

The role of Forests in Global Ecology



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

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- Forest - climate interaction and global climatic changes
- Forests in global carbon cycle
- Sustainability and global biodiversity conservation and wood supply
- Other ecological and societal aspects of forests protection in the world

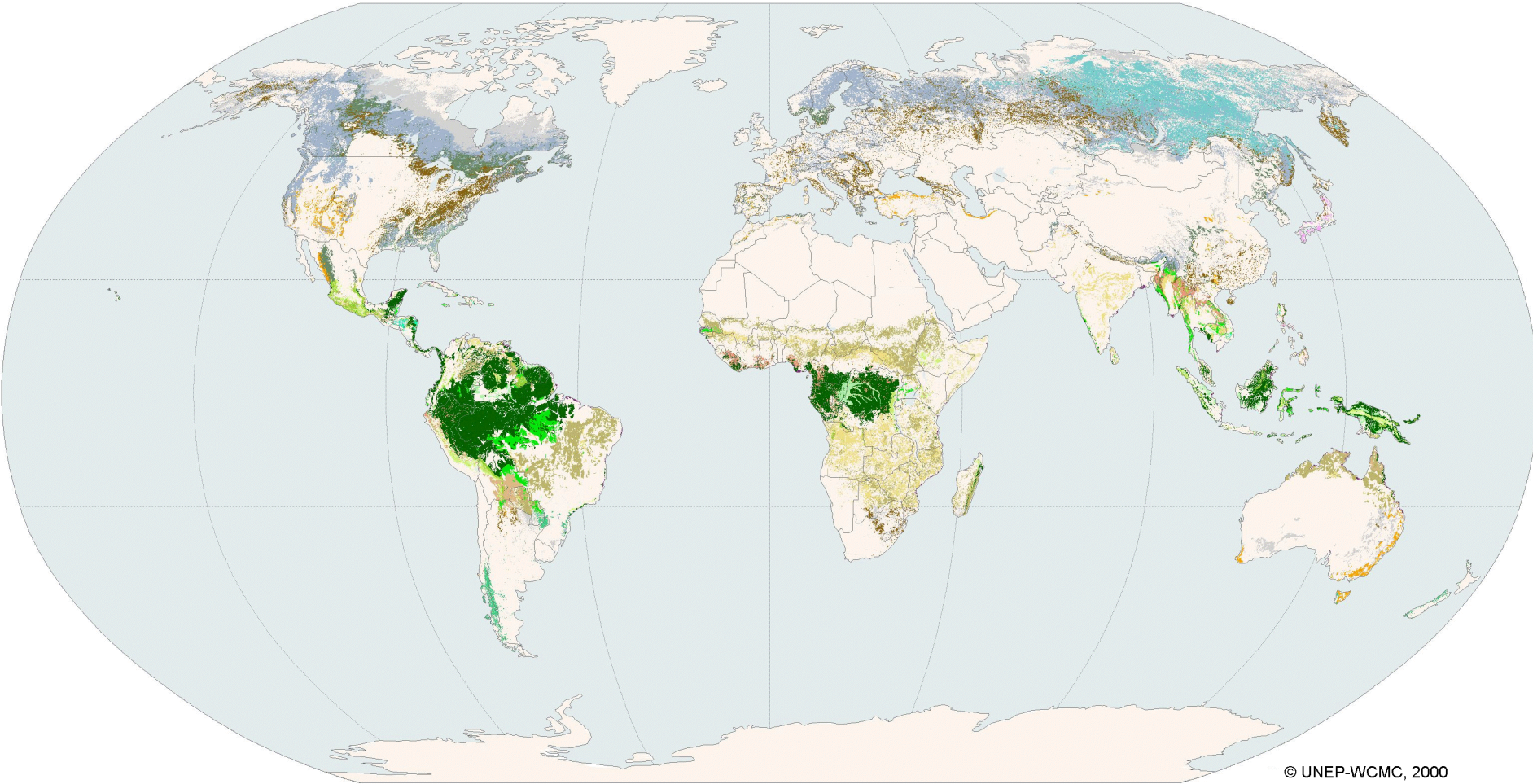
Forest definition

- (FAO 1998) - forest is a land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach *in situ* these thresholds.
- Another 800 forest definitions around the World



