

# GRASSLANDS AND DRY FORESTS

# Grasslands: What are they?

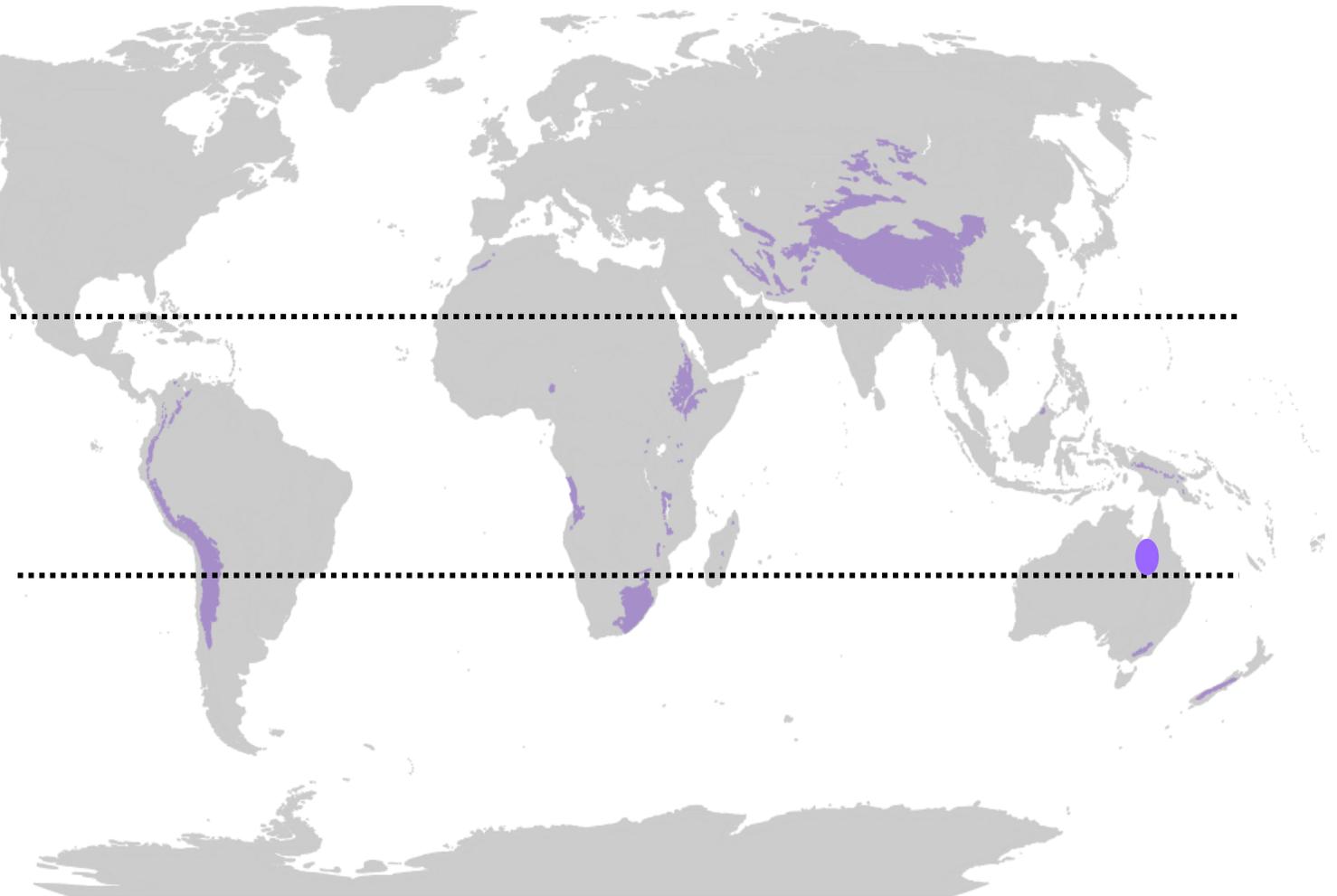
- Ecosystems in which **graminaceous** (grass-like) species dominate the vegetation, dominated by **perennial** sp.
- **Less than 5-10% of aerial cover** by woody plants
- Occurs in areas where the **soil moisture** becomes insufficient to support **higher plant strata**, or the **altitude** is too high (winds)
- It is **difficult** to **distinguish** between **grasslands** and **open savannas** but is of little ecological significance
- Often, highly use for **cattle raising**, especially in low altitude grasslands



# Grasslands: Where are they located?

## Montane grasslands

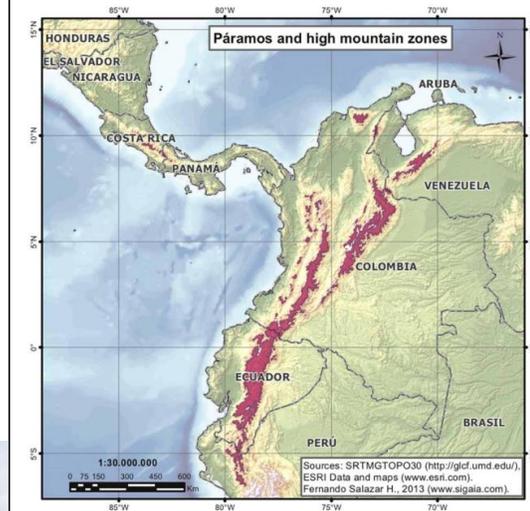
- **Montane grassland** in subtropical and tropical regions, **evolved as virtual islands**, separated from other montane regions by warmer, lower elevation regions.
- Are home to **many distinctive and endemic plants** which evolved in response to the **cool, wet** climate and abundant **tropical sunlight**.



# Grasslands

### Paramo

- High altitude Neotropical grassland (>3500 m)
- Climate wet and cold with frequently nightly frosts
- High biodiversity (5000 plants sp., including ferns and bromeliads)
- Similar environments are located in Africa (**mount Kilimanjaro**) and in New Guinea



# Grasslands

### Puna

- **Cold alpine grassland** with severe climatic condition (>3500 m)
- It is much more arid than “**paramo**”
- Often is **snow-covered**
- Besides **grasses**, **cacti** are common
- Such Alpine grasslands also occur in African mountains and high elevations in New Guinea



