ForHeal Forestry Higher Education Advancement in Laos

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Biomes of the World

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Main biomes of the Earth - zonobiomes

Zonality of zonobiomes reflects the geographical zonality of climate

- Tropical rain forest
- Deciduous tropical forests and savannas
- Tropical deserts
- Mediterranean sclerophyllous forests
- Deciduous forests
- Steppe
- Continental deserts
- Boreal forests – taiga
- Tundra
- Arctic plains

Azonal biomes – conditioned by local particularities

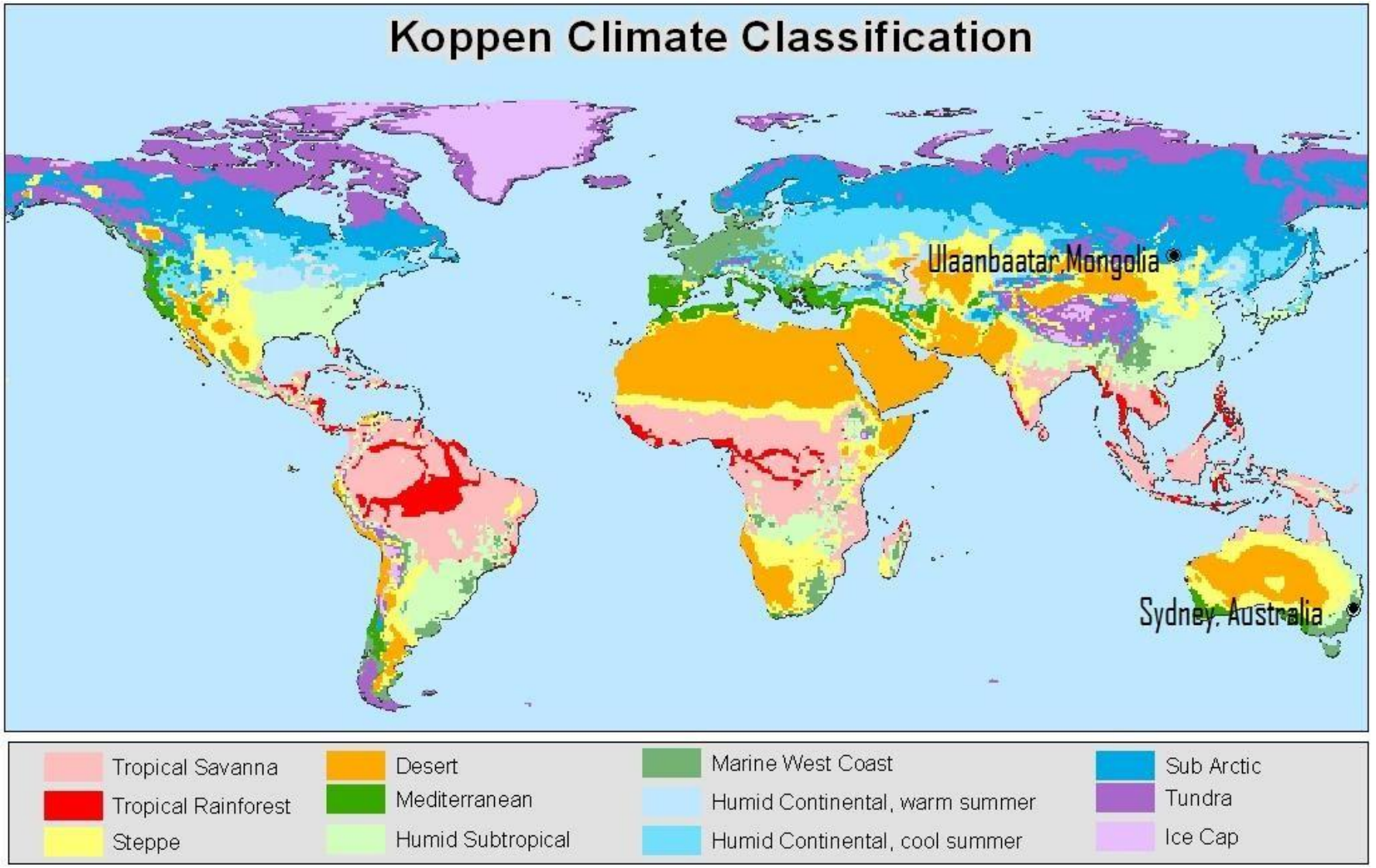
Pedobiomes - particular soil conditions – **edaphic climax**

Examples: peat, rocks, salty soils – solontschack, solonetz

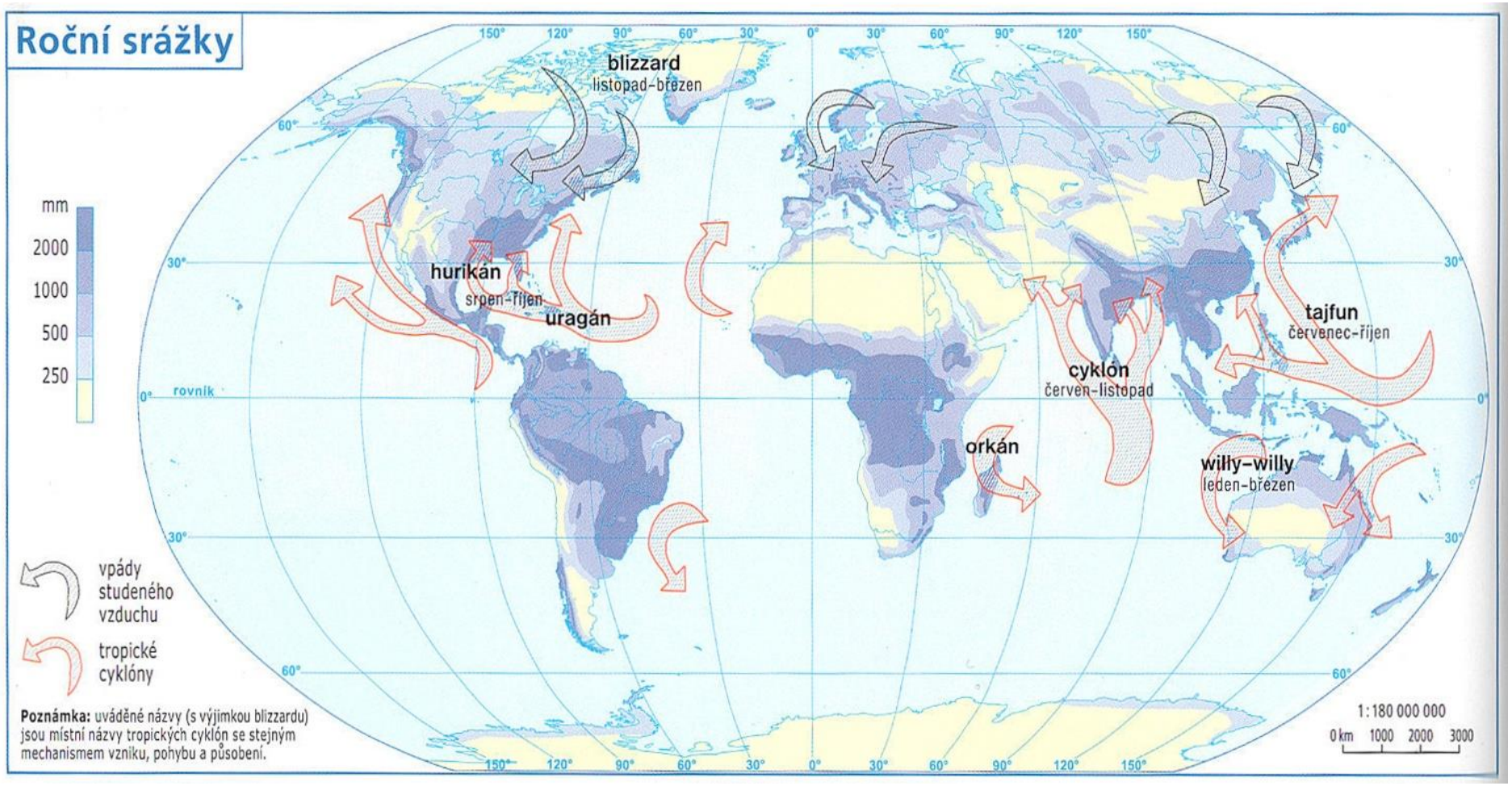
Orobiomes - zonality depending on the altitude – **altitudinal zones**