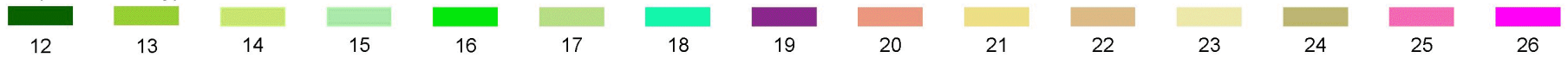
Global forest distribution

Temperate and Boreal Forest Types:



© UNEP-WCMC, 2000

Tropical Forest Types:



Global forest distribution

- **Forests cover 31 percent of total land area**
- The world's total forest area in 2010 is estimated to be just over 4 billion hectares
- The five most forest-rich countries (the Russian Federation, Brazil, Canada, the United States of America and China) account for more than half of the total forest area (53 %)
- 64 countries with a combined population of 2 billion people have forest on no more than 10 percent of their land area.



Rate of deforestation

- shows signs of decreasing, but is still alarmingly high
- mainly the conversion of tropical forest to agricultural land
- around 13 million hectares of forest were converted to other uses or lost through natural causes each year in the last decade
- compared with 16 million hectares per year in the 1990s
- both Brazil and Indonesia, which had the highest net loss of forest in the 1990s, have significantly reduced their rate of loss
- in Australia, severe drought and forest fires have exacerbated the loss of forest since 2000

Afforestation and natural expansion

- in some countries have significantly reduced the net loss of forest area at the global level
- The net change in forest area in the period 2000–2010 is estimated at -5.2 million hectares per year at the global level (an area about the size of Costa Rica).
- This is down from -8.3 million hectares per year in the period 1990–2000.



Forest regeneration

- **More than 90 % of the total forest area consists of naturally regenerated forests**
- Primary forests – are estimated to occupy **36 %** of the total forest area.
- Other naturally regenerated forests – **57 %**
- Planted forests – **7 %**, of the total forest area.

