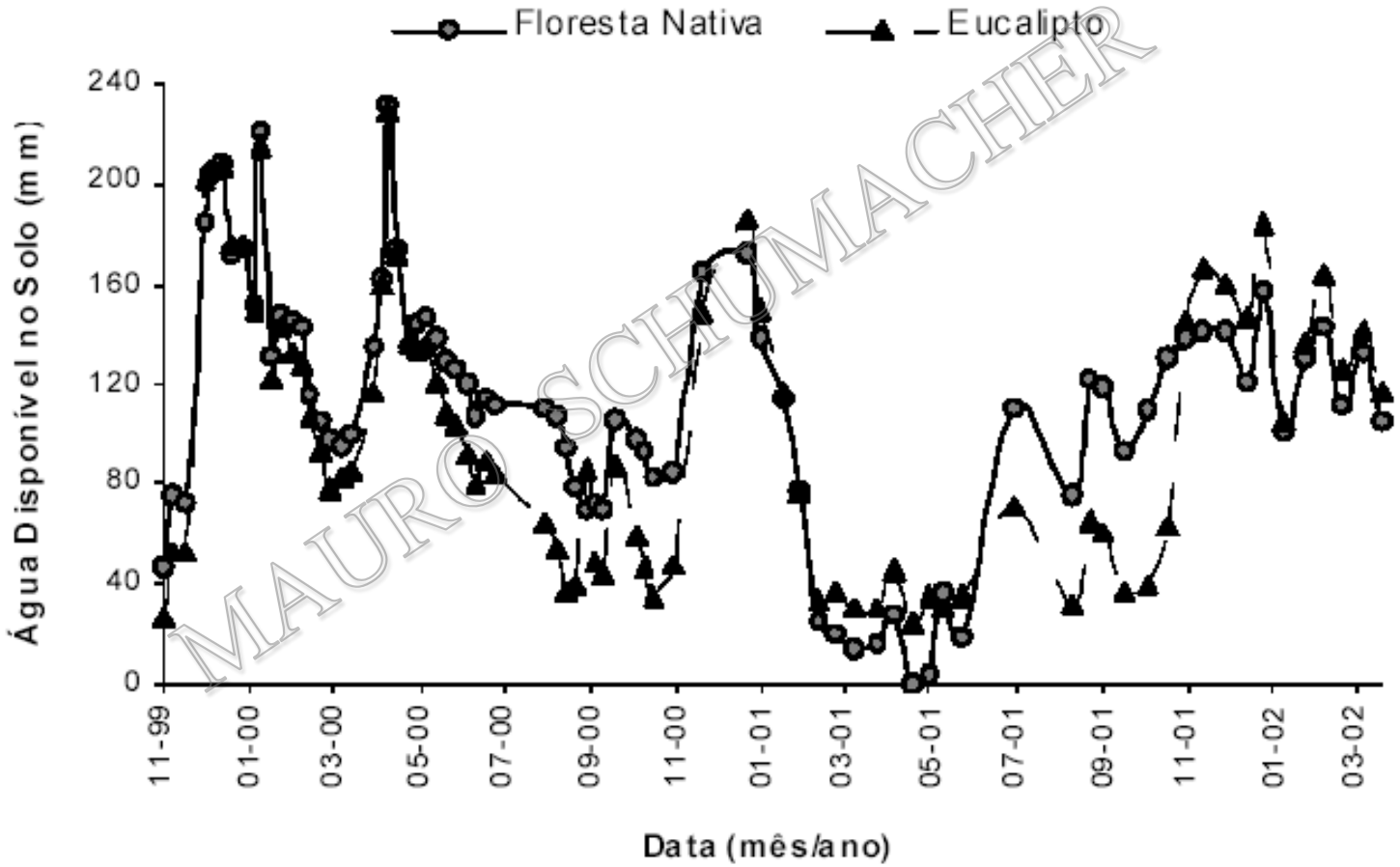
Available Water in Soil under Eucalyptus and Native Forest (Atlantic Forest), in the coastal region of Espírito Santo



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Source: Almeida and Soares, 2003

Unit 3. THE NUTRIENT CYCLE IN FOREST ECOSYSTEMS

3.1 - Geochemical cycle of nutrients;

3.2 - Biogeochemical cycle of nutrients;

3.3 - Biochemical cycle of nutrients;

3.4 - Soil organisms and the transformation of organic matter;

3.5 - Nutrient dynamics in tropical and boreal forests.

3.6 - Methodologies of biomass sampling and quantification of nutrients in forest ecosystems.