There is some similarity between latitudinal and altitudinal zones, but also difference (day lengths, year seasons), similarity is prevailing often

Example: boreal and mountain spruce stands


Koppen Climate Classification
Ulaanbaatar, Mongolia
Sydney, Australia
Tropical Savanna
Tropical Rainforest
Steppe
Desert
Mediterranean
Humid Subtropical
Marine West Coast
Humid Continental, warm summer
Humid Continental, cool summer
Sub Arctic
Tundra
Ice Cap

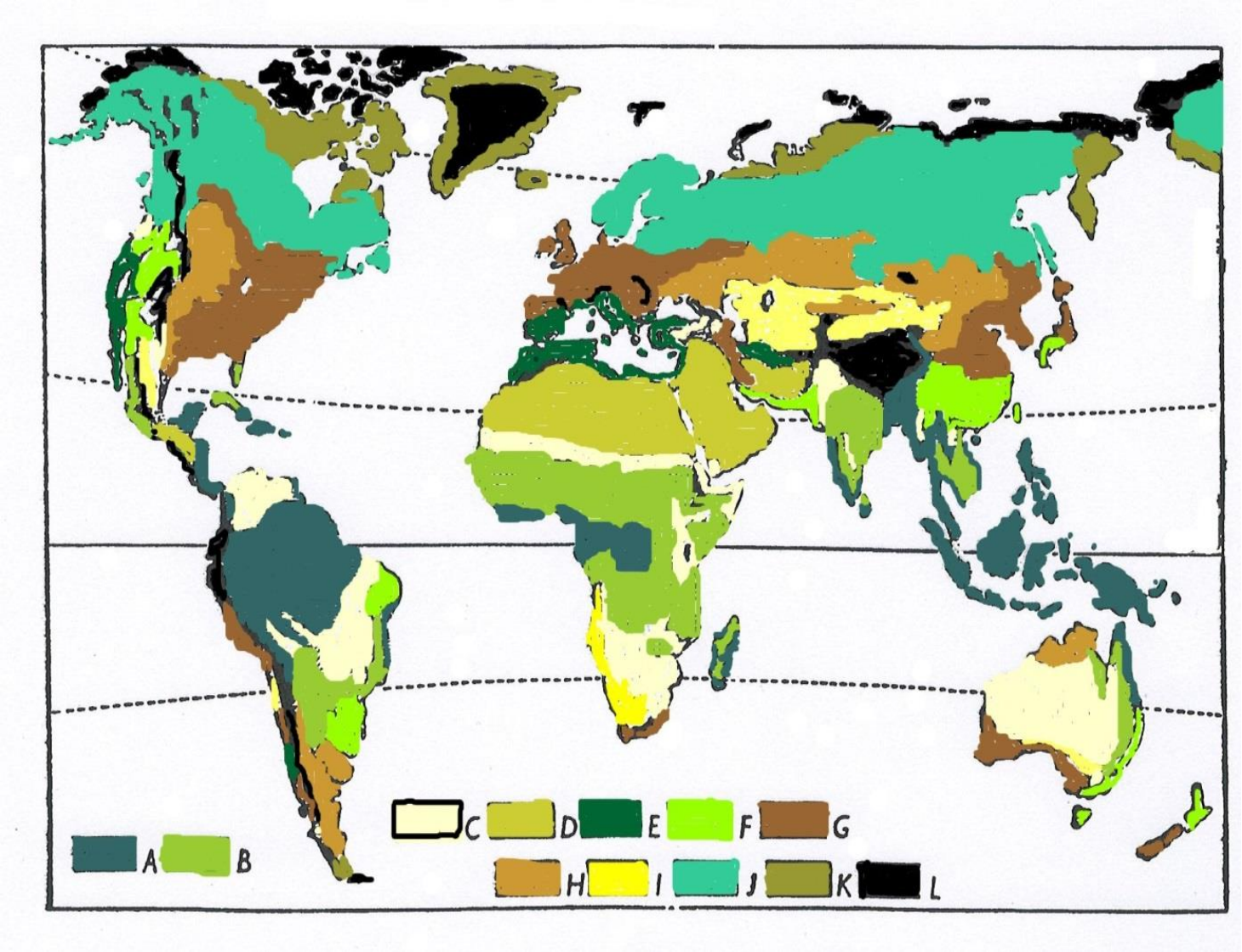
Rainfall distribution



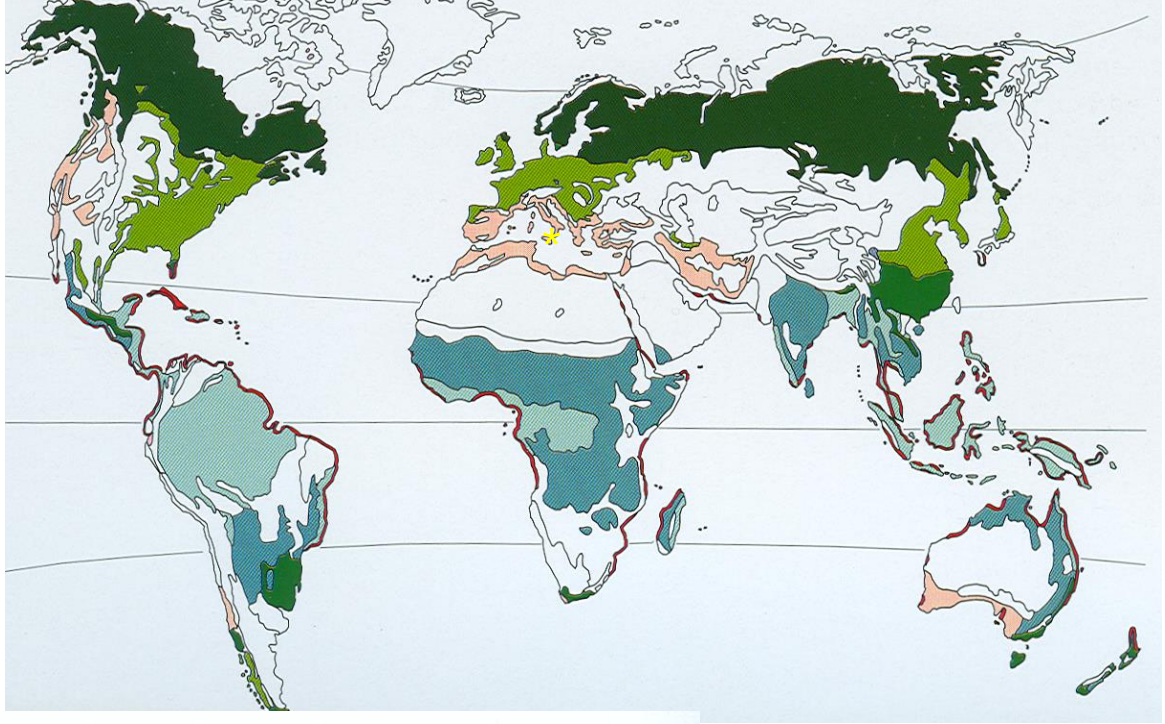
Biomes of the World

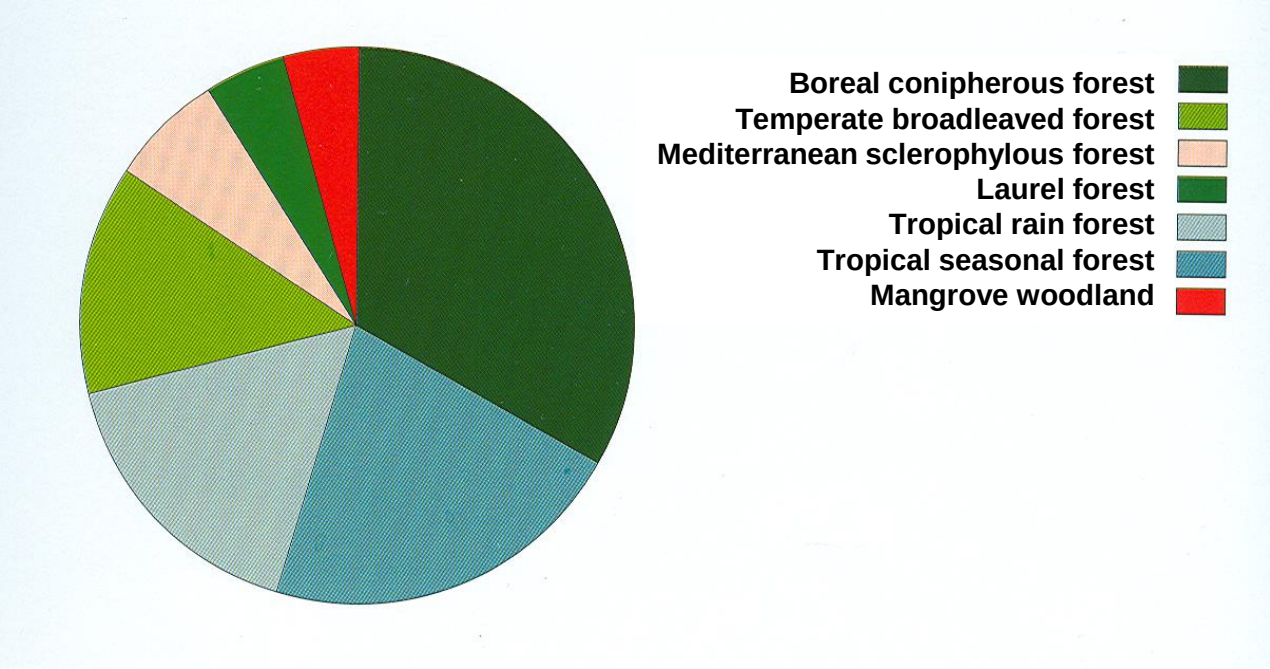
A. Tropical evergreen rain forest zone
B. Tropical semi-deciduous and deciduous forest zones
C. Savannah zones
D. Tropical desert and semi-desert zones