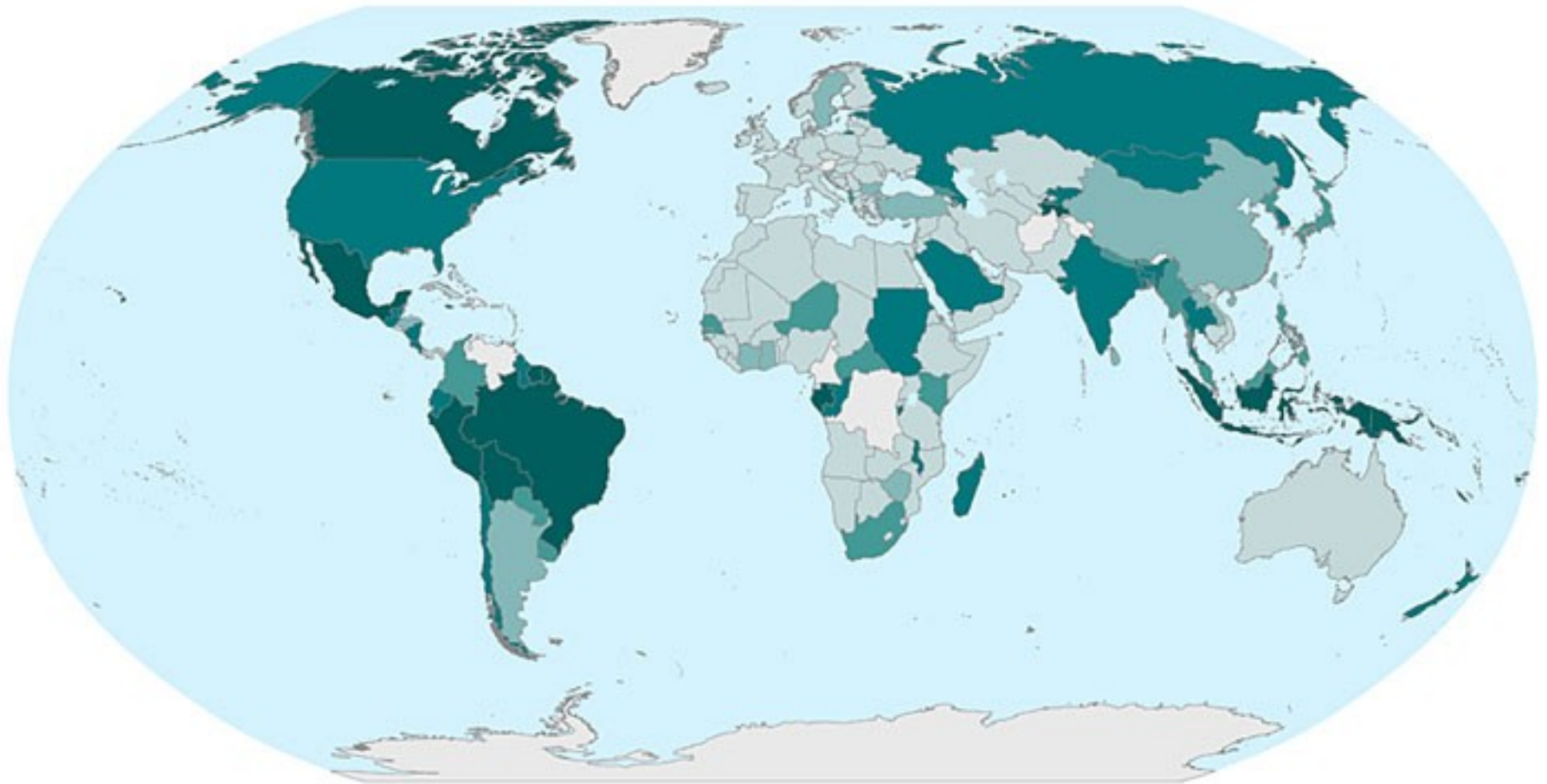


Primary forests

- ***= forest of native species where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed.***
- **Primary forests account for 36 percent of forest area – but have decreased by more than 40 million hectares since 2000.**
- On a global average, more than one-third of all forest is primary forest.
- Primary forests, in particular tropical moist forests, include the most species-rich, diverse terrestrial ecosystems.
- The decrease of primary forest area, 0.4 percent annually over a ten-year period, is largely due to reclassification of primary forest to ‘other naturally regenerated forest’ because of selective logging and other human interventions.

Primary forests II

Primary forest as a percentage of total forest area by country, 2010



(% of forest area)