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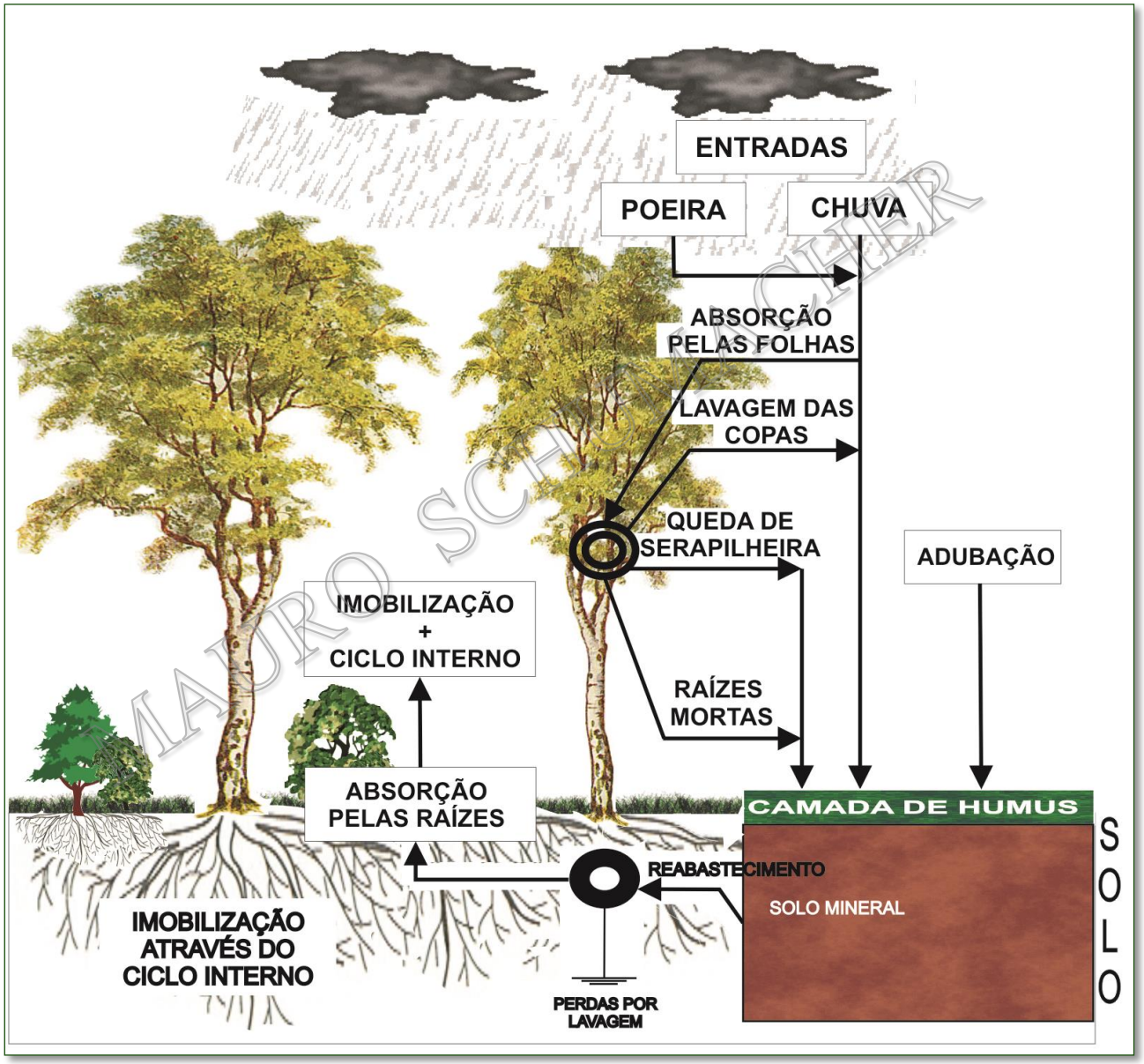