*Puya raimondii*

### The Tropical Andes eco-regions



# Grasslands

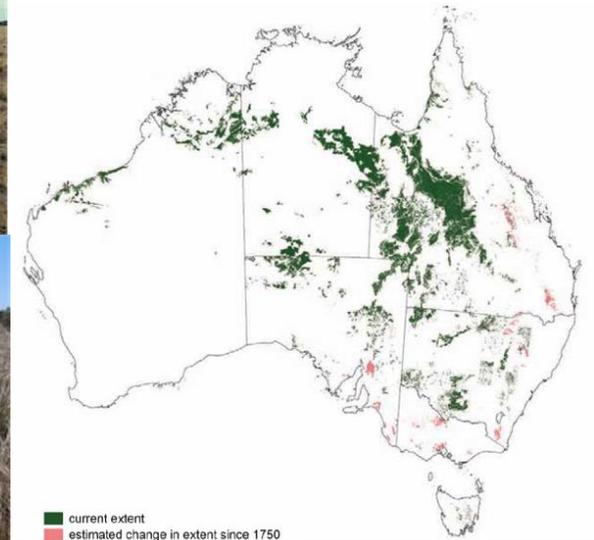
## Puna



# Grasslands

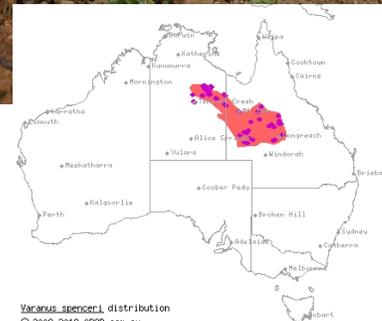
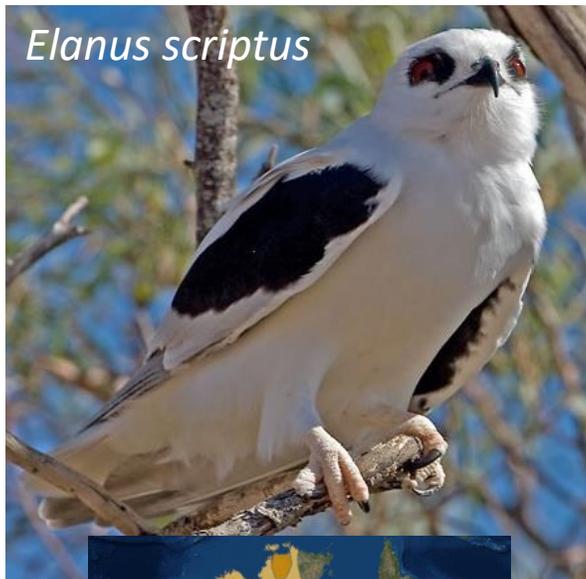
## Tussock grasslands (Australia)

- Typified by **perennial grasses** with a tufted growth habit
- Extensive areas of Tussock Grasslands have been **cleared and replaced by exotic pasture species**.
- Most other areas have been modified by **grazing, weed invasion** and **land management practices** associated with **grazing** domestic stock (e.g. frequent fire and the application of fertilisers).
- Native grasslands from the *Dichanthium sericeum* (blue grass) and *Astrebla* spp. (Mitchell grass)



# Grasslands

## Tussock grasslands (Australia)



*Varanus spenceri* distribution  
© 2008-2018 ARDD.com.au  
Red area = estimated range  
Purple dots = from primary literature

# Grasslands

- Many **native grasslands** have been replaced by **exotic pastures**
- What are the consequences?
  - E.g. Exotic pastures had lower dung beetle richness, abundance and biomass than native pastures

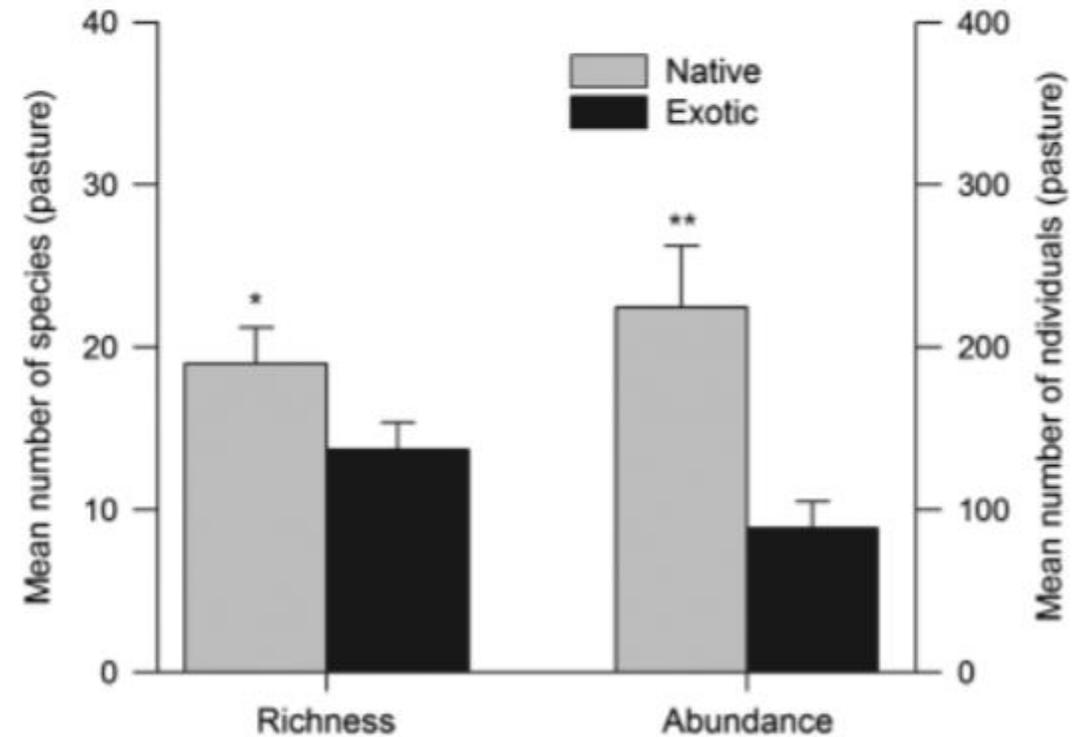
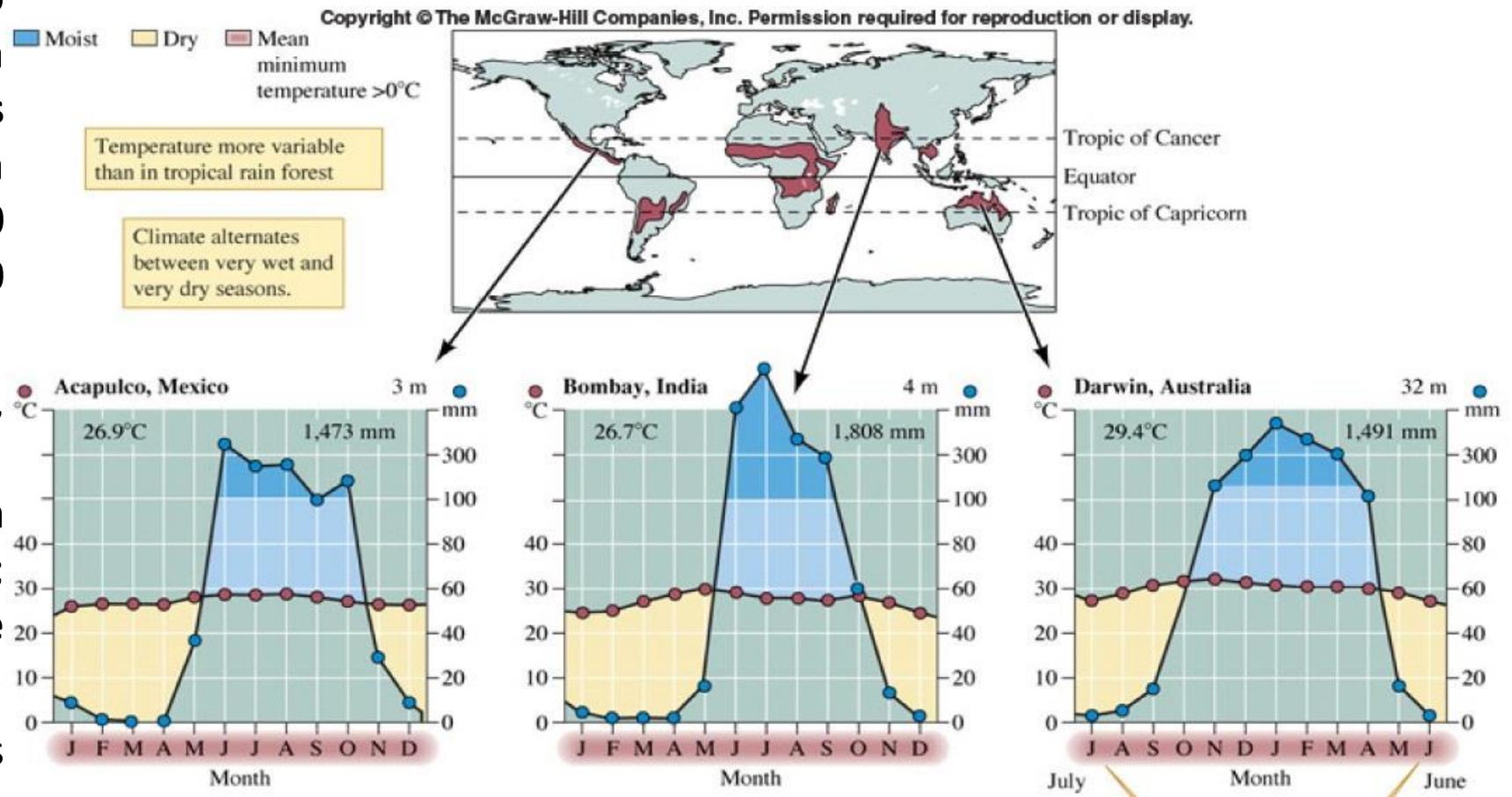