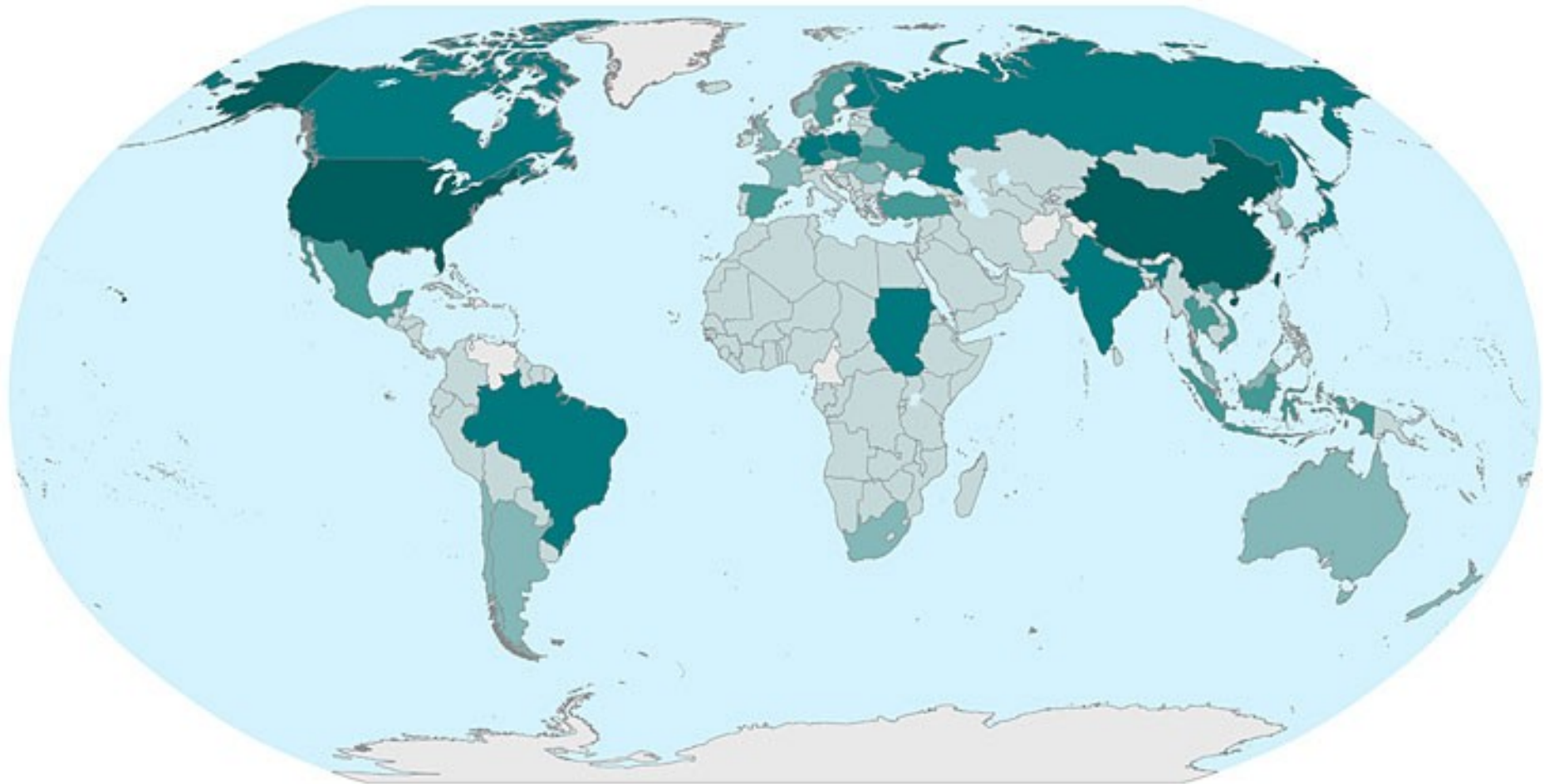


Planted forests

- The area of **planted forest is increasing** and now accounts for **7 percent of total forest area** (or 264 million hectares).
- Between 2000 and 2010, the area of planted forest increased by about 5 million hectares per year.
- Most of this was established through afforestation (i.e. planting of areas not forested in recent times) particularly in China.
- Three-quarters of all planted forests consist of native species while one-quarter comprises introduced species.

Planted forests II

Area of planted forest by country, 2010



(million ha)