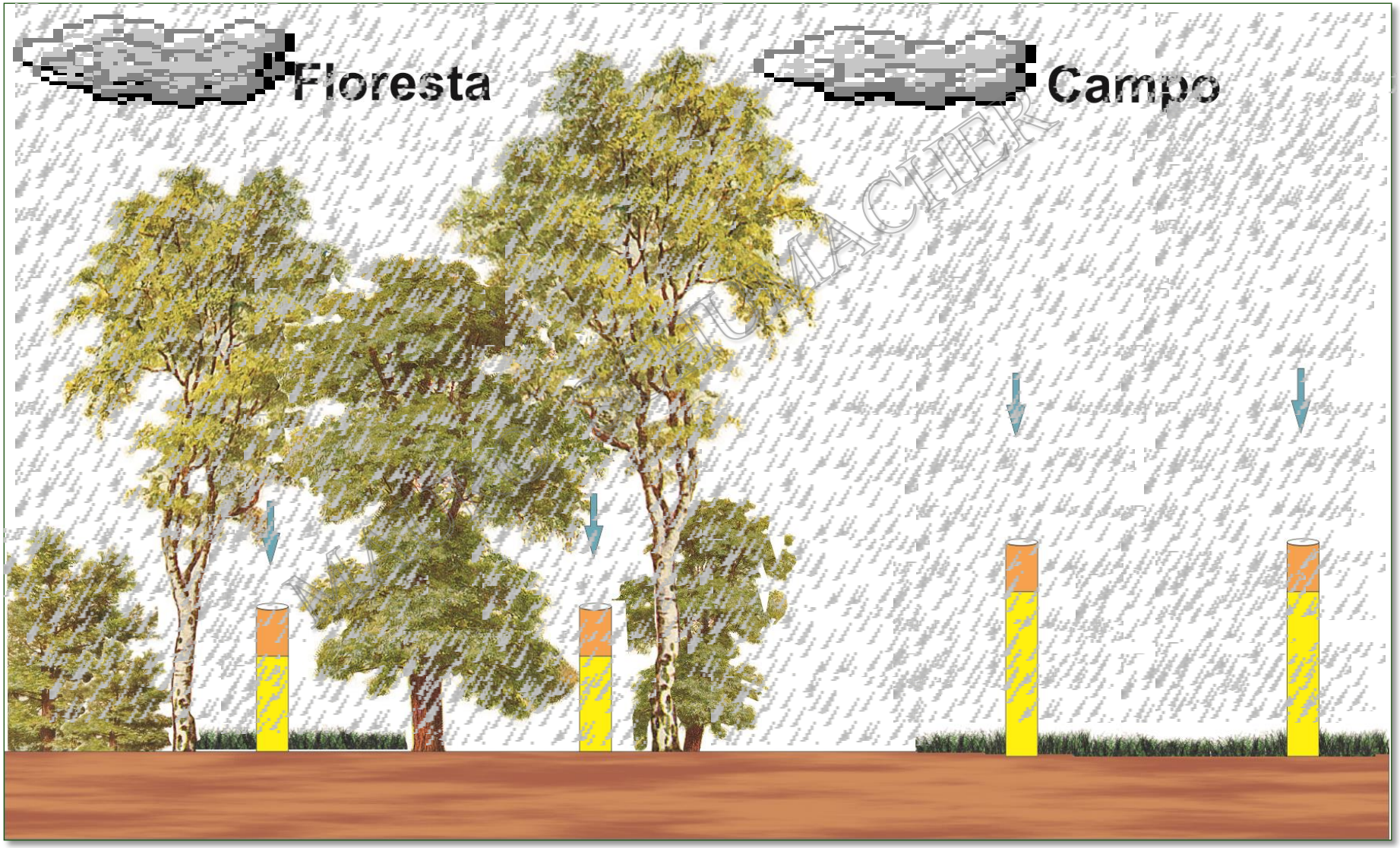
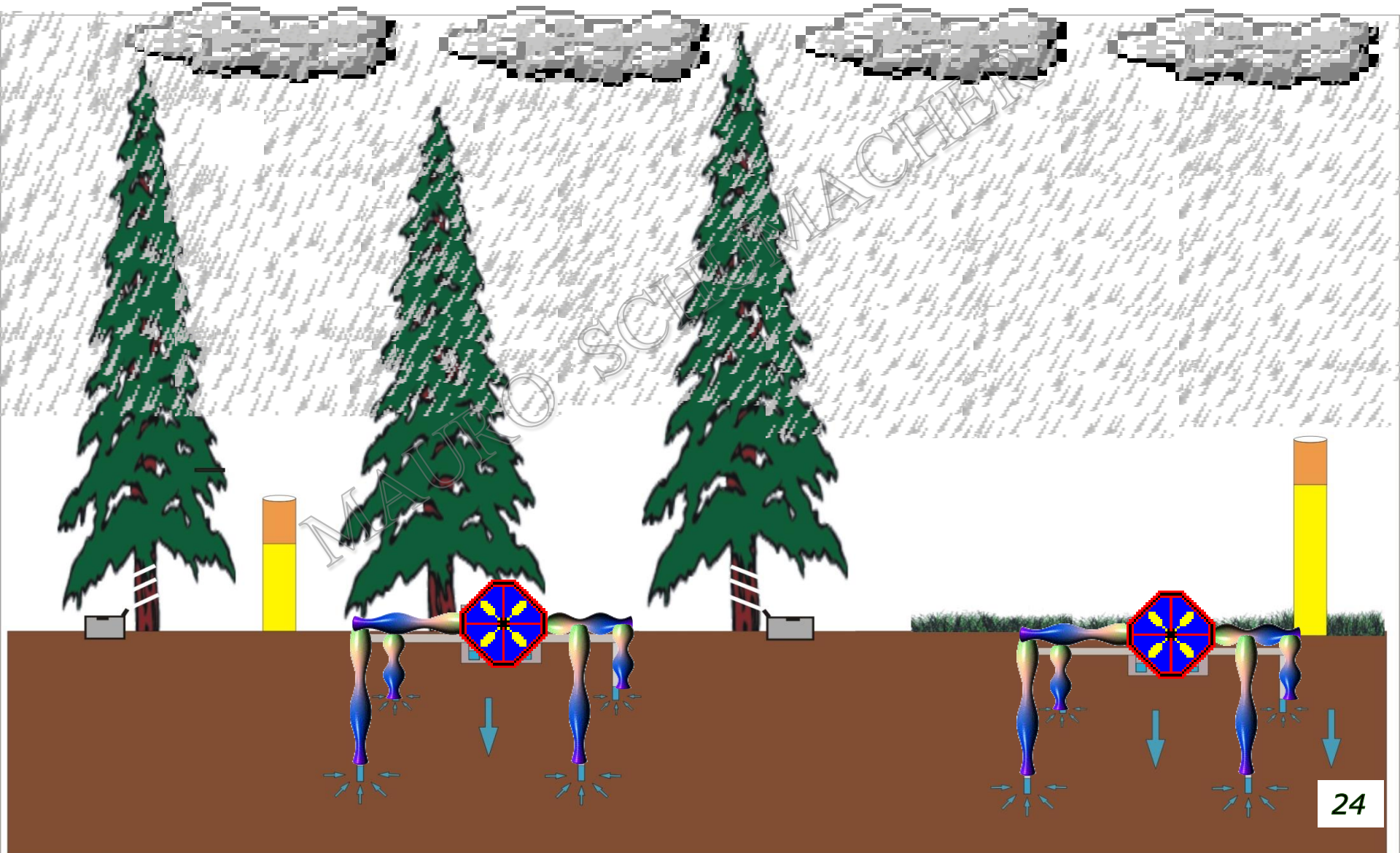