E. Hardwood, evergreen vegetation zones of winter rain areas (known as étesia vegetation)
F. Evergreen forests of humid meso-thermal climate zones
G. Deciduous broadleaves forests of temperate climate zones
H. Forest-steppe, steppe and prairie zones
I. Desert and semi-desert of temperate climate zones
J. Boreal coniferous forests zone
K. Forest-tundra and tundra zones
L. Frost desert and glacial area zones

Borrowed and modified after Hendrych 1984)



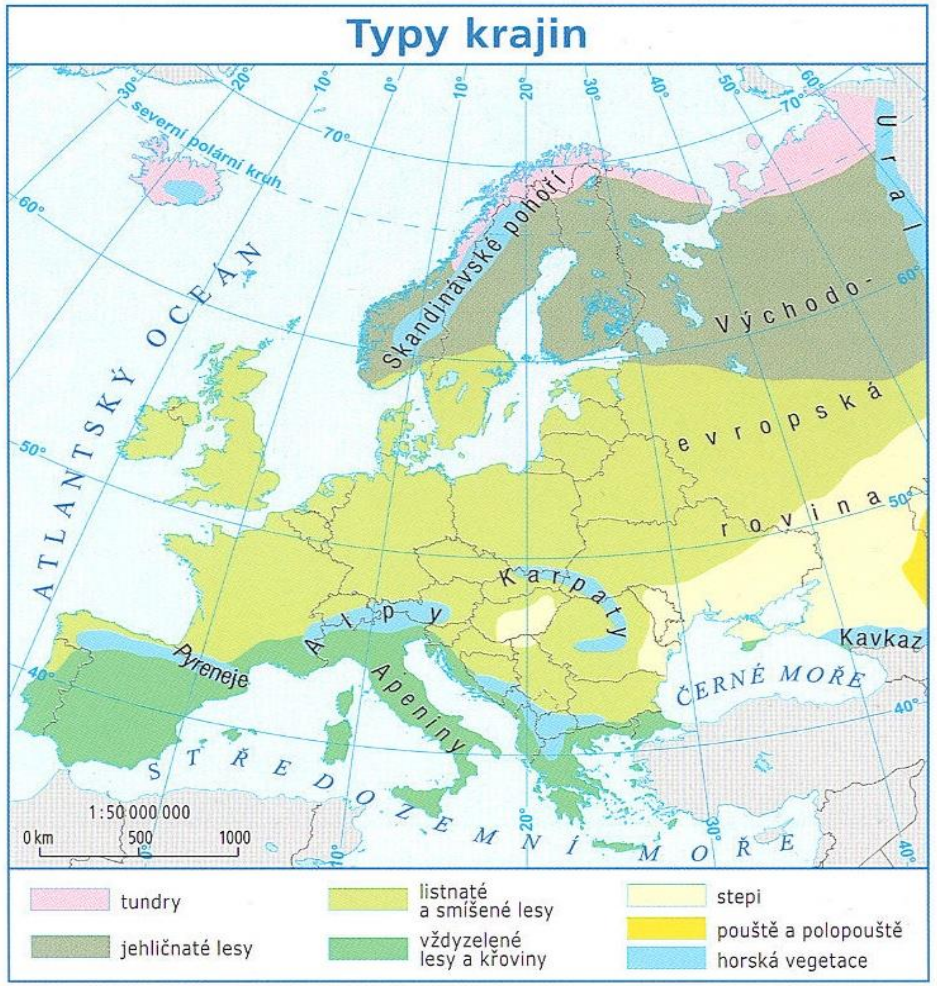
Potential global distribution of woody biomes





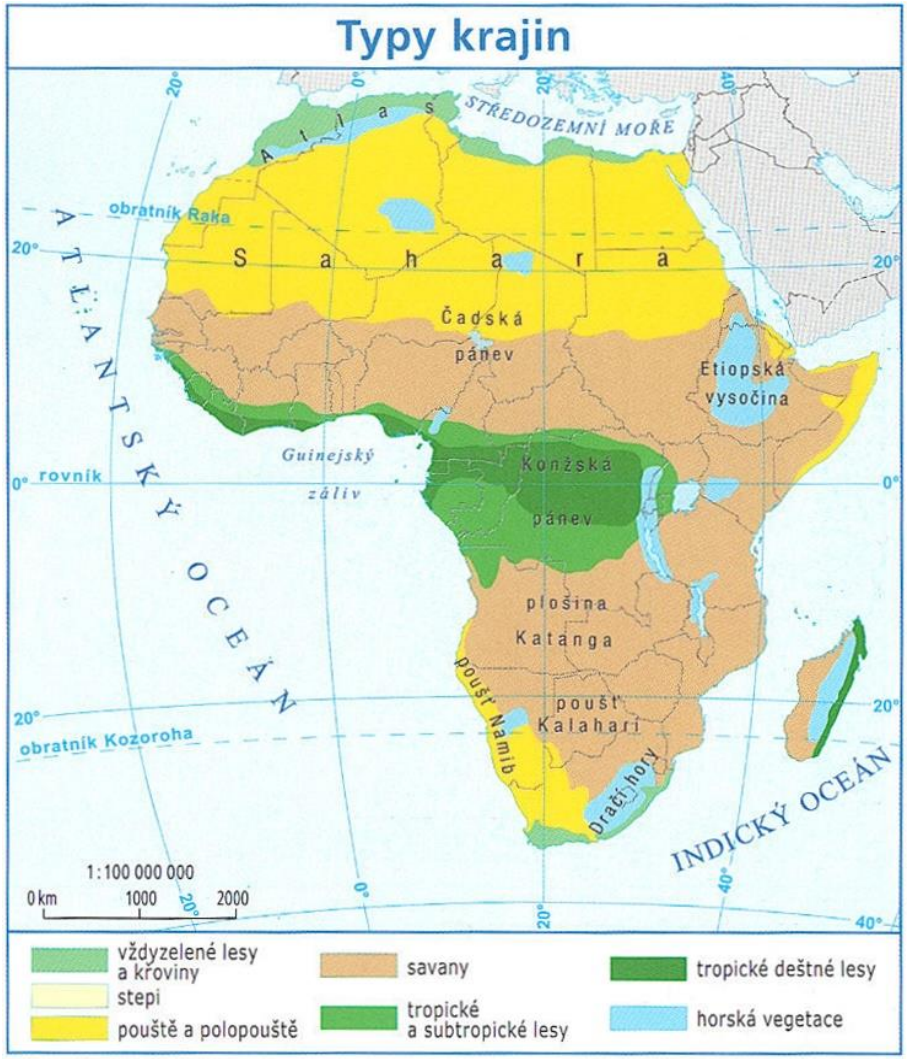
Europe

- Green – mediterranean sclerophyllous f.
- Light green – deciduous and mixed f.
- Grey – boreal coniferous f.
- Pink - tundra
- Light yellow – steppe
- Dark yellow - deserts
- Blue – mountain vegetation