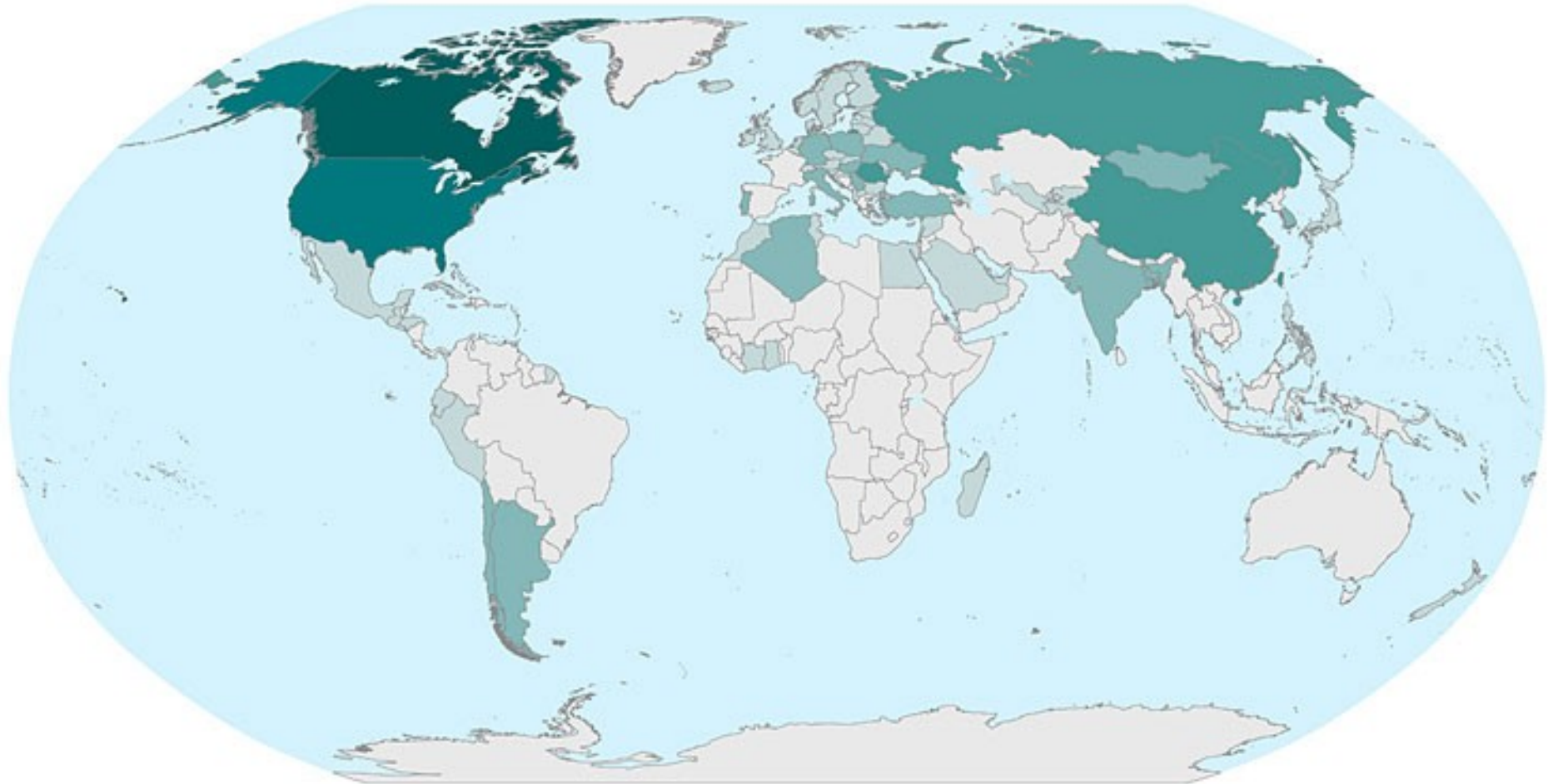


Insect pests and diseases, natural disasters and invasive species

- **Insect pests and diseases, natural disasters and invasive species are causing severe damage in some countries.**
- Outbreaks of forest insect pests damage some 35 million hectares of forest annually, primarily in the temperate and boreal zone.
- The mountain pine beetle has devastated more than 11 million hectares of forest in Canada and the western United States of America since the late 1990s .
- Woody invasive species are of particular concern in small island developing states, where they threaten the habitat of endemic species.