ENTRADAS
POEIRA
CHUVA
ABSORÇÃO PELAS FOLHAS
LAVAGEM DAS COPAS
QUEDA DE SERAPILHEIRA
ADUBAÇÃO
IMOBILIZAÇÃO + CICLO INTERNO
RAÍZES MORTAS
ABSORÇÃO PELAS RAÍZES
CAMADA DE HUMUS
REABASTECIMENTO
SOLO MINERAL
SOLO
IMOBILIZAÇÃO ATRAVÉS DO CICLO INTERNO
PERDAS POR LAVAGEM

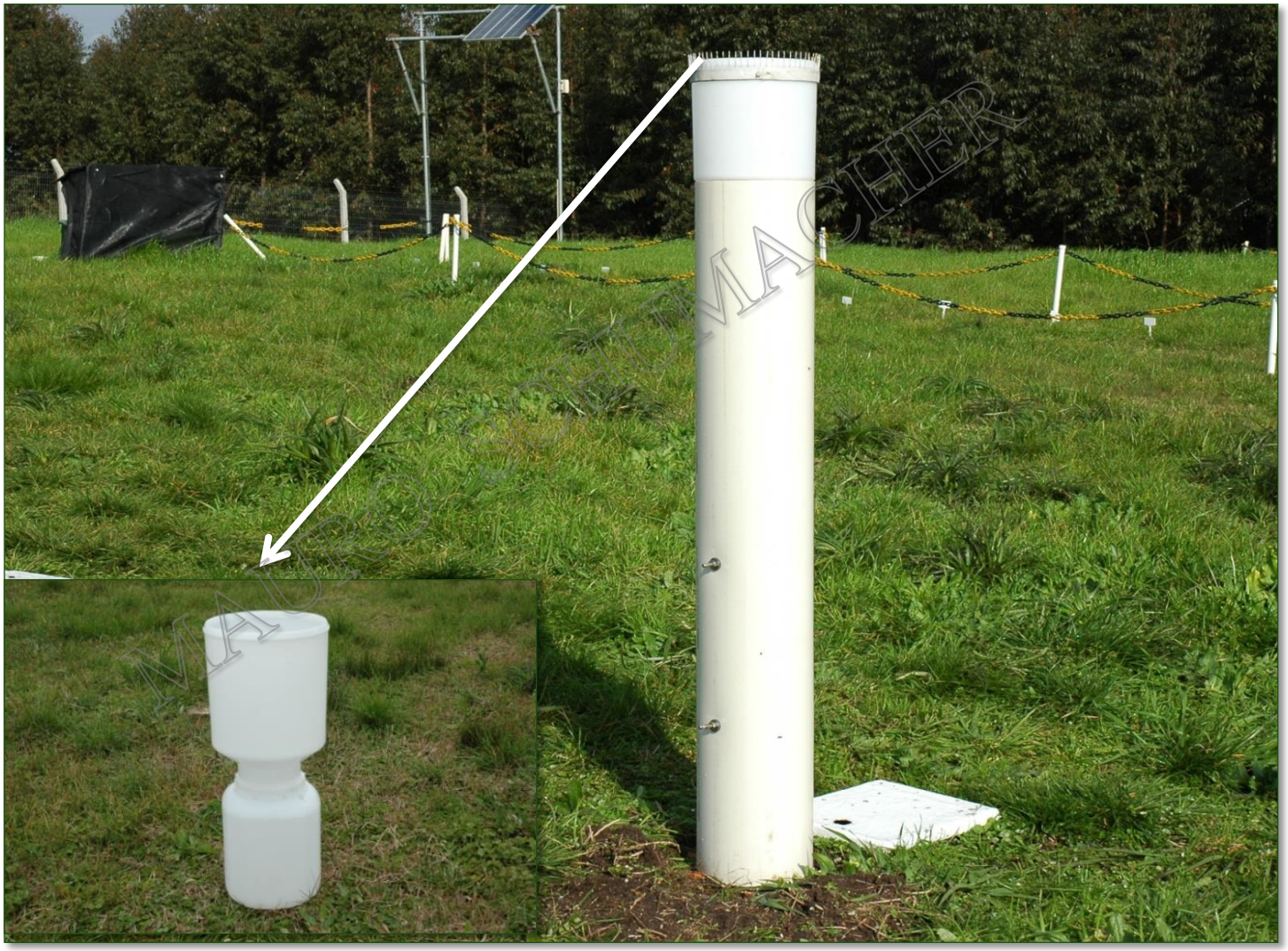
Nutrient Cycling in Native Forest



Nutrient Cycling in Plantations



Atmospheric deposition



Source: © Schumacher (2008)

Throughfall

Source: © Schumacher (2009)

Stemflow

Source: © Schumacher (2010)

Stemflow

Source: © Schumacher (2008)

Sampling of soil solution by lysimeters

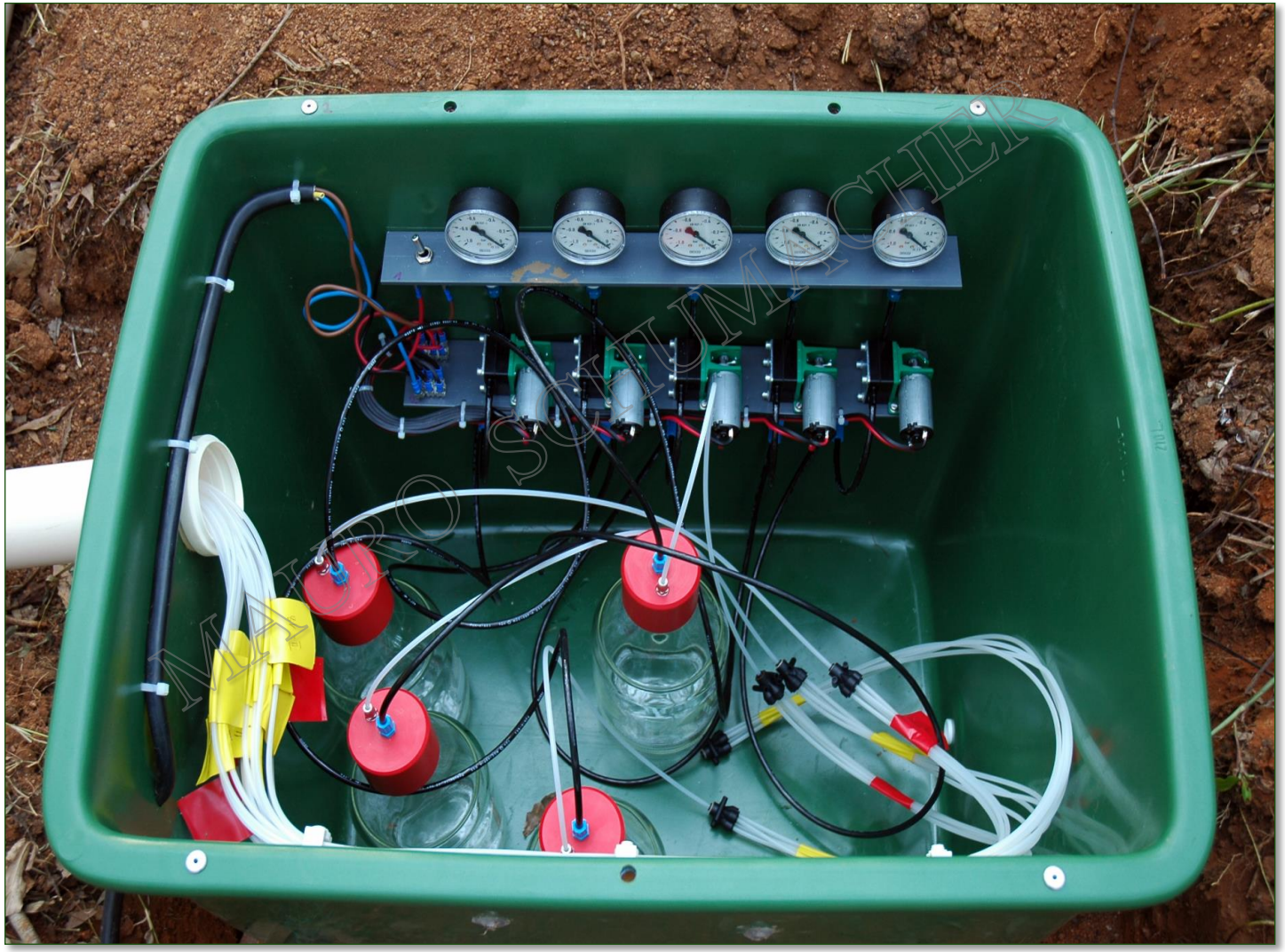


Foto: © Schumacher (2008)

Water yield in watersheds with forests and plantations

Litter trap

Foto: © Schumacher (2010)

Sampling of thick branches (> 0.5 cm)

Foto: © Schumacher (2010)

Nutrient inputs via Atmospheric deposition

(kg ha^{-1} ano $^{-1}$)					Source
K	Ca	Mg	Na	Cl	
9,4	7,8	1,1	6,8	-/-	1
17,1	23,3	2,9	15,8	23,3	2
1,9	4,1	0,7	3,9	7,7	3
11,0	5,7	1,7	33,3	40,3	4
3,6	9,3	1,5	4,8	14,0	5