Africa

- Dark green – trop. rain f.
- Less dark g. – tr. and subtr. f.
- Green – mediterranean sclerophyllous f.
- Brown - savannas
- Dark yellow - deserts
- Blue – mountain vegetation



Asia

- Dark green – trop. rain f.
- Less dark g. – tr. and subtr. f.
- Green – mediterranean sclerophyllous f.
- Brown - savannas
- Light green – deciduous and mixed f.
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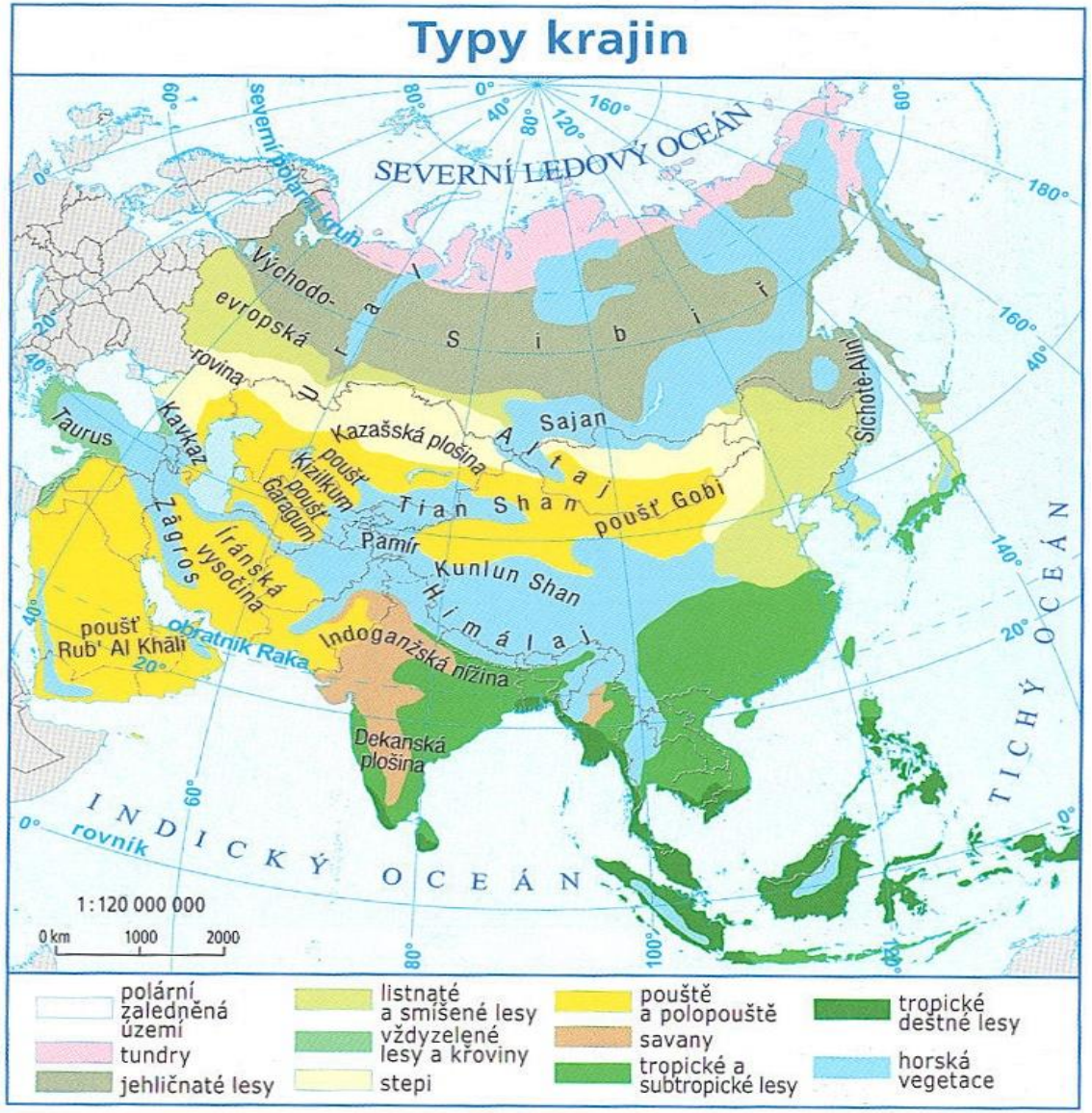
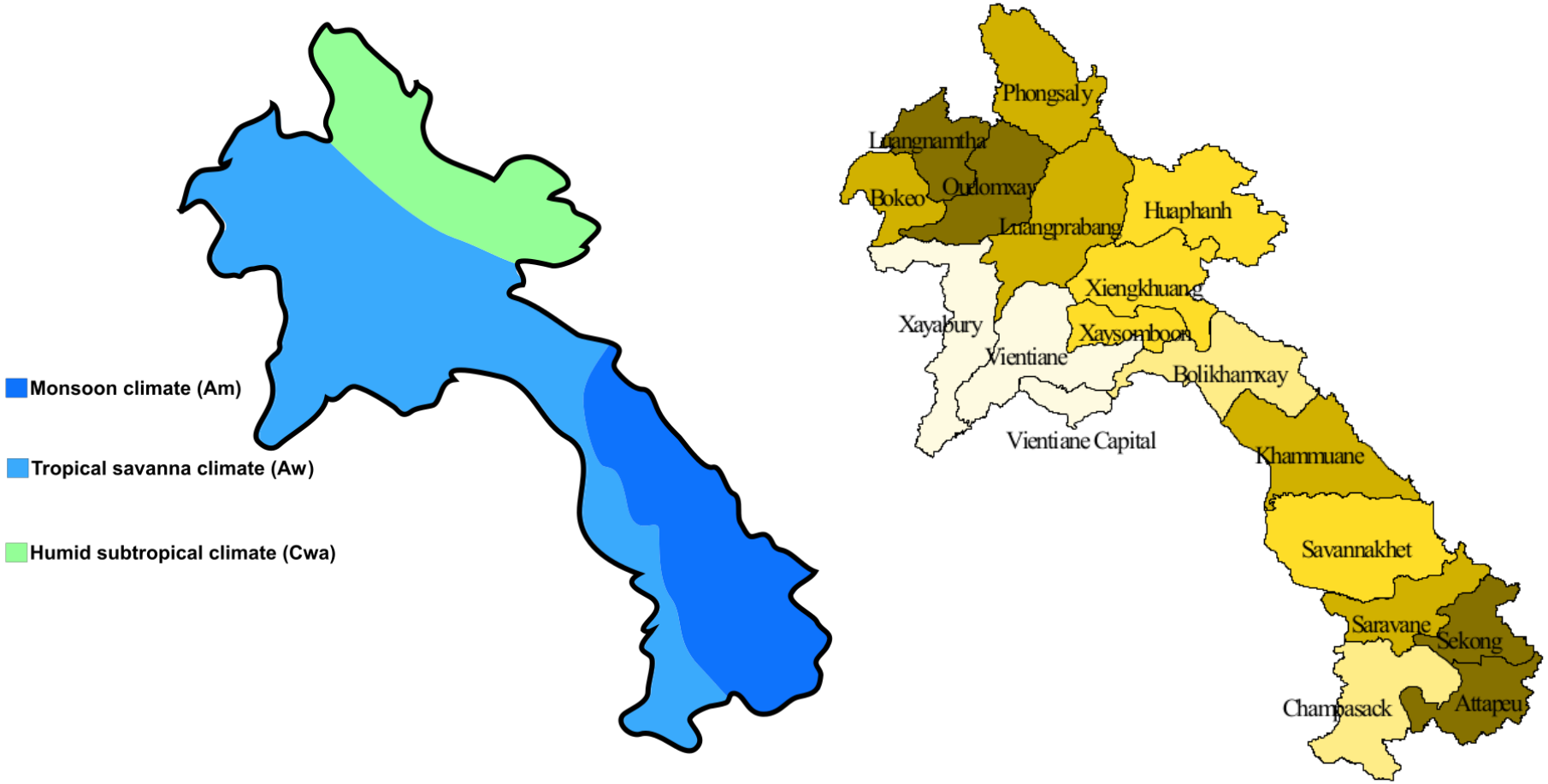
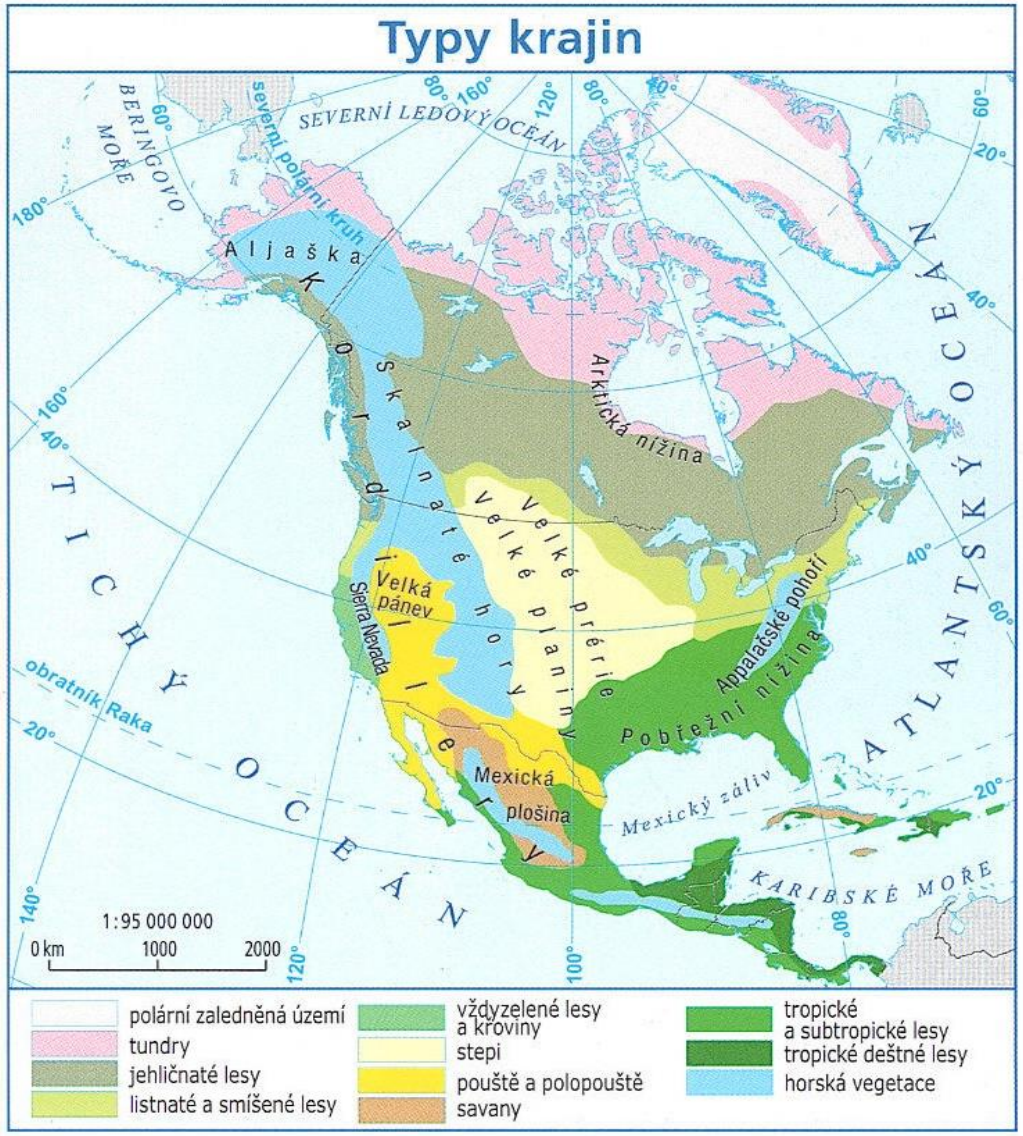