Insect pests

Average area of forest annually affected by insects by country, 2005

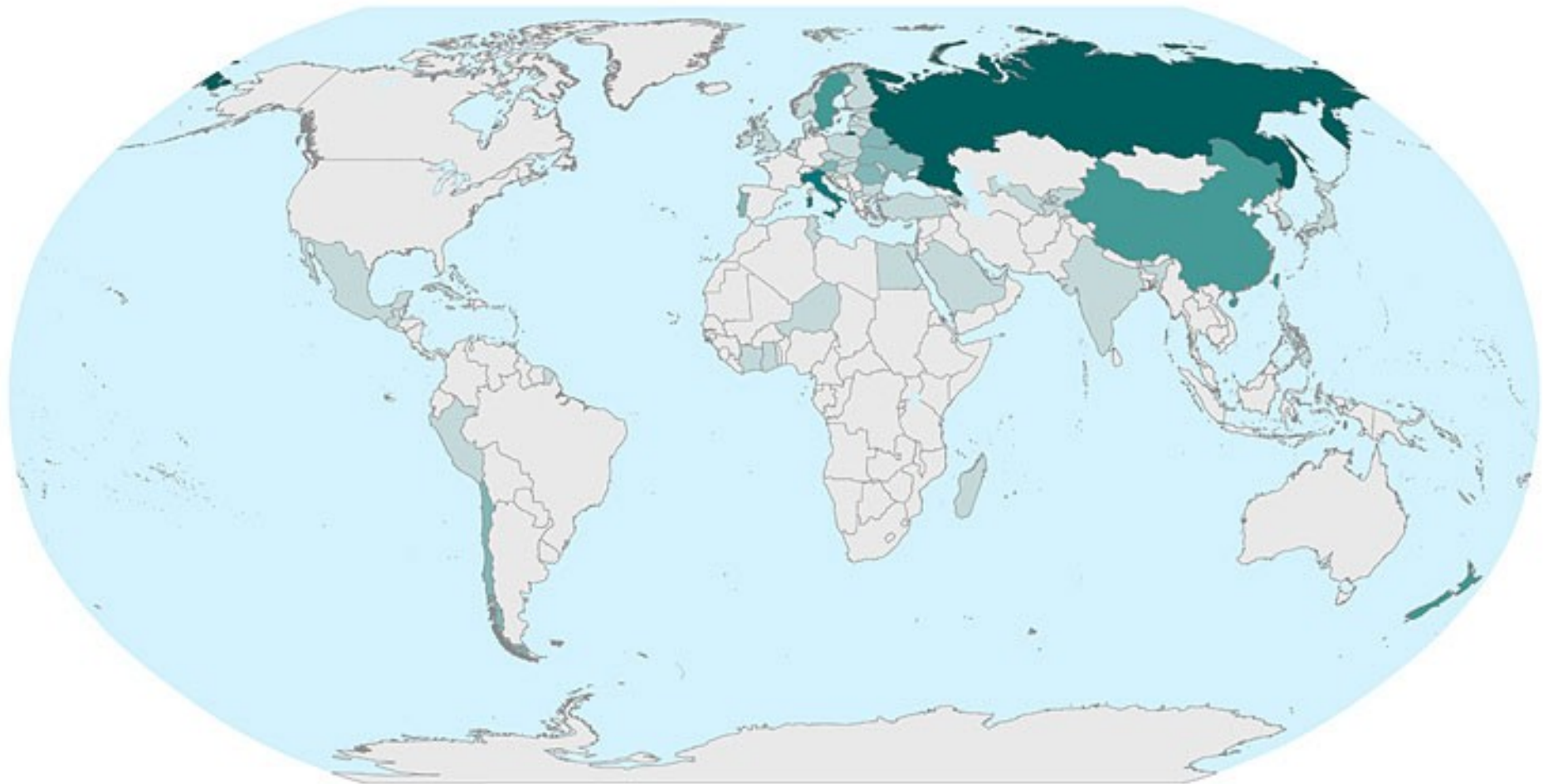


(1000 ha)