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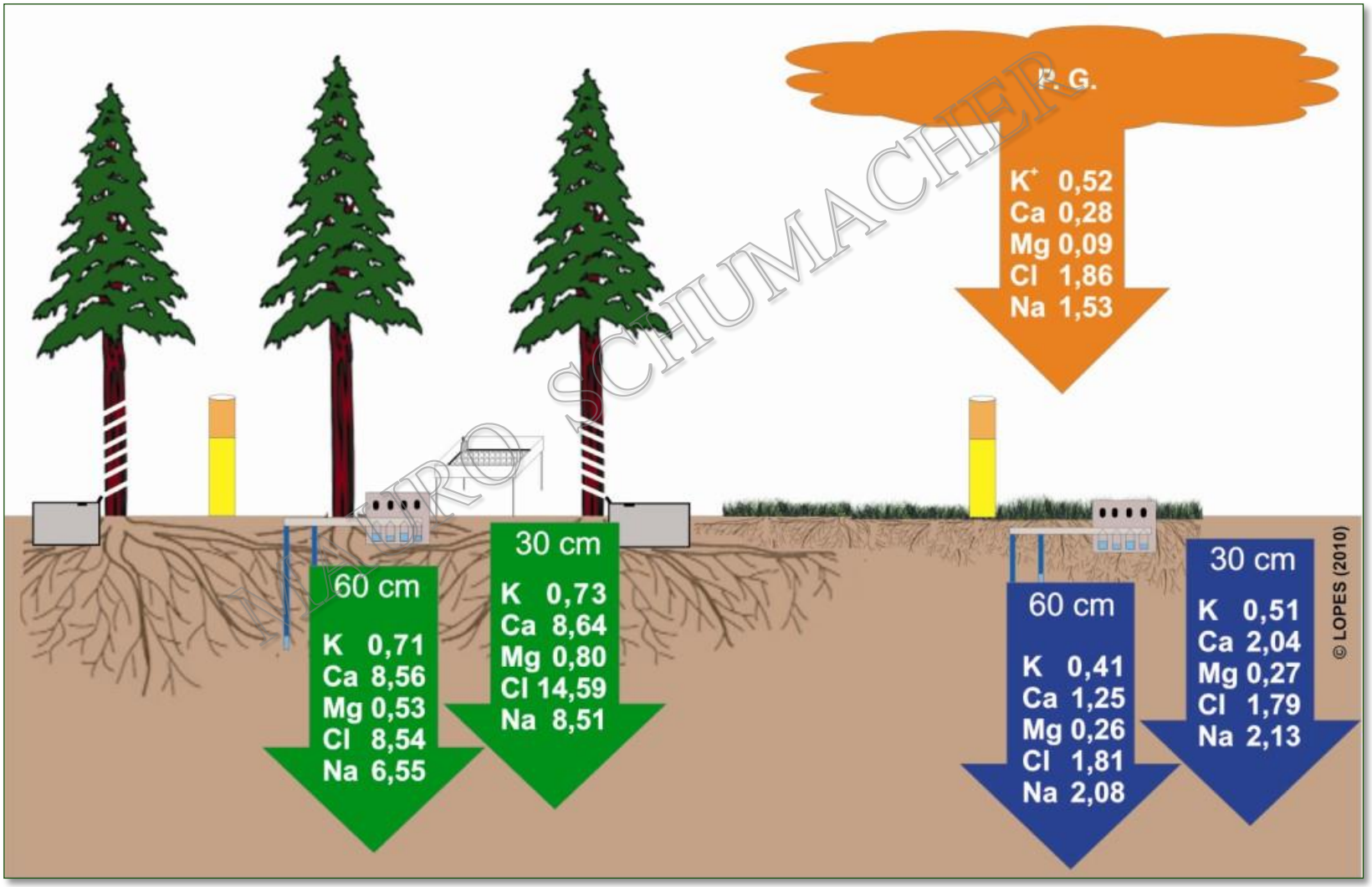
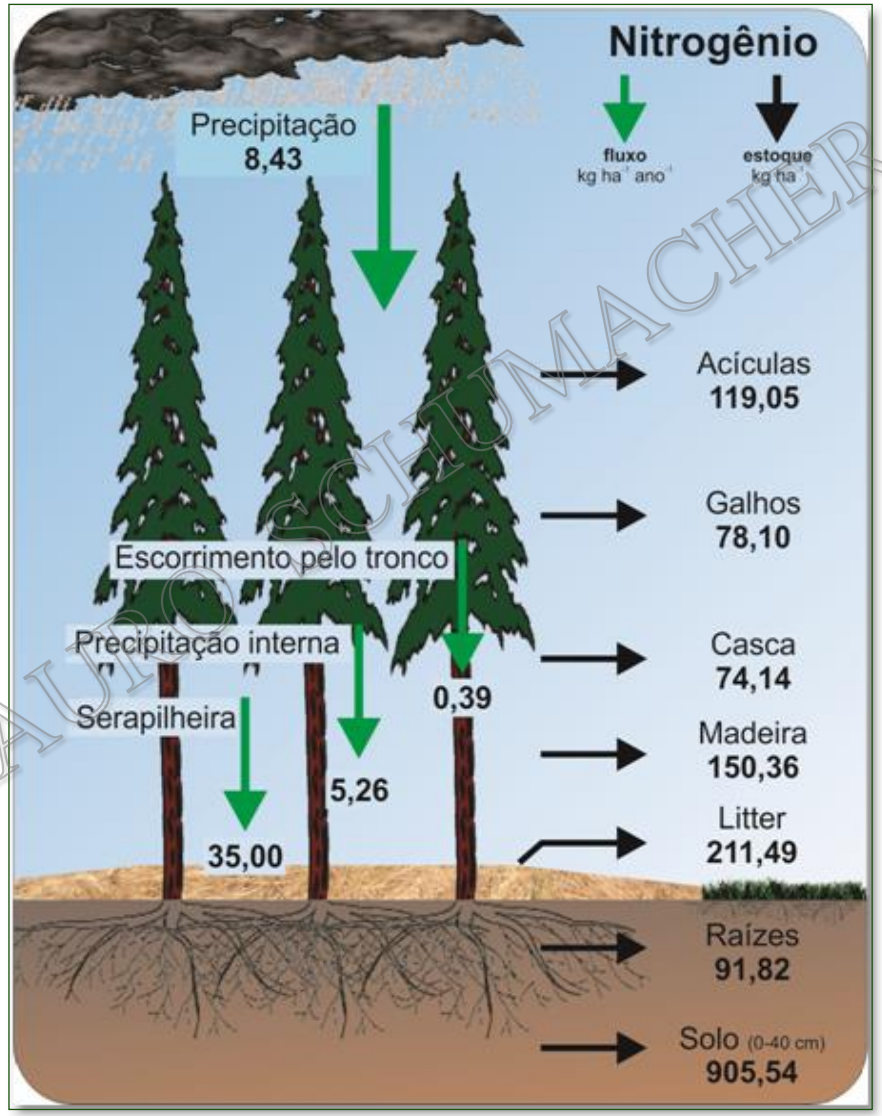
1 = Castro (1980) região de Viçosa onde não existem indústrias;
2 = SIF (1986) no Vale do Aço;
3 = Armbruster et al. (1997) Alemanha;
4 = Schumacher et al. (2009) Cambará do Sul /RS;
5 = Laclau et al. (2010) Itatinga/SP.