FIGURE 2. Observed mean richness and abundance of dung beetles (per pasture) in native ( $N=14$ ) and exotic ( $N=21$ ) pastures ( $*P < 0.05$ ,  $**P < 0.005$ ) based on Poisson's generalized linear model.

# Dry Forests: What are they?

- Occur in areas with no frost, where the mean annual temperature is  $> 17\text{ }^{\circ}\text{C}$  and the mean annual rainfall  $< 1800\text{ mm}$  (5-6 months  $< 100\text{ mm}$ )
- The duration, frequency/occurrence of the dry season varies with latitude; Short and less severe near the equator
- Closer to the tropics is more severe and can last 6 months



# Dry Forests: What are they?

- Plants within this forest type include **deciduous and evergreen trees** that have specialized water-retention traits such as **stem-succulence** to help tolerate the stress of the prolonged dry season
- **Loss of leaves** by the majority of trees during the long dry season



# Dry Forests: What are they?

Tropical Ecology



# Dry Forests: What are they?

Trait	Forest type	
	Dry <sup>a</sup>	Wet <sup>b</sup>
<u>Structural traits, community level</u>		
Number of tree species <sup>c</sup>	35–90	50–200
Complexity index <sup>d</sup>	5–45	180–405
Canopy height, <i>m</i>	10–40	20–84
Number of canopy strata	1–3	3 or more
Leaf area index <sup>e</sup> , $m^2/m^2$	3–7	5–8
Ground vegetation cover <sup>e</sup>	low-high	<10 %
Basal area of trees <sup>f</sup> , $m^2/ha$	17–40	20–75
<u>Plant biomass, t/ha</u>		
Stems and branches	28–266	209–1163
Leaves	2–7	7–10
Roots	10–45	11–135
Total	78–320	269–1186
Root biomass as % of total	8–50	<5–33

## Dry vs rainforests

- Lower tree diversity than in rain forests
- Lower tree height
- Lower tree basal area
- Lower plant biomass
- Higher proportion of root biomass

# Dry Forests: Where are they located?

- It is estimated that about 1 million km<sup>2</sup> remains today with about half of that in South America

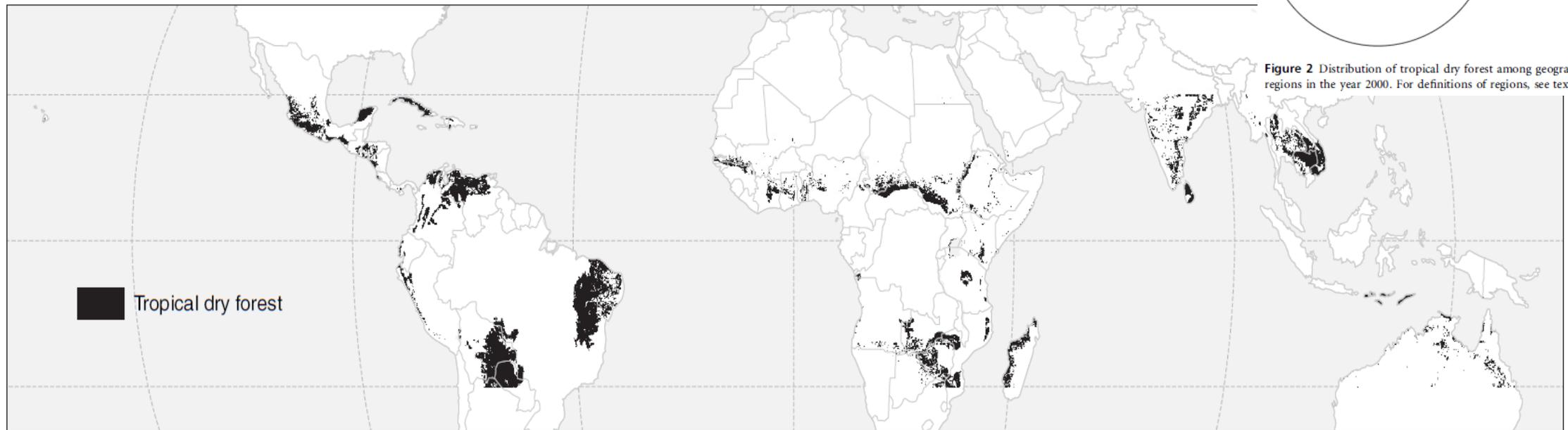
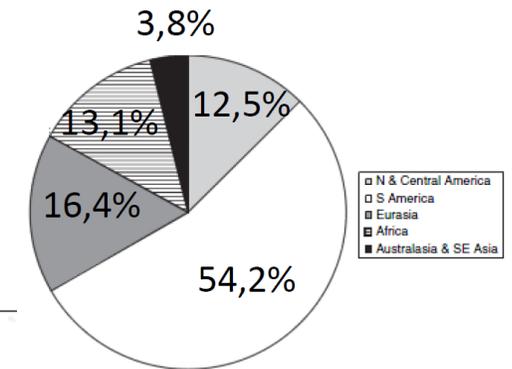


Figure 2 Distribution of tropical dry forest among geographical regions in the year 2000. For definitions of regions, see text.