Laos map of Köppen climate classification



North America

- Green – mediterranean sclerophyll
- Light green – deciduous and mixed
- Darker green – trop. and. s. f.
- Dark green – Trop. rain f.
- Grey – boreal coniferous f.
- Pink - tundra
- Brown - savannas
- Light yellow – steppe
- Dark yellow - deserts
- Blue – mountain vegetation

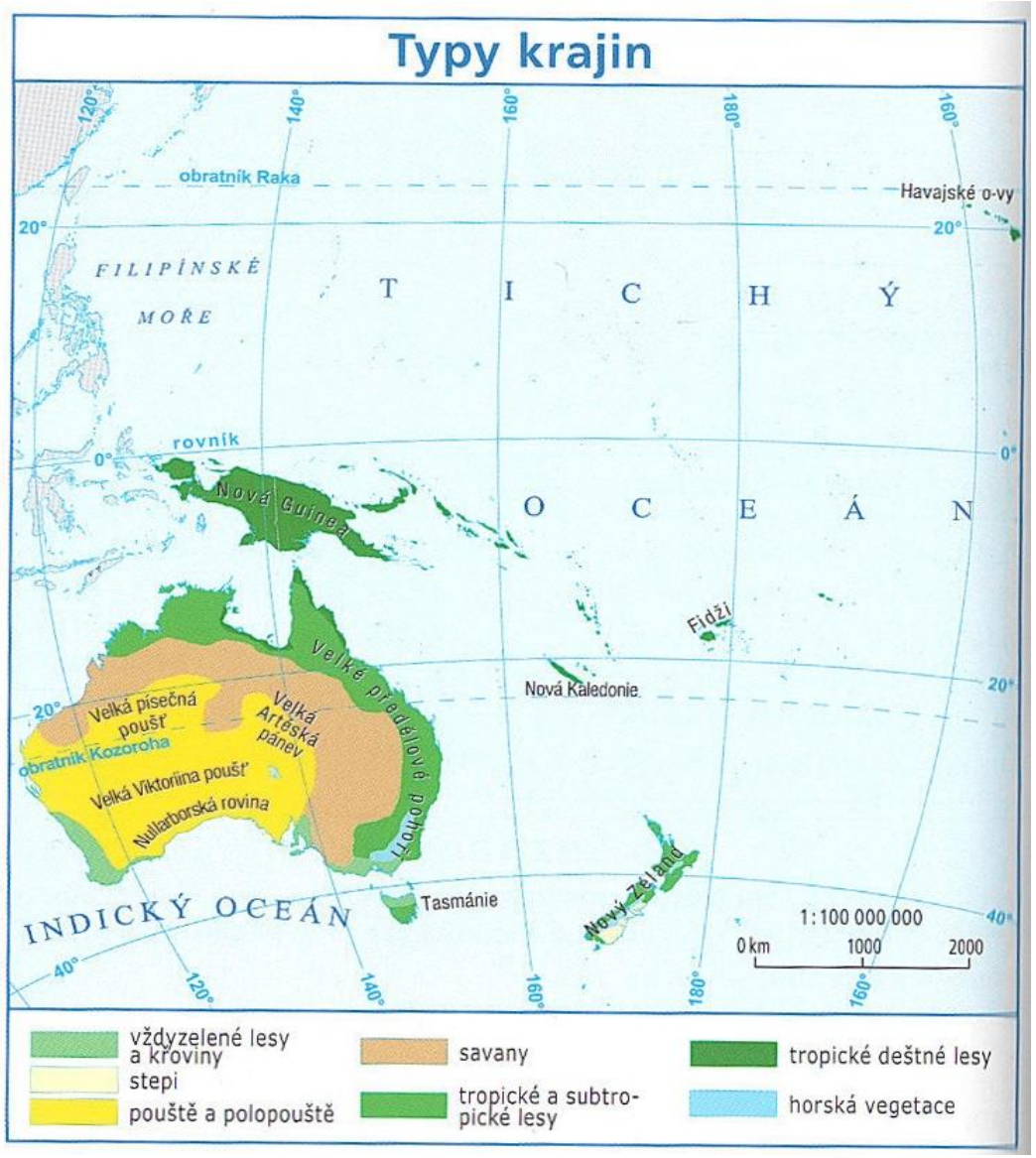


South America

- Green – mediterranean sclerophyllous f.
- Light green – deciduous and mixed f.
- Darker green – trop. and. s. f.
- Dark green – Trop. rain f.
- Pink - tundra
- Brown - savannas
- Light yellow – steppe
- Dark yellow - deserts
- Blue – mountain vegetation

Australia

- Green – mediterranean sclerophyllous f.
- Darker green – trop. and. s. f.
- Dark green – Trop. rain f.
- Light yellow – steppe
- Brown – savannas
- Dark yellow - deserts
- Blue – mountain vegetation



Tropical forests: selected topics from their distribution and structure

- Tropical rain forest (TRF)
- Tropical seasonal forest (TSF),
- Tree savannah, Grass savannah
- Mangrove woodland/Mangal