Concentration of ions (mg/L) in the incident rainfall and soil solution in Pinus taeda.



Fonte: Schumacher et al. (2009)

Nitrogen fluxes and stocks



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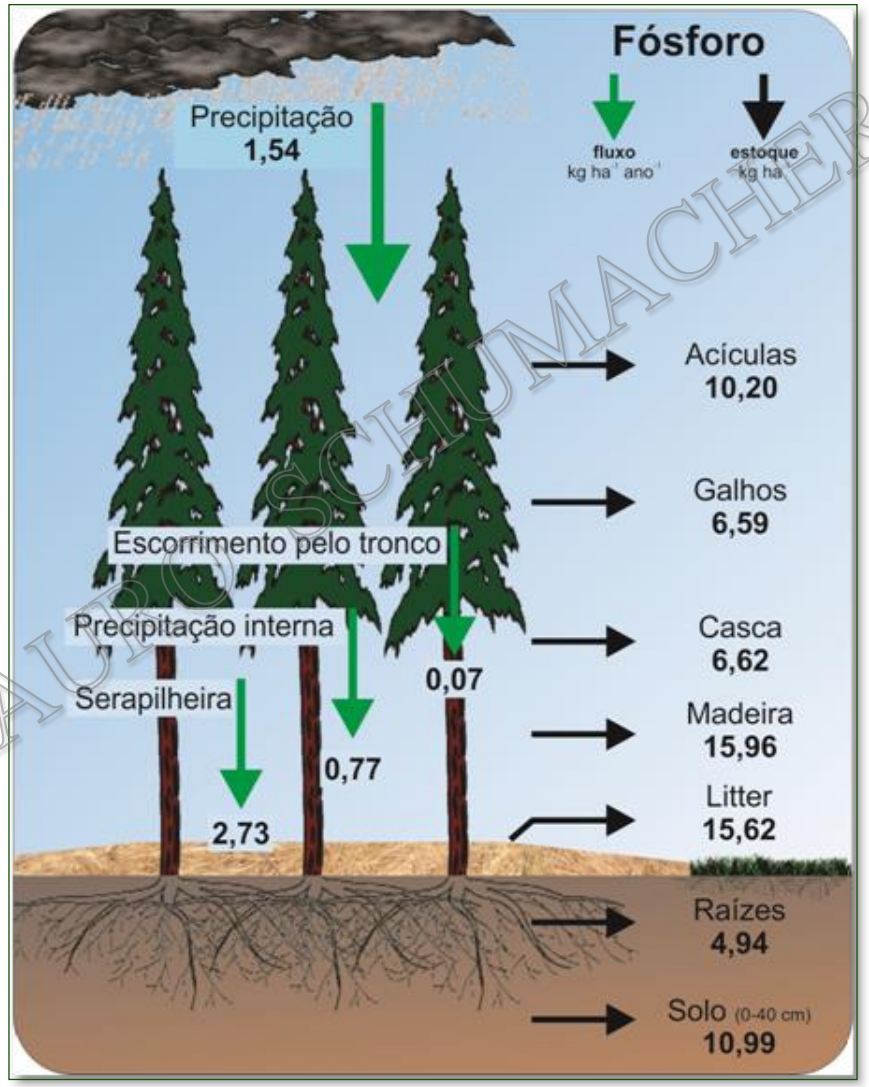
Fonte: Schumacher et al. (2009)

Phosphorus fluxes and stocks



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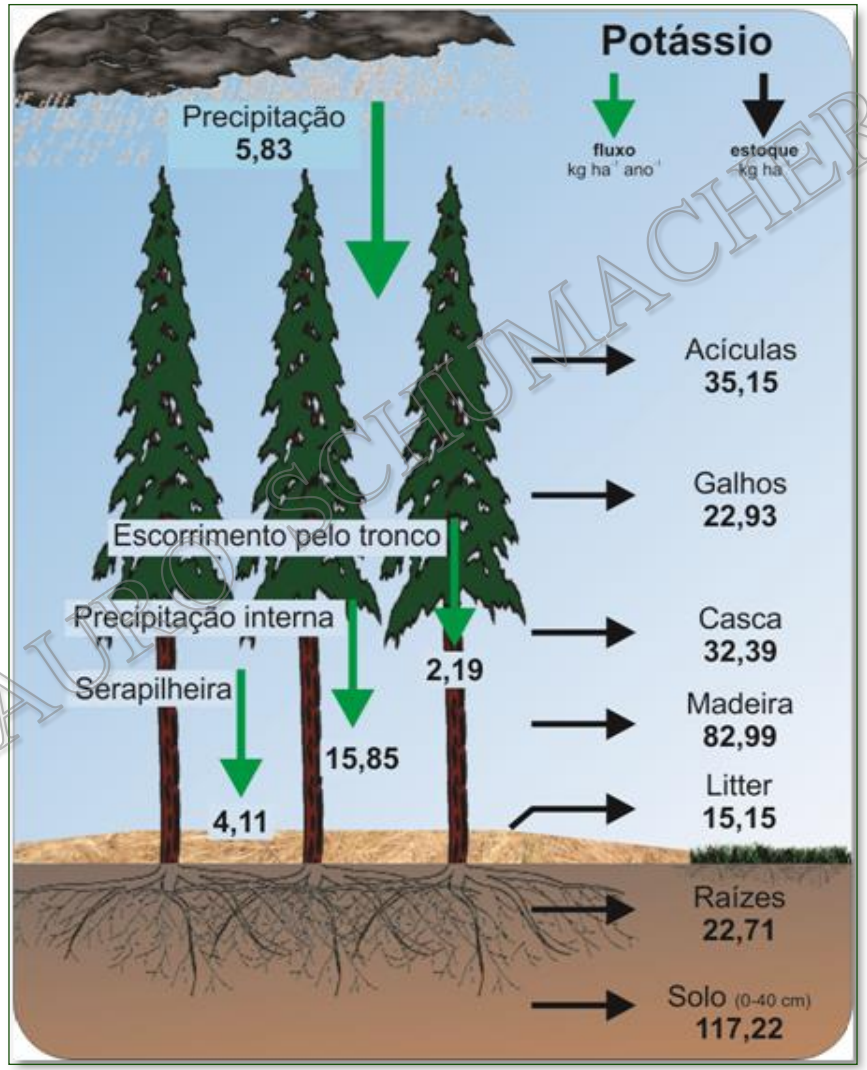
Fonte: Schumacher et al. (2009)

Potassium fluxes and stocks



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Fonte: Schumacher et al. (2009)

Importance of the nutrient cycles in a Pinus taeda stand (20 years old)

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Cycle	N	P	K	Ca
Geochemical	16%	5%	12%	31%
Biogeochemical	45%	35%	66%	69%
Biochemical	39%	60%	22%	traços

Fonte: KIMMINS (1987)

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Unit 4. FOREST STRUCTURE AND IS ECOLOGICAL IMPORTANCE

4.1 - Original and present vegetation;

4.2 - Ecological importance of different forest structures;

4.3 - Ecological groups;

4.4 – Site Indicator Species.