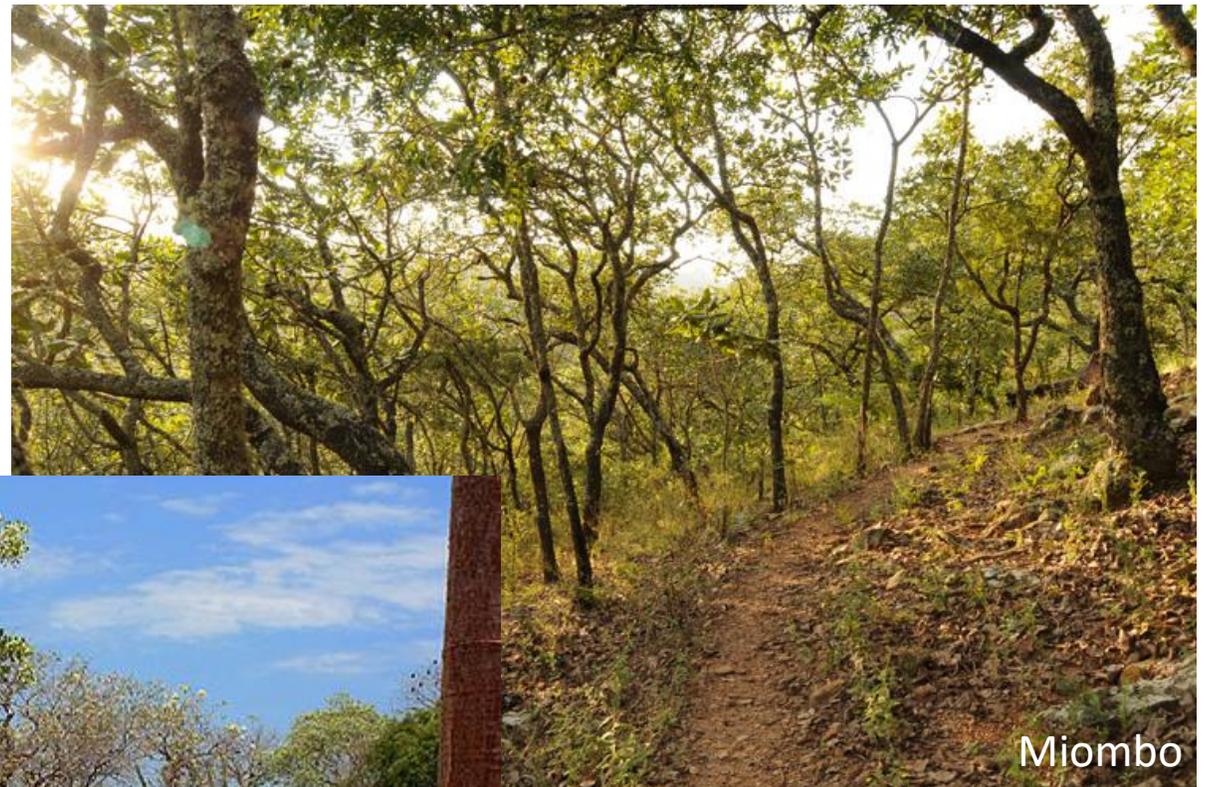
Figure 1 Global distribution of tropical dry forest in the year 2000, displayed as 10-km cells containing this forest type (including plantations in tropical dry forest areas). Based on biogeographic realms from Olson *et al.* (2001) masked with MODIS 500-m resolution forest cover data set (Hansen *et al.*, 2003), with forest canopy cover > 40%. For details, see text. Robinson projection.

# Dry Forests: Where are they located?

Tropical Ecology



Caatinga



Miombo

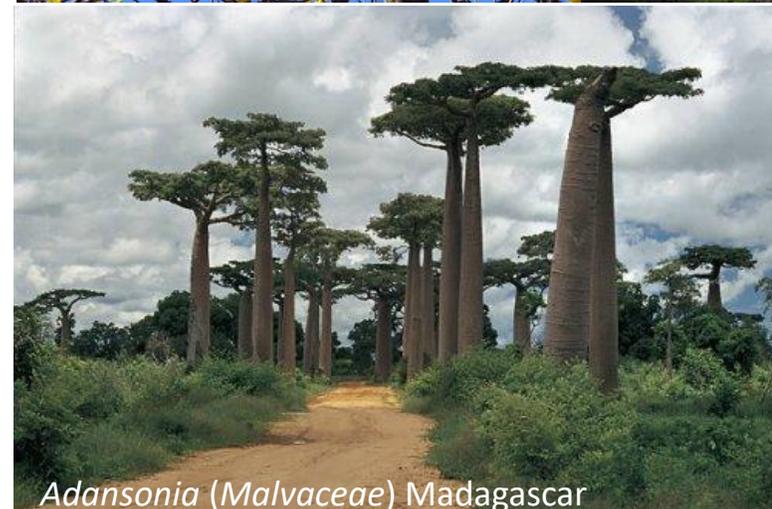


Madagascar

# Dry Forests

## Plants

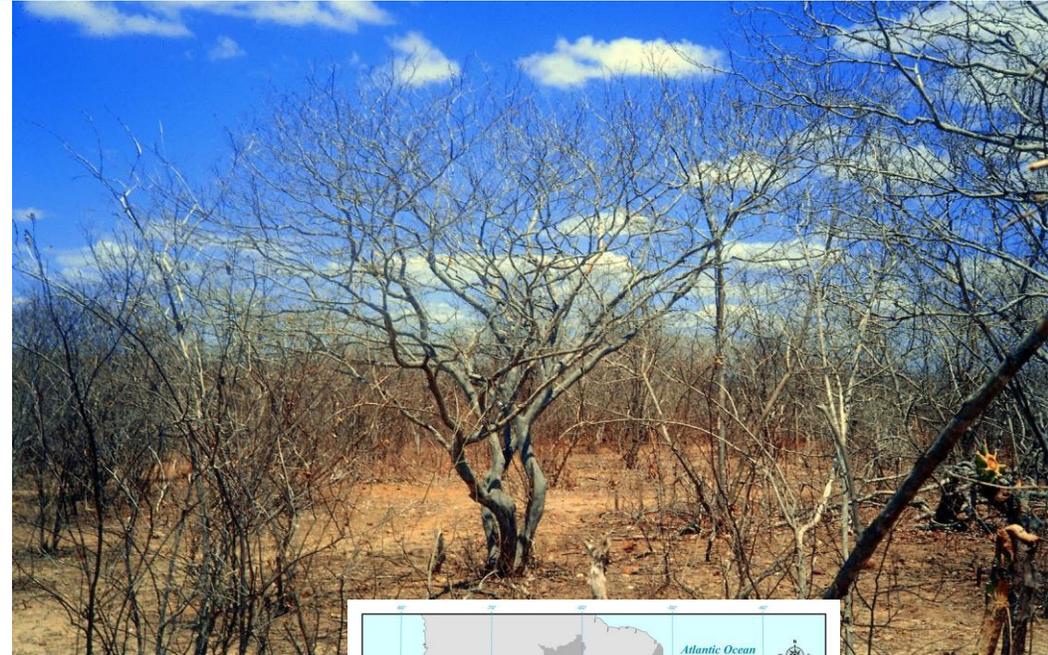
- **High  $\beta$  diversity** between different dry forest, which increases with distance
- ***Leguminosae*** is the plant family with higher number of sp
- **Low** development of the **herbaceous strata**
- Often **flowering occurs at the end of the dry season - trees without leaves**
- **Trees** developed **anti-herbivory strategies** (Thorns)
- Some Trees with capacity to **store water in logs**
- **Epiphytes** and **lianas** are rare