 < 100  100 - 1000  1000 - 5000  5000 - 10000  > 10000  No Data

Diseases

Average area of forest annually affected by diseases by country, 2005

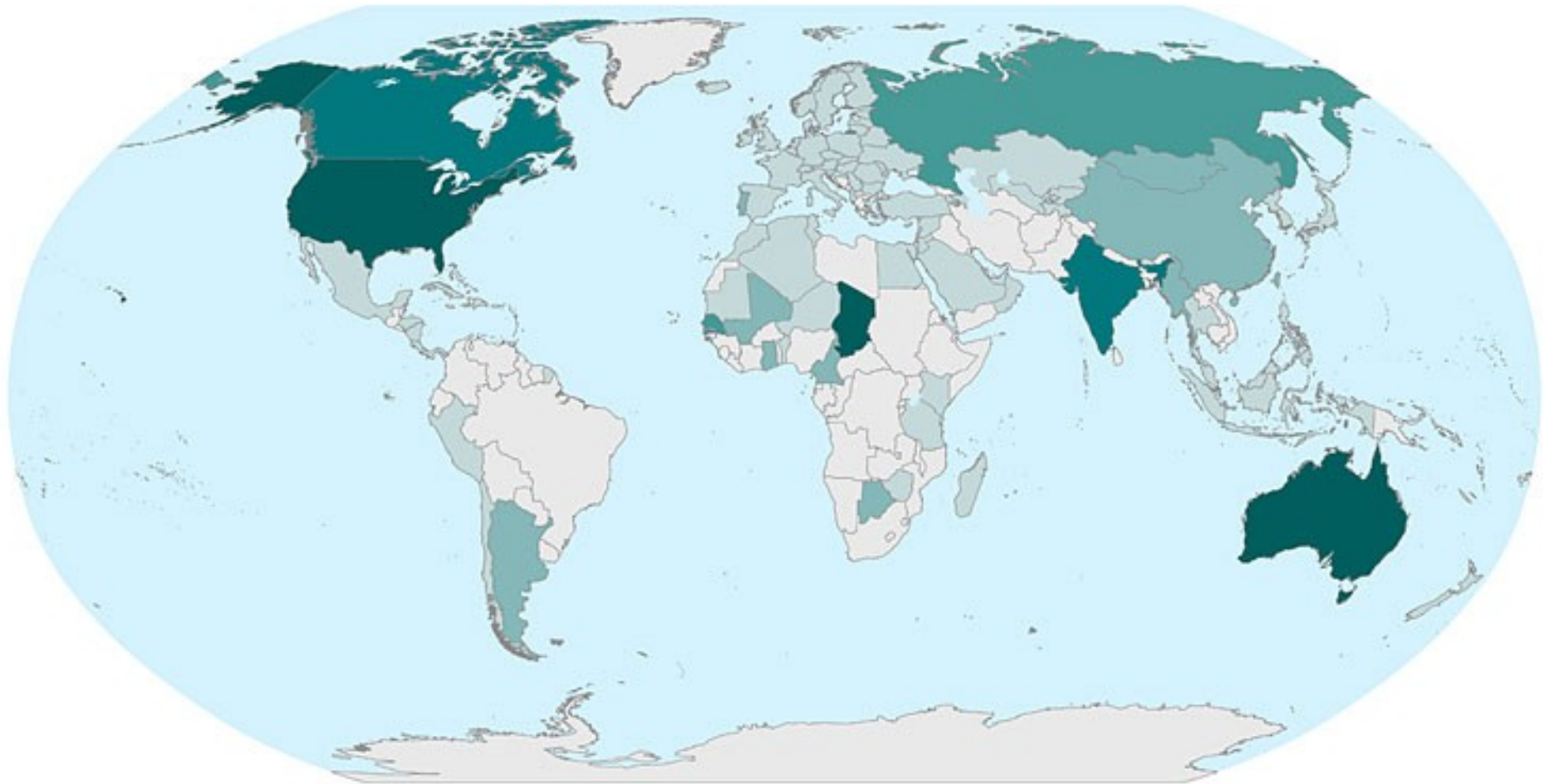


(1000 ha)



Forest fires

Average area of forest annually affected by fire by country, 2005



(1000 ha)