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Source: Schumacher et al. (2019)

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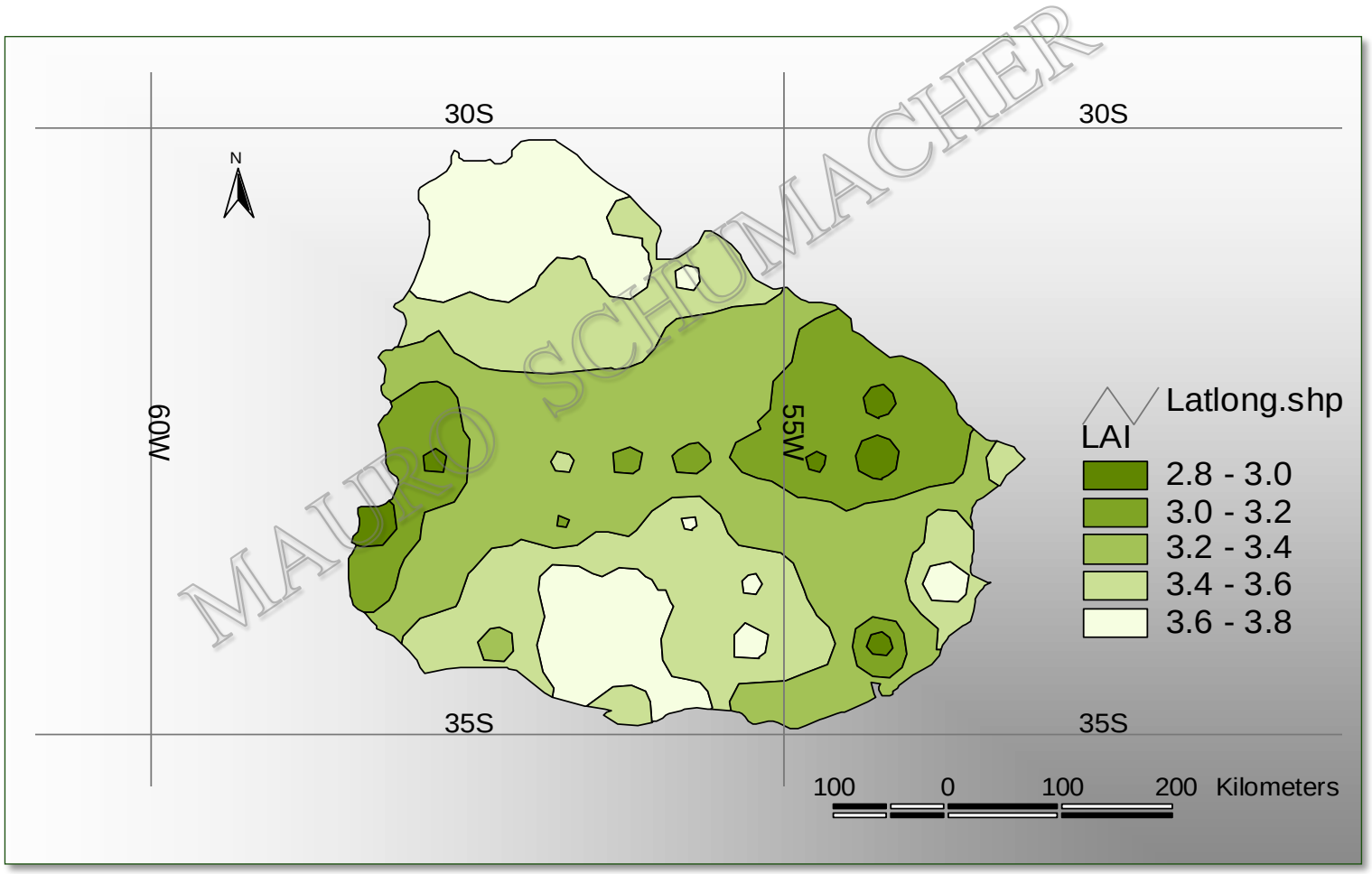
Unit 5. DETERMINATION OF PRODUCTION UNITS

5.1 - Classification of forest habitats;