# Dry Forests

## CAATINGA

- **Very arid climate**, with annual precipitation ranging from **300 to 800 mm**
- Typical forest of the Brazilian “Sertão”
- Composed of **deciduous vegetation**, with many **cacti** dominating xerophytic plants.
- **3 strata**: Trees (<12 meters), shrubs (<5 meters) and herbaceous extract (<2 meters)
- Present in salinized soil, with **small plants**, with **deep roots**

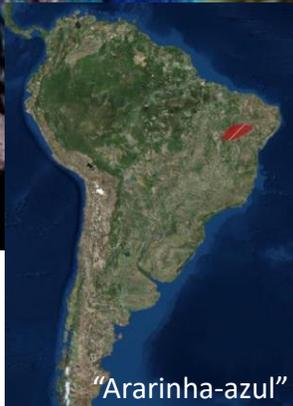


# Dry Forests

## Tropical Ecology

### CAATINGA

- Low wildlife density and few endemic species



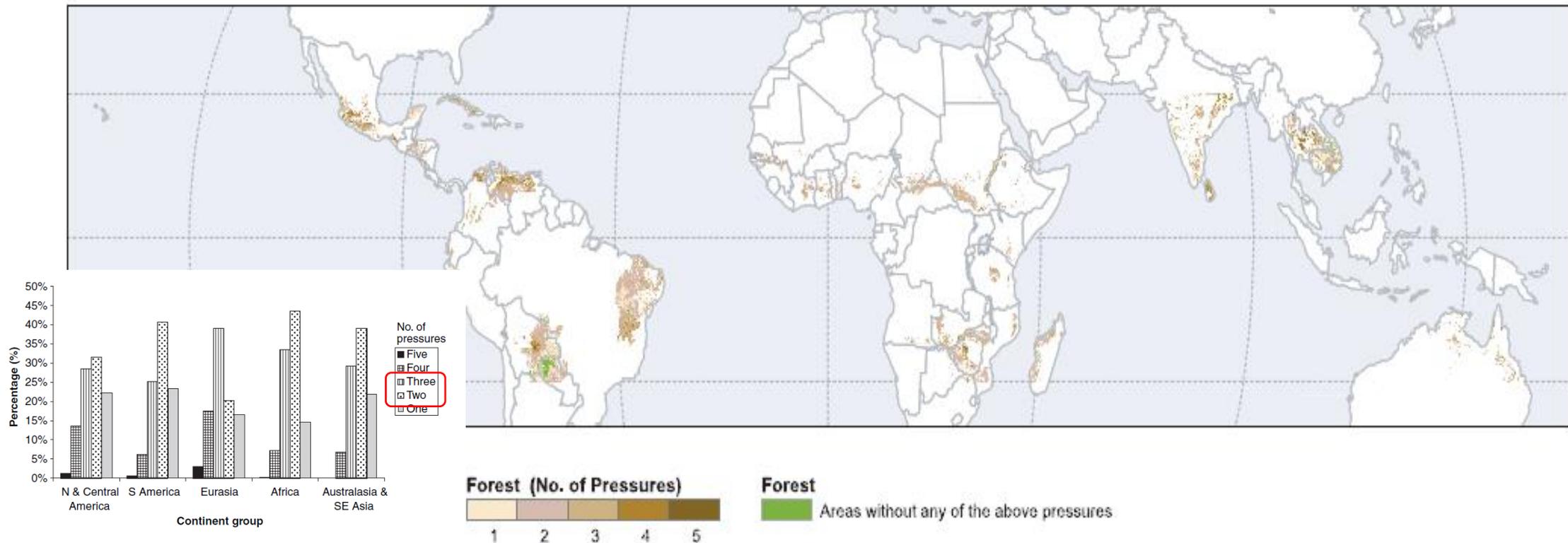
# Dry Forests

## CAATINGA



# Dry Forests

- Considered one of the **most threatened tropical Biome** (95% of its areas is menaces by at least 2 types of threats)



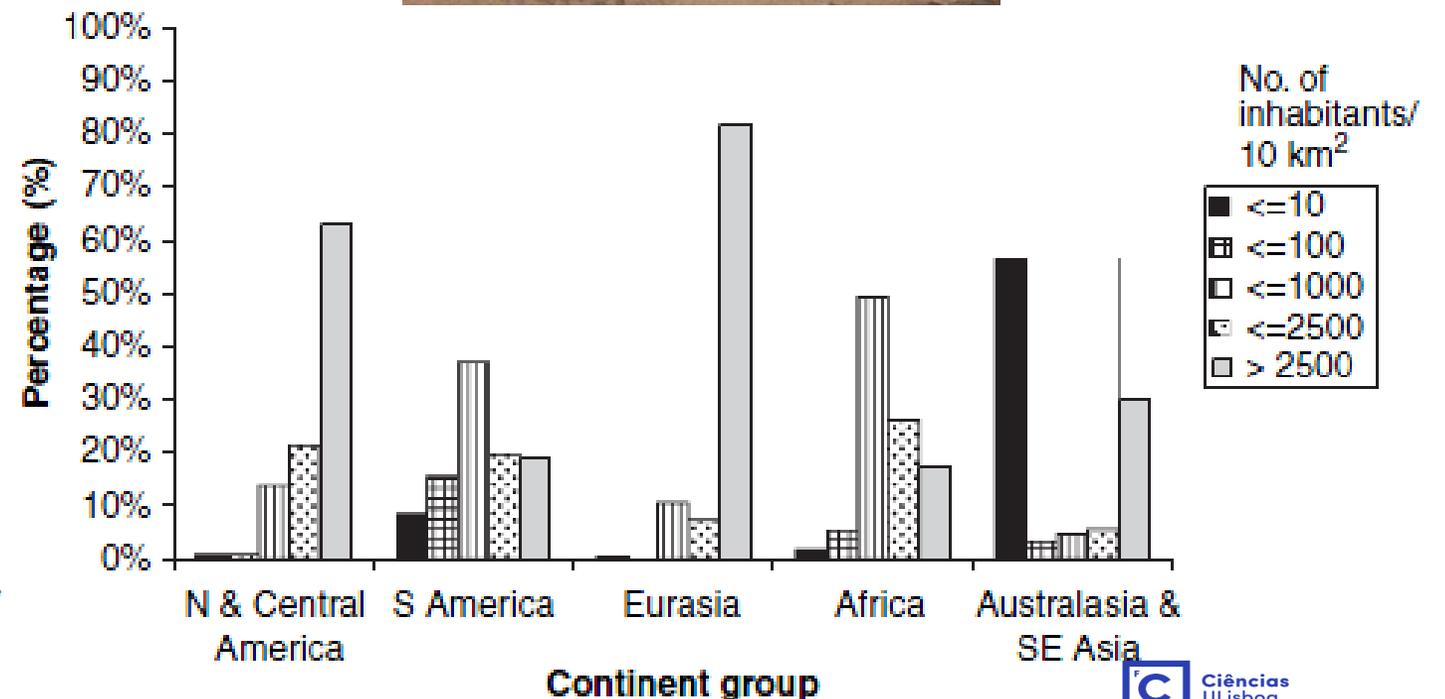
**Figure 10** Global distribution of tropical dry forest illustrating the spatial variation in exposure to different threats, including future climate change. For details of methods of calculation, including dates, see text. Robinson projection.