Tropical rain forest

Tropical rain forest (jungle – Asia, selva – Amazonia) is the terrestrial biome with maximum biodiversity

Tropical rainforest

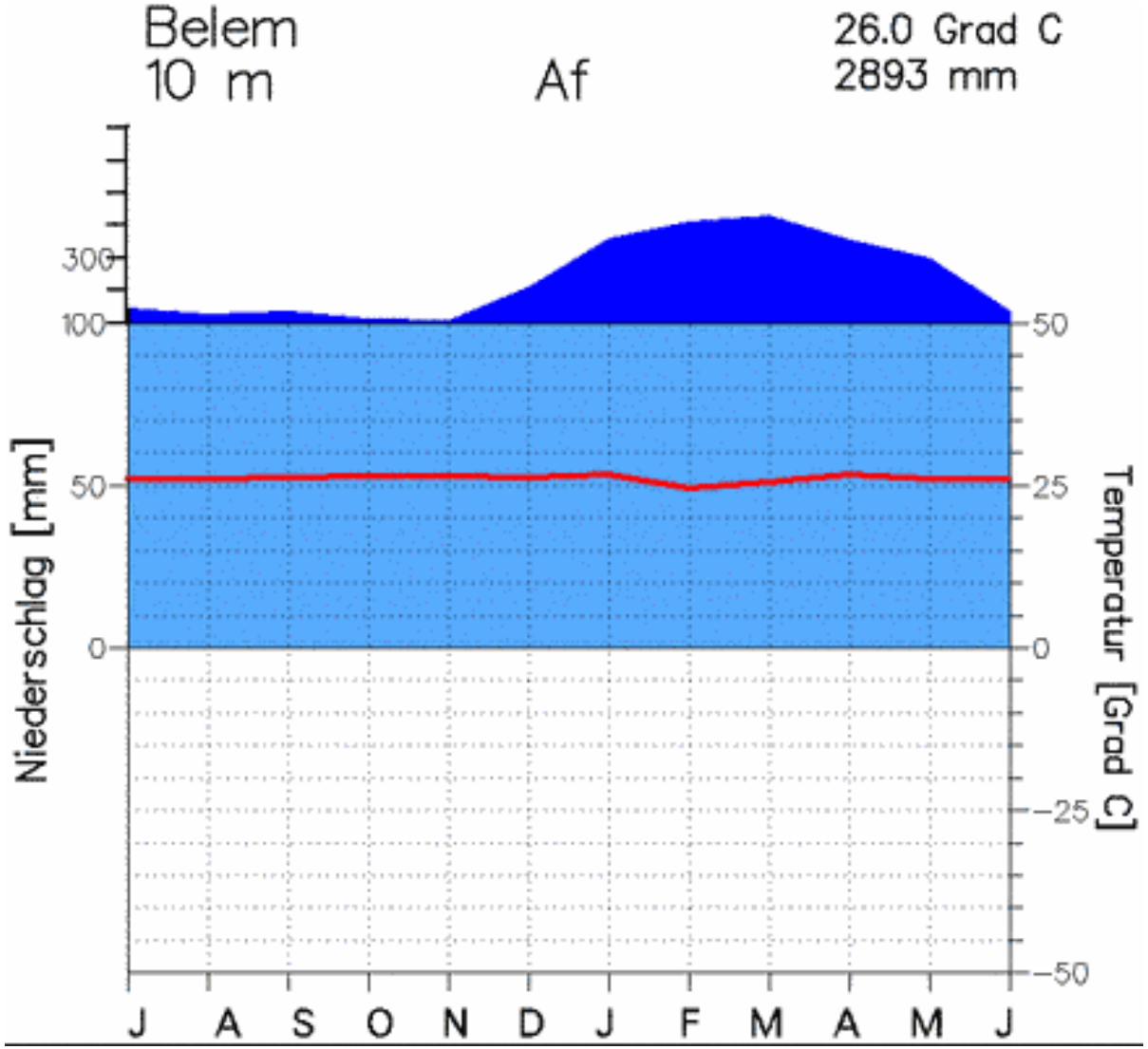
- the zonal biome of the tropical, warm, perhumide climate,
- evergreen plant-tree community, with dominant **tree layer, multi structured, multistoried,**
- tropical rainforest re-cycles the nutrients very effectively – opening of these cycles by disturbance results in the degradation,
- **amount of biomass is huge**, the primary production is very intense,
- **the vulnerability by human impacts is very high** too,
- **forestry**, based on good knowledge, **represents the only sustainable use of the lands**,
- **the agroforestry** is the most modern option, the role of trees is vital.

Main occurence + - 10 degrees North and South from Equator (exceptions). Equatorial Africa, Central and South America, SE Asia, NE Australia.

Climate

Average year temperature 25 – 28 degrees centigrade, without visible year amplitude, with day amplitude not exceeding 11 – 15 degrees. These conditions change profoundly after deforestation and direct insolation.

Precipitations exceed 2 – 3 m, often more then 10 m, not distinct seasonality. Seasonality (more rain and more dry season) increases with distance from equator.

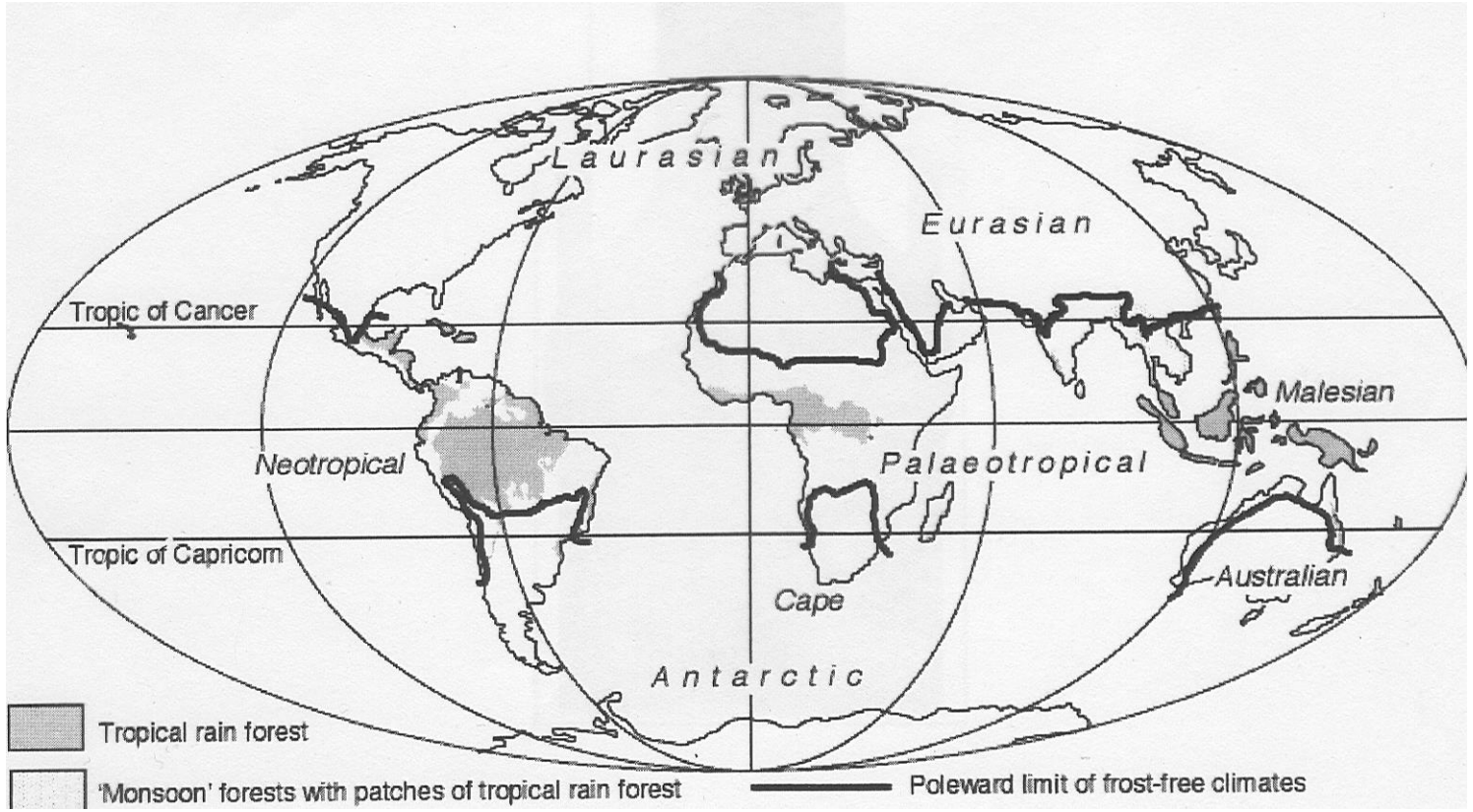


Source:

www.klimadiagramme.de

Equatorial climate

Main areas of the TRF´s distribution and frost-free climate



Soils and their fertility

- long time, not interruption in pedogenesis and **intense chemical weathering** due to excess of water and high temperatures,