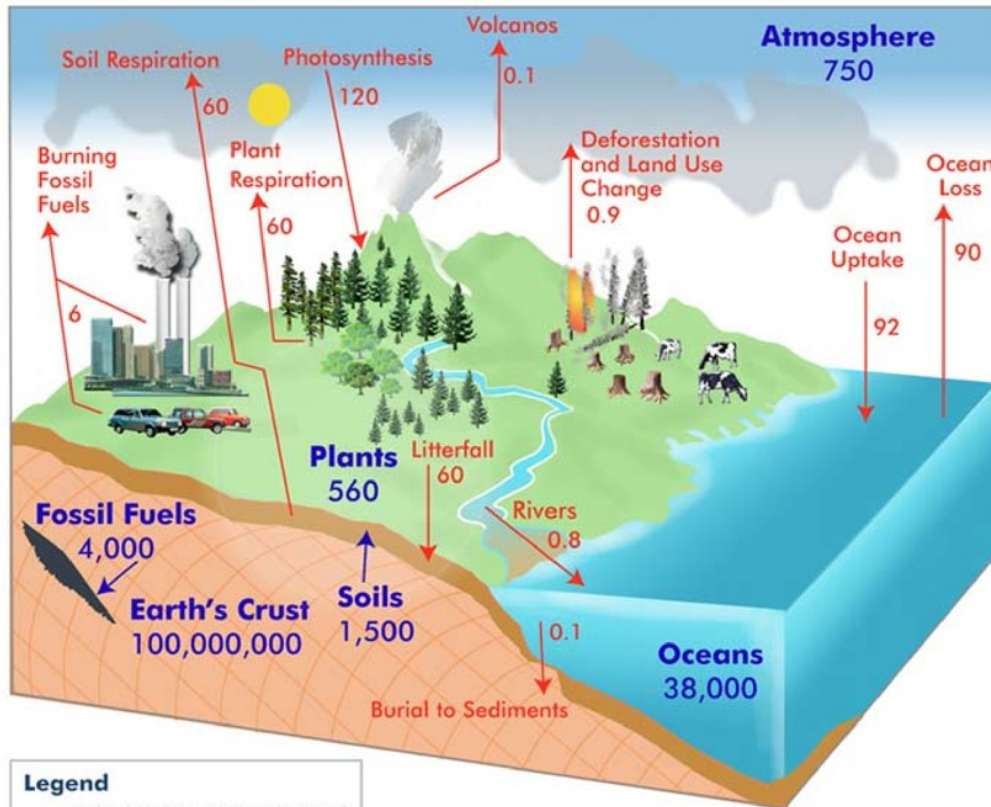


Forests in global carbon cycle and global climatic changes

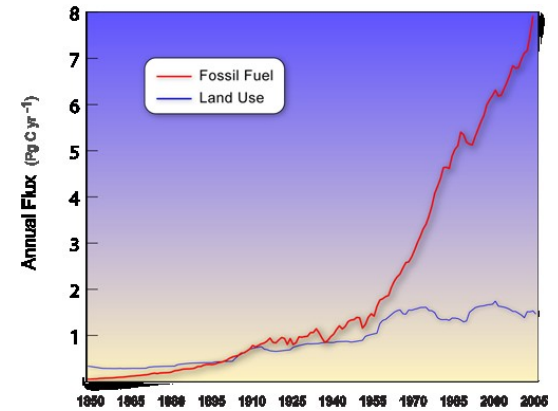
- ***The total carbon stock in dead wood and litter*** in 2010 amounts to 72 billion tonnes or 17.8 tonnes per hectare.
- ***The total stock of carbon in soil*** is estimated at 292 billion tonnes or 72.3 tonnes per hectare.
- Taking together all carbon in biomass, dead wood, litter and soils, the estimated total carbon stock in forests in 2010 is 652 billion tonnes, corresponding to 161.8 tonnes per hectare.
- The total carbon stock in the biomass of the world's forests shows a decrease of about 10 Gt for the period 1990–2010 or -0.5 Gt per year on average, mainly due to a reduction in the world's forest area.

Forests in global carbon cycle

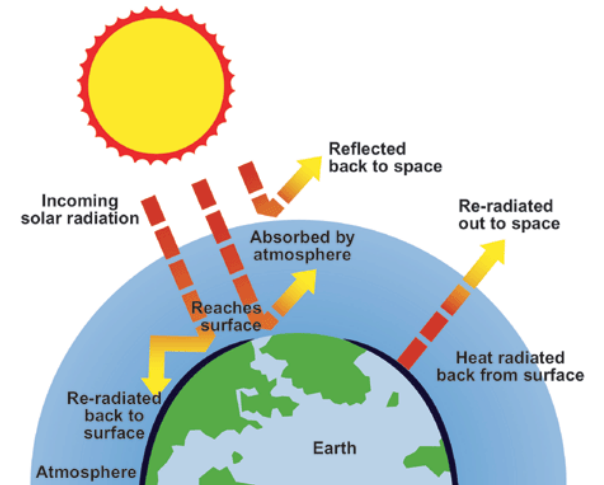
Global Carbon Cycle