# Dry Forests

## Dry forests threats

- Human population
  - The scale varies between continents: high in the **neotropics** and **Eurasia**; lower in Australia and SE Asia
  - Only 17.4% of African Dry Forests coincide with areas of high population density

**Figure 8** Estimated human population in 1994 for 10-km cells containing tropical dry forest in 2000. For details of methods of calculation, see text.



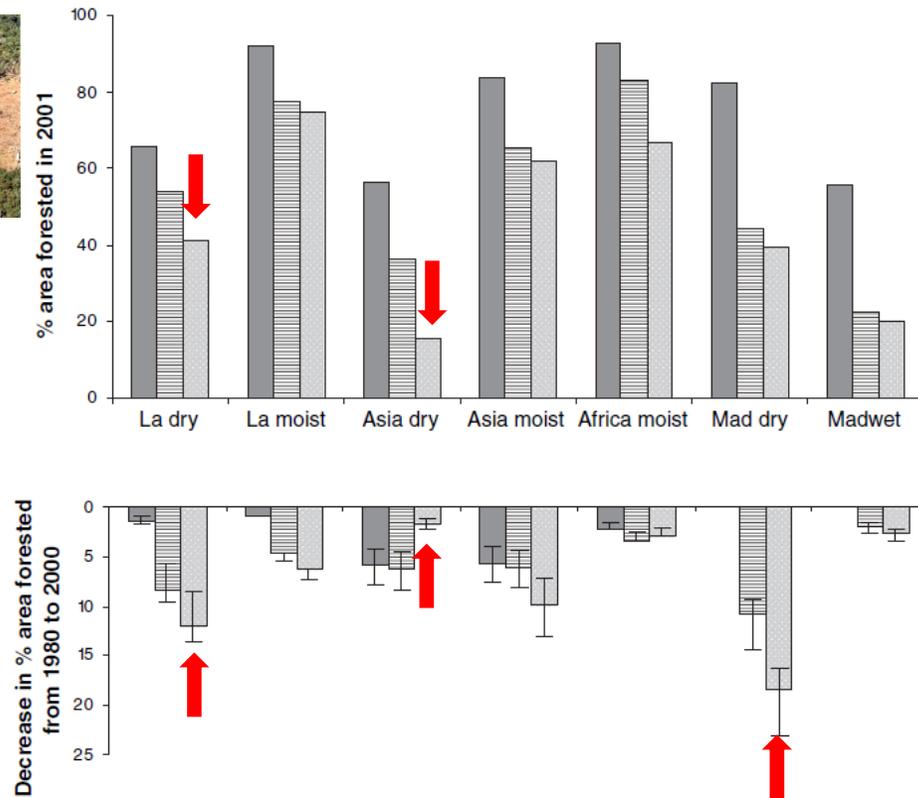
# Dry Forests

## Dry forests threats



- Deforestation

- **Percentage of forested area (2001) relative to total area of habitat, varies from c. 16% (South and Southeast Asia) to more than 40% (Latin America)**
- **Dry forests of Latin America had one of the greatest decreases between 1980 and 2000 (12%)**
- **For Asia, the decrease was low (2%).**
- **African deforestation rates were low, except in Madagascar (18%)**



**Figure 3** Estimated percentage area forested in the year 2001 relative to total area of forest habitat (top) and estimated decreases in percentage forest area from 1980 to 2000 relative to total area (bottom) within the administrative boundaries of the protected areas (dark grey), within the 50-km buffer surrounding the protected areas (striped) and total area (dotted). Abbreviations, with total habitat area as delineated by Olson *et al.* (2000) in  $10^6$  km<sup>2</sup> given in parentheses, are: LA DRY = Latin American Dry Forests (1.8), LA MOIST = Latin American Moist Forests (9.2), ASIA DRY = South and Southeast Asia Dry Forests (3.7), ASIA MOIST = South and Southeast Asia Moist Forests (6.0), AFRICA MOIST = African Moist Forests (3.3), MAD DRY = Madagascar Dry Forests (0.3), MAD MOIST = Madagascar Moist Forests (0.3) (after DeFries *et al.*, 2004). Error bars represent the range of estimates for decrease in forest cover based on correction

# Dry Forests

## Dry forests threats



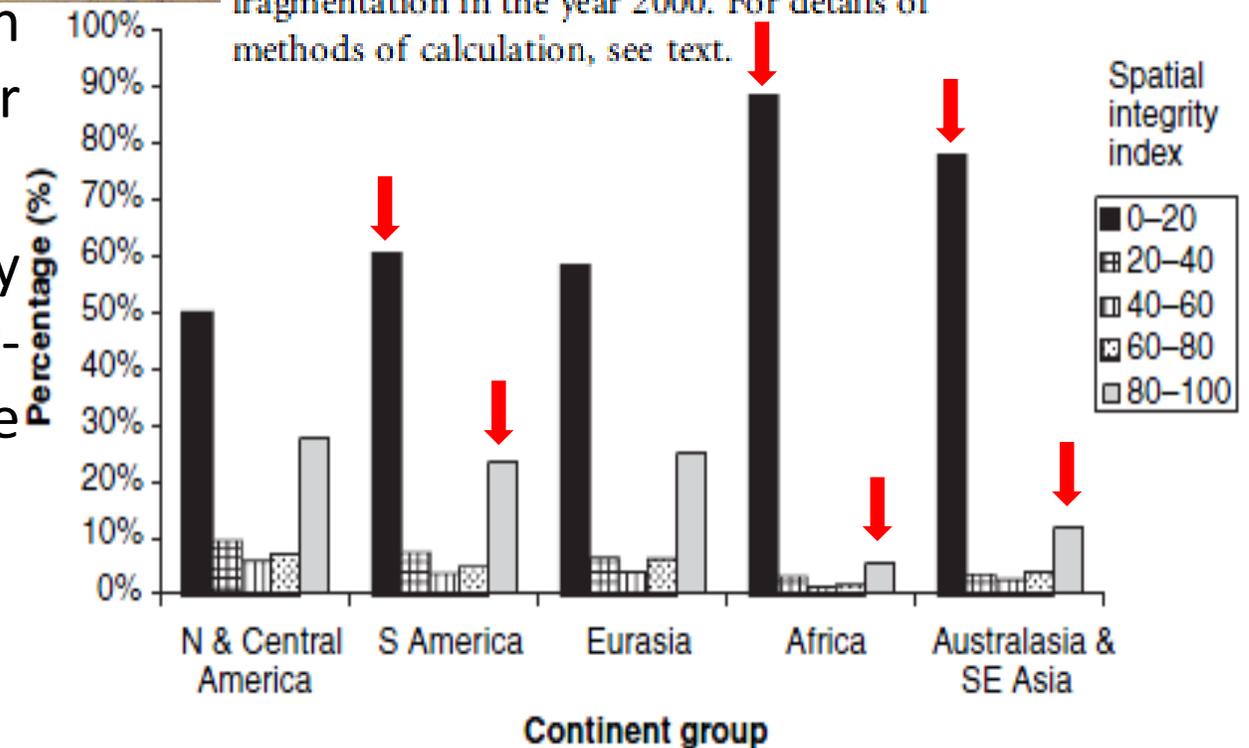
- Forest Fragmentation

- **Tropical dry forest** tend to occur in relatively **intact blocks** of habitat or in **small fragments**

- But, in every region, the most highly fragmented values of the index (0-20; integrity in 10km cells) were the most frequently encountered,

- 49.9% - North and Central America
- 60% - South America
- 88.2% - Africa
- 77.9% - Southeast Asia and Australasia.