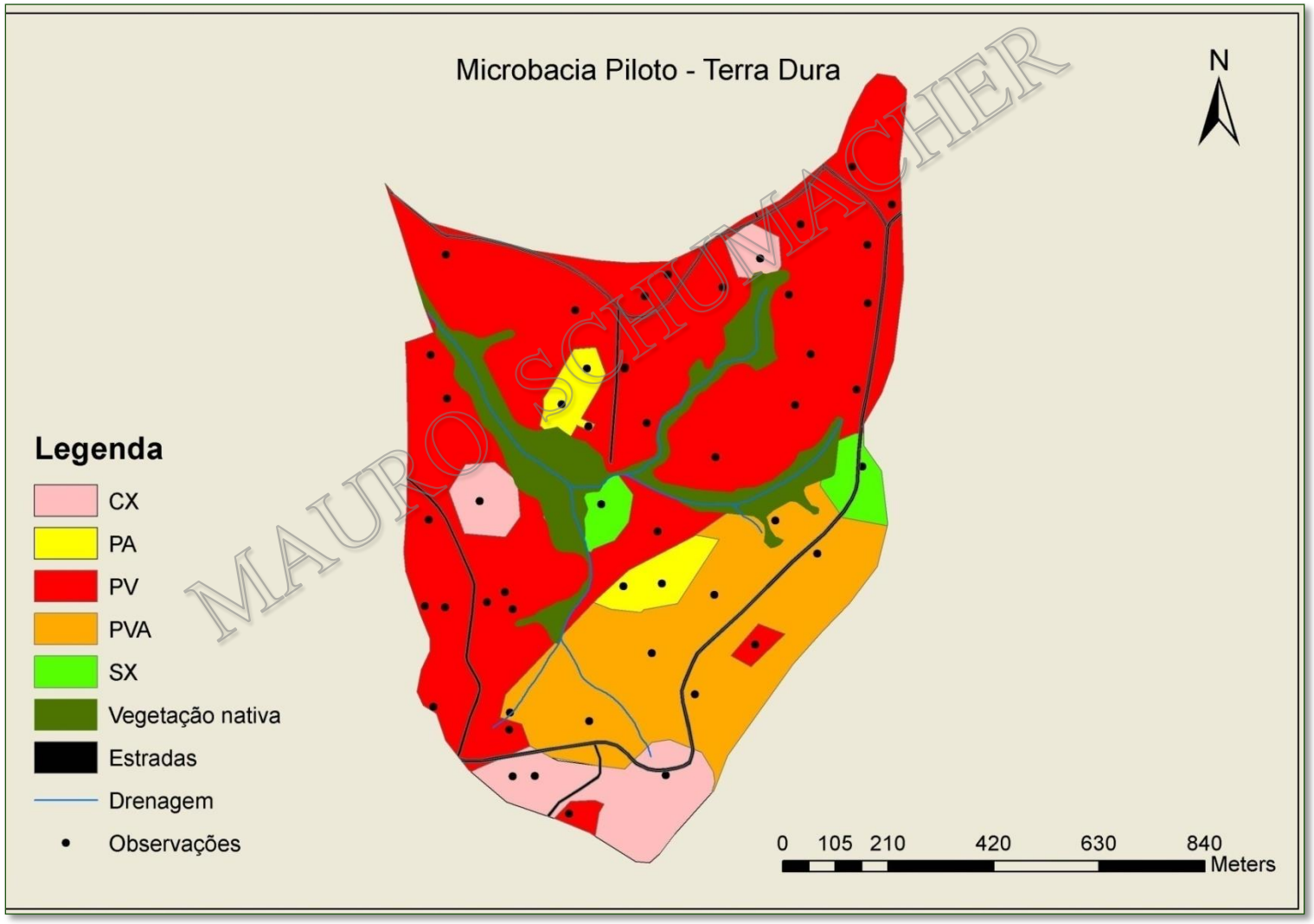
5.2 - Forest planning.

Leaf Area Index - LAI (m^2 m^2)



Source: Neves et al. (2005)

Soil types in operational forestry areas



Unit 6. ECOLOGICAL ZONES OF PLANET EARTH

6.1 - Boreal zone;

6.2 - Subtropical zone always humid;

6.3 - Tropical zone always humid.

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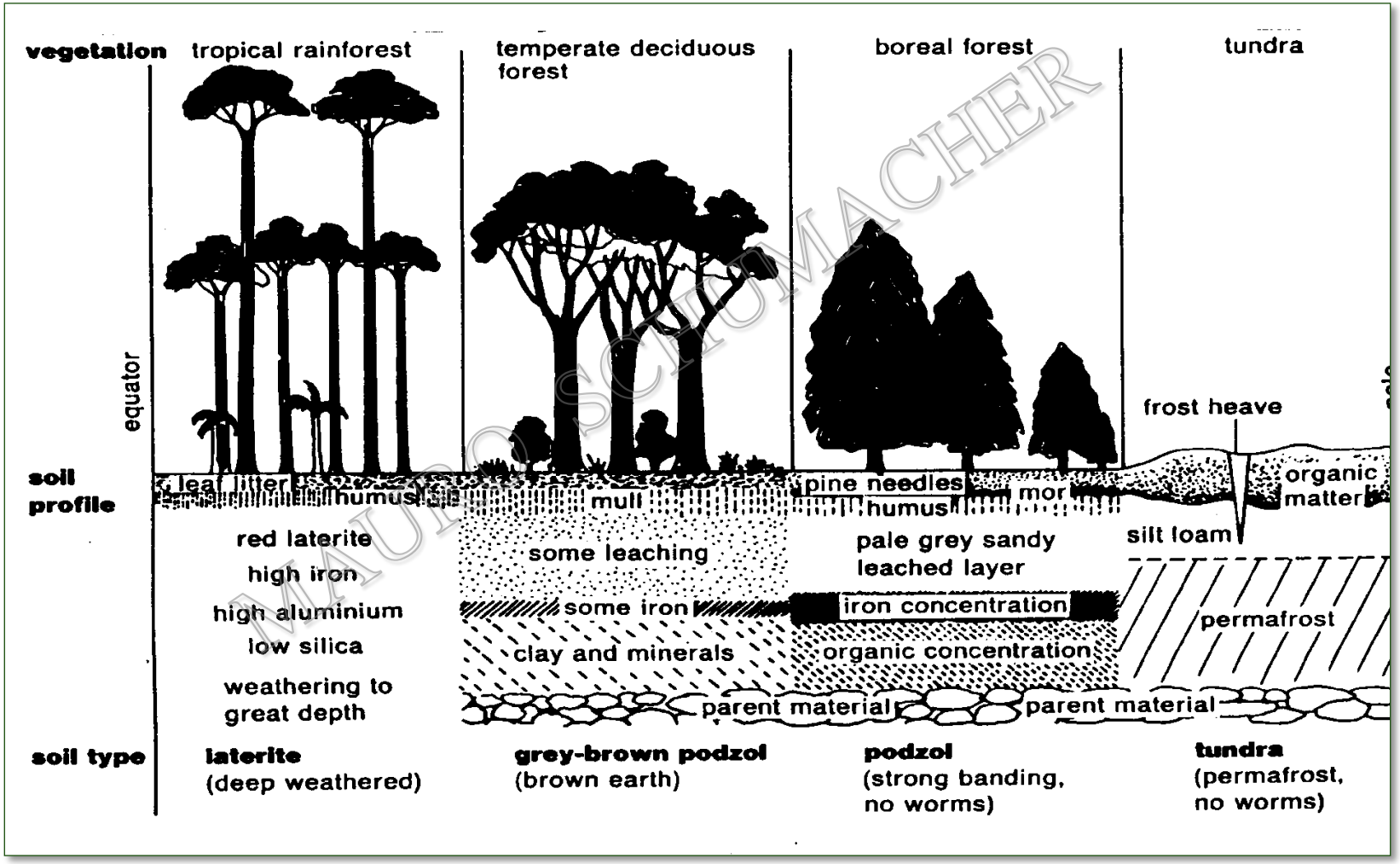
Groups of soils in vegetation areas.



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