- **deep weathering**, big chemical change - **Oxisols** and **Ultisols** originate, several tens of m deep very often,

- **kaolinization** (secondary clay), **feralitisation**, the mineral soil matter – kaolinit, oxides and hydroxides of iron and aluminum rest only,

- **the nutrient content is very low** due to intense weathering and leaching by excess of rain water,

- **the nutrients are** very often **the limiting factor of production**, (water is in excess, temperature is optimal),

- **the fertility of soils is conditioned by intense nutrient cycling**, so by intense bio-geochemical and biochemical cycling of nutrients,

- **the plant litter plays an important role in the nutrient cycling**, the thin humus litter and its conservation is of vital importance for nutrient cycling and forest survival,
- **deforestation and humus mineralisation** and/or erosion means the deep **degradation of soils,**
- t**he tree-based ecosystem is** the only one, **able to conserve effectively the vegetation cover** and maintain the sustainable ecosystems,
- **agriculture is almost excluded there**, or results in total ecosystem degradation – it is not sustainable,
- only **the shifting cultivation (slash-and-burn) practiced by aboriginals/local population can be conducted**, movement of settlements is necessary.

Classification of TRFs

Internationally unified, standard classification – in terms of the Czech forest typology does not exist; sampling of forest vegetation (relevés) and syntaxonomic classification in terms of European plant sociology is next to impossible

Gross biome classification with regard to altitudinal zonation :

- **Tropical lowland rain forest** (= zonobiome)
- **Tropical montane forest** (= orobiome above 1000m a.s.l.)
- **Tropical mist forest** (= orobiome at 2000 to 3000 m)
- **Alluvial tropical rain forest** (pedobiome in flood plains),
- **Tropical swamp forest** (pedobiome adapted to waterlogged soils)
- **Tropical peat forest** (pedobiome in acid, nutrient poor and peaty waterlogged soils)

Terminology referring to biomes situated between the TRF and semiarid region (after Jeník)

TRF

↓

Tropical Seasonal/monsoon Forest

↓

Tropical dry forest

↓

Savanna woodland

↓

Tree savanna, shrub savanna

↓

Grass savanna, tall/short grass savanna

↓

semidesert

Degradation by clear-cut and humus erosion –
Sarawak, Borneo, Malaysia


The soils contain almost only the oxides and hydroxides of Fe and Al, from the clay mineral, only kaolinite. Despite this, fast growing tree species grow very well there (*Pinus caribea*, var.*hondurensis)*

Trees are the dominant vegetation in the tropical rainforest

Trees are the only sustainable vegetation of these conditions

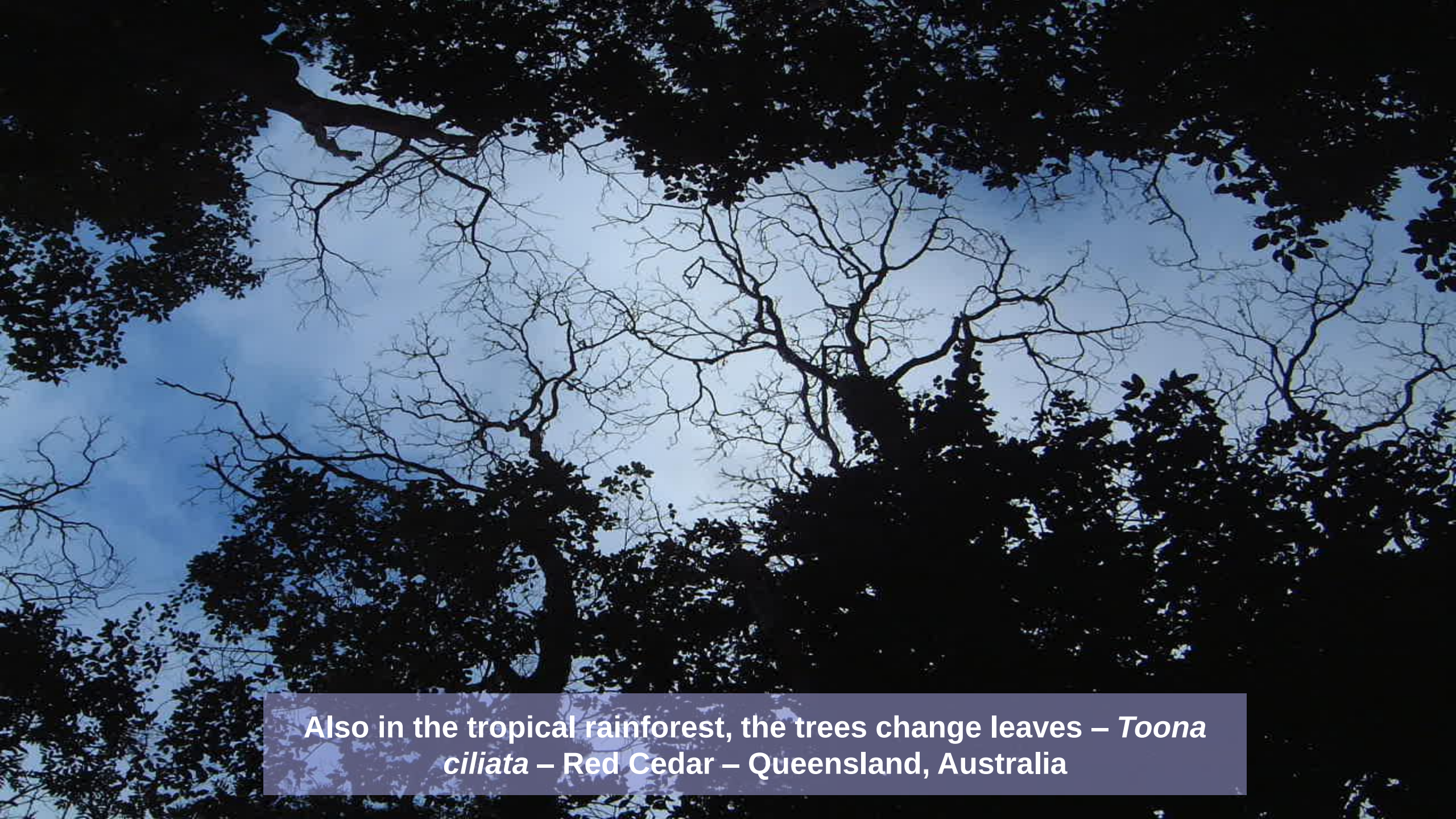
- The **forest structure is very complicated** – 5 – 6 storeys.
- T**he biodiversity is extreme** for all plant as well as animal societies, it was registered the occurence of **400 tree species/ 1 ha area!**
- The **main tree level reaches 30 – 40 m**, the dominant trees up to 60 m.
- The **root systems are adapted** to increase static stability of trees.
- **The leaves of trees are changed continuously** – the whole forest remains evergreen.