**Figure 5** Estimated forest spatial integrity for 10-km cells containing tropical dry forest, providing an indication of the extent of forest fragmentation in the year 2000. For details of methods of calculation, see text.



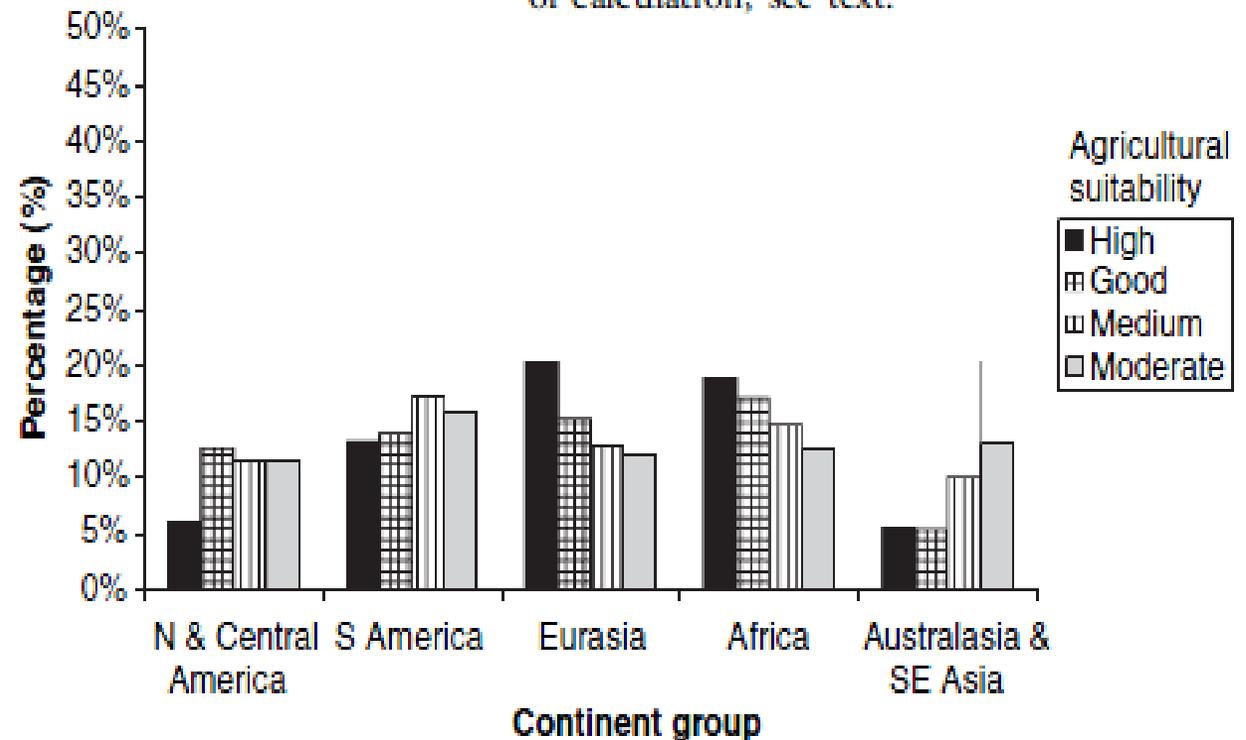
# Dry Forests

## Dry forests threats

- Conversion to agriculture
  - **Forest areas with high suitability for cultivation of rain-fed crops** ranged from 5.5% (Southeast Asia and Australasia) to 20.2% (Eurasia)
  - Overall **suitability for crop cultivation reached 60% for South America, Eurasia and Africa** - **agricultural conversion represents a substantial threat** in these regions



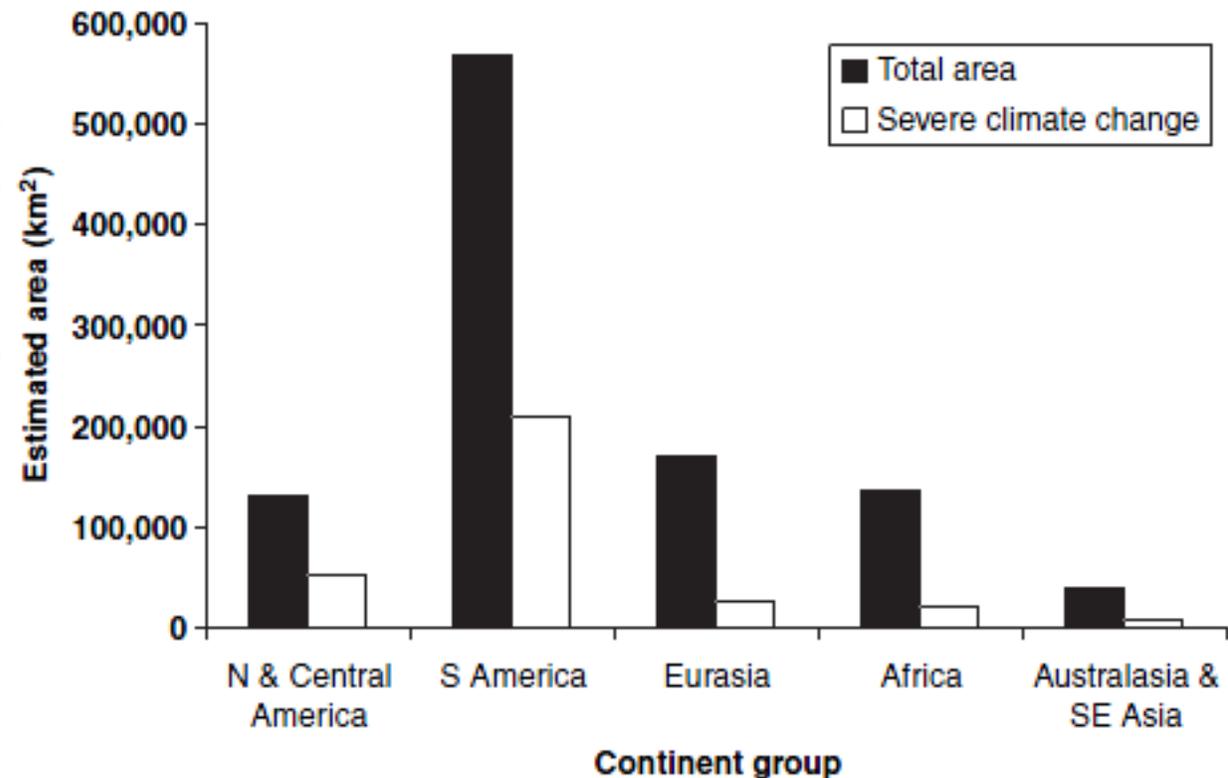
**Figure 7** Estimated percentage of 10-km cells containing tropical dry forest with greater than marginal suitability for rain-fed crops in the year 2000. For details of methods of calculation, see text.



# Dry Forests

## Dry forests threats

- Climate change
  - The proportion of dry forests at **risk due to climate change** is higher in the Americas, with **the Neotropics reaching 37%**, namely due a projected decrease in rainfall

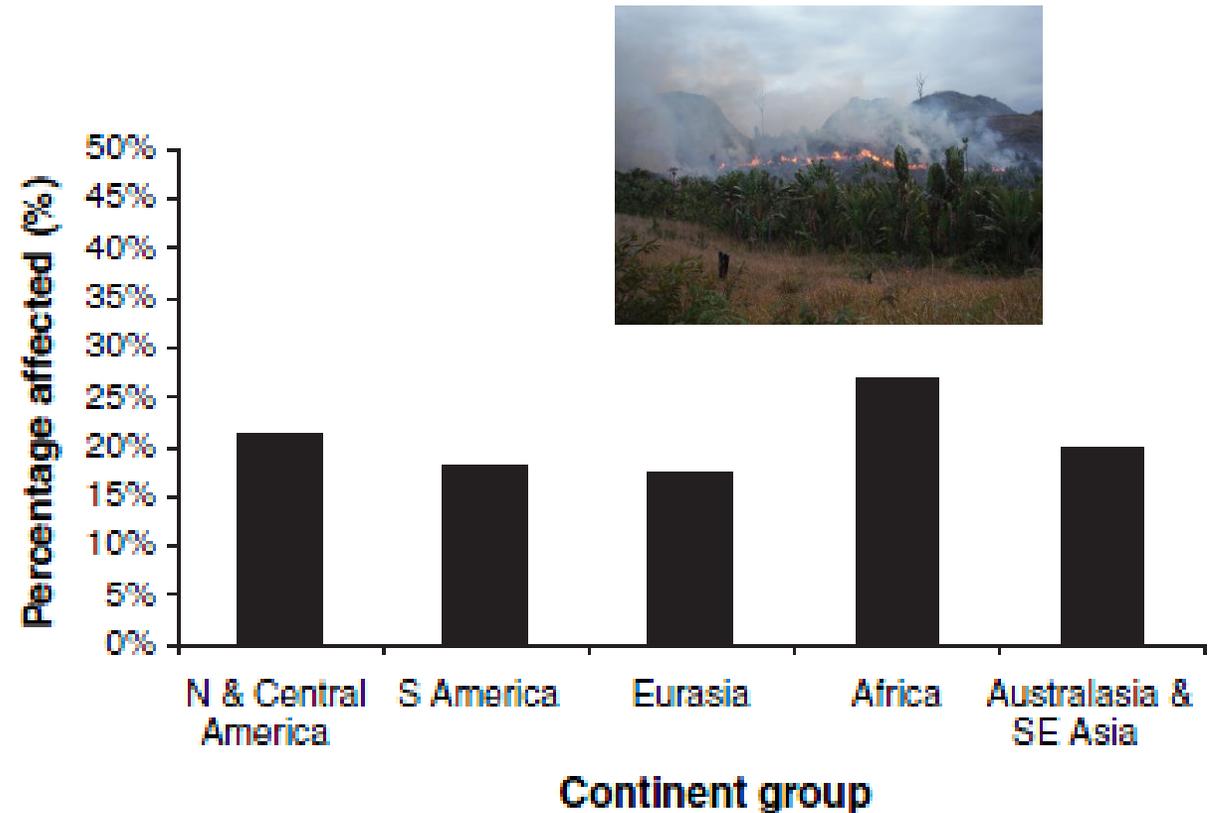


**Figure 4** Estimated distribution of tropical dry forest at risk of serious climate change (2040–69). For details of methods of calculation, see text.

# Dry Forests

## Dry forests threats

- Fires
  - Fire is a natural event, but the increase in fire frequency affects dry forests regeneration
  - The % of dry forests area affected is similar worldwide
  - Forest areas affected by fire ranged between **17.4% (Eurasia)** to **26.9% (Africa)**

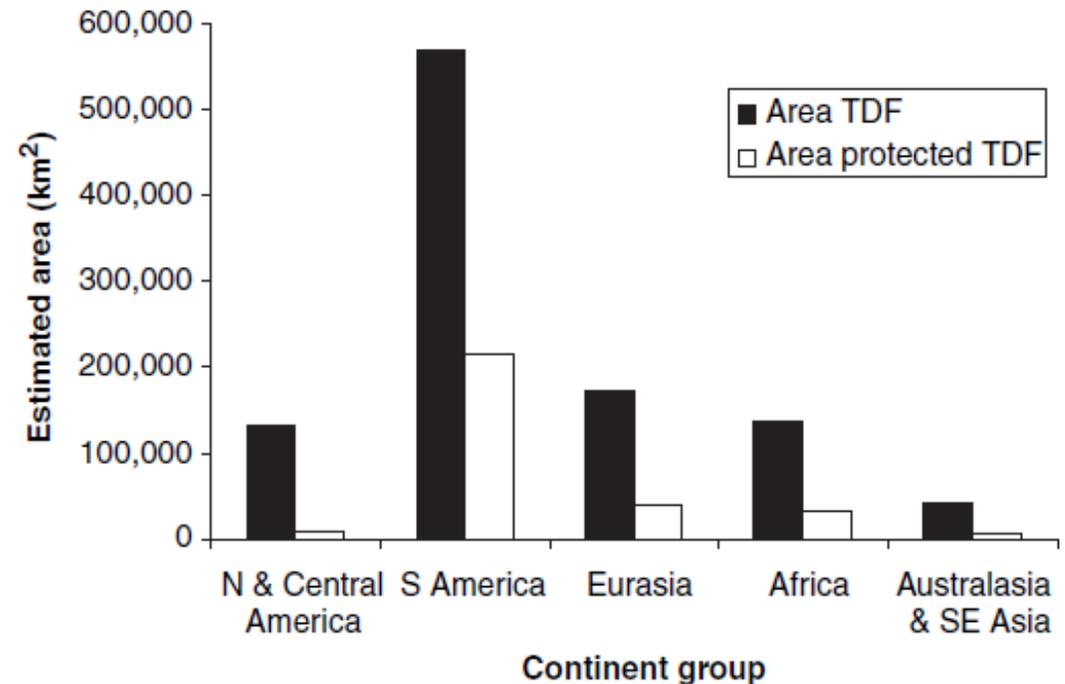


**Figure 6** Estimated percentage of 10-km cells containing tropical dry forest to have experienced fire, 1998–2000. For details of methods of calculation, see text.

# Dry Forests

## Dry forests Protection

- Protected areas
  - % of dry forest that is protected range between **5.7% for North and Central America**, to **37.8% for South America**
  - In **Southeast Asia** protected areas represent only **14.2%**
  - Globally, 299,100 km<sup>2</sup> (28,5%) are now designated as protected (**71.8% of this total being located within South America**).



**Figure 11** Estimated designated protected area (2002) coinciding with tropical dry forest (2000), compared to total tropical dry forest. For details of methods of calculation, see text.

Miles et al. (2006). Journal of Biogeography 33: 491-505

# Bibliography

## Tropical Ecology

- Almeida, S., Louzada, J., Sperber, C., Barlow, J. (2011). Subtle land-use change and tropical biodiversity: Dung beetle communities in Cerrado grasslands and exotic pastures. *Biotropica*, 43(6): 704–710.
- Miles, L., Newton, A.C., Defries, R.S., Ravilious, C., May, I., Blyth, S., Kapos, V., Gordon, J.E. (2006). A global overview of the conservation status of tropical dry forests. *Journal of Biogeography* 33: 491-505.