The complicated structure of the tropical rainforest


The biodiversity is enormous – almost each tree
belongs to another species – with connected animals

The biodiversity increases along rivers and streams – Danum river, Sabah, Borneo


The fertile soil layer is usually very shallow, including the humus layer only

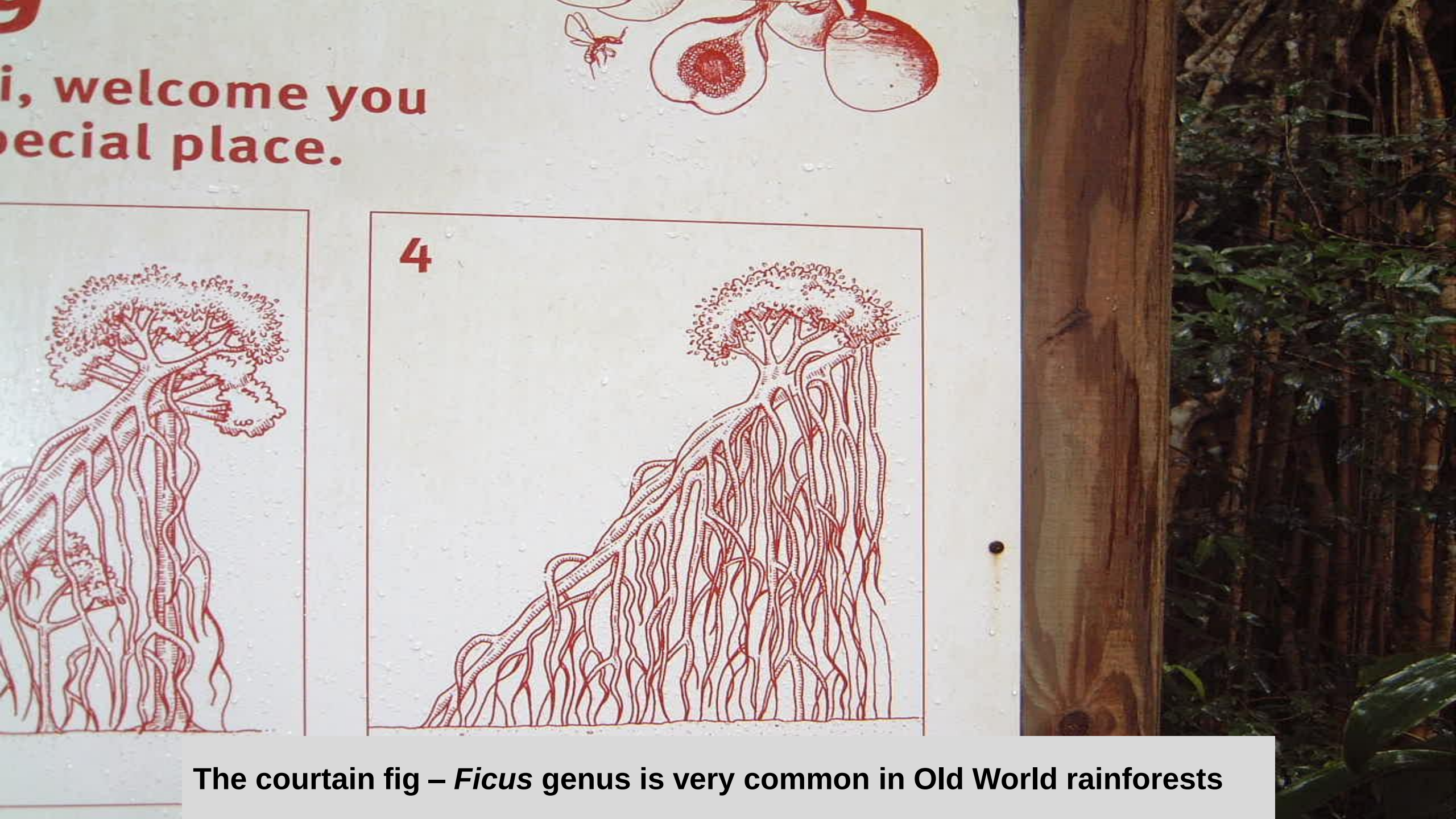


Also in the tropical rainforest, the trees change leaves – *Toona ciliata* – Red Cedar – Queensland, Australia

The roots are superficial, following the nutrient rich layers

Lianas and wines are important part of the crown layer, using different strategies, how to reach the access to sun

Large Kauri pine – *Agathis sp.* – the remembering on Gondwana



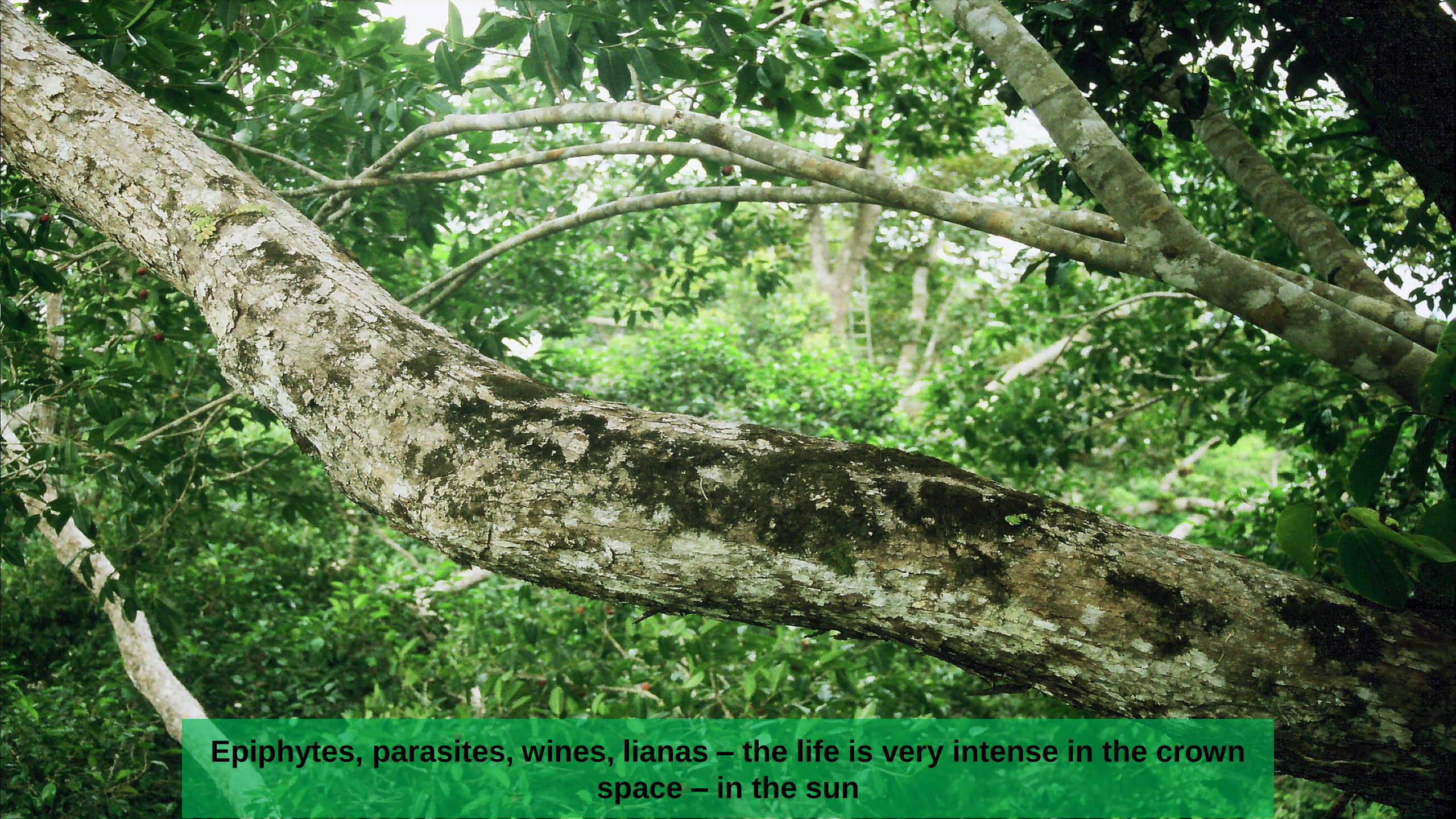
The courtain fig – *Ficus* genus is very common in Old World rainforests

Ficus benjamina – common species of our houses

Root buttresses – the static stabilization of trees because of shallow root-zone

Two years after cyclone – gaps everywhere, wines cover the trees – the natural disturbance helps to forest regeneration

Botanical garden in Brisbane – huge Bunya pine – *Araucaria bidwillii*



Epiphytes, parasites, wines, lianas – the life is very intense in the crown space – in the sun


The forest seems to be infinite – but this is not true

Tropical rainforest is one of the most endangered ecosystems

Almost exterminated Teak (*Tectona grandis*)

- Example from Thailand
- Non-controlled cut of Teak lead to its extermination
- Not Teak forests more in Thailand
- Only plantations, sometimes on commercial basis
- Big research connected with Teak breeding and wood industry
- Restoration of renewable forest resources

The importance of tropical rainforest is crucial for the balance of the planet

They represent:

a) the huge stabilizer of the climate of the whole planet, also due ton the carbon dioxide fixation,

b) the potential gene source of utile plants ad animals – food, technical crops, medical plants,

c) the evolutionary laboratory due to long-term stability.

Tropical rain forest – source of knowledge, benefit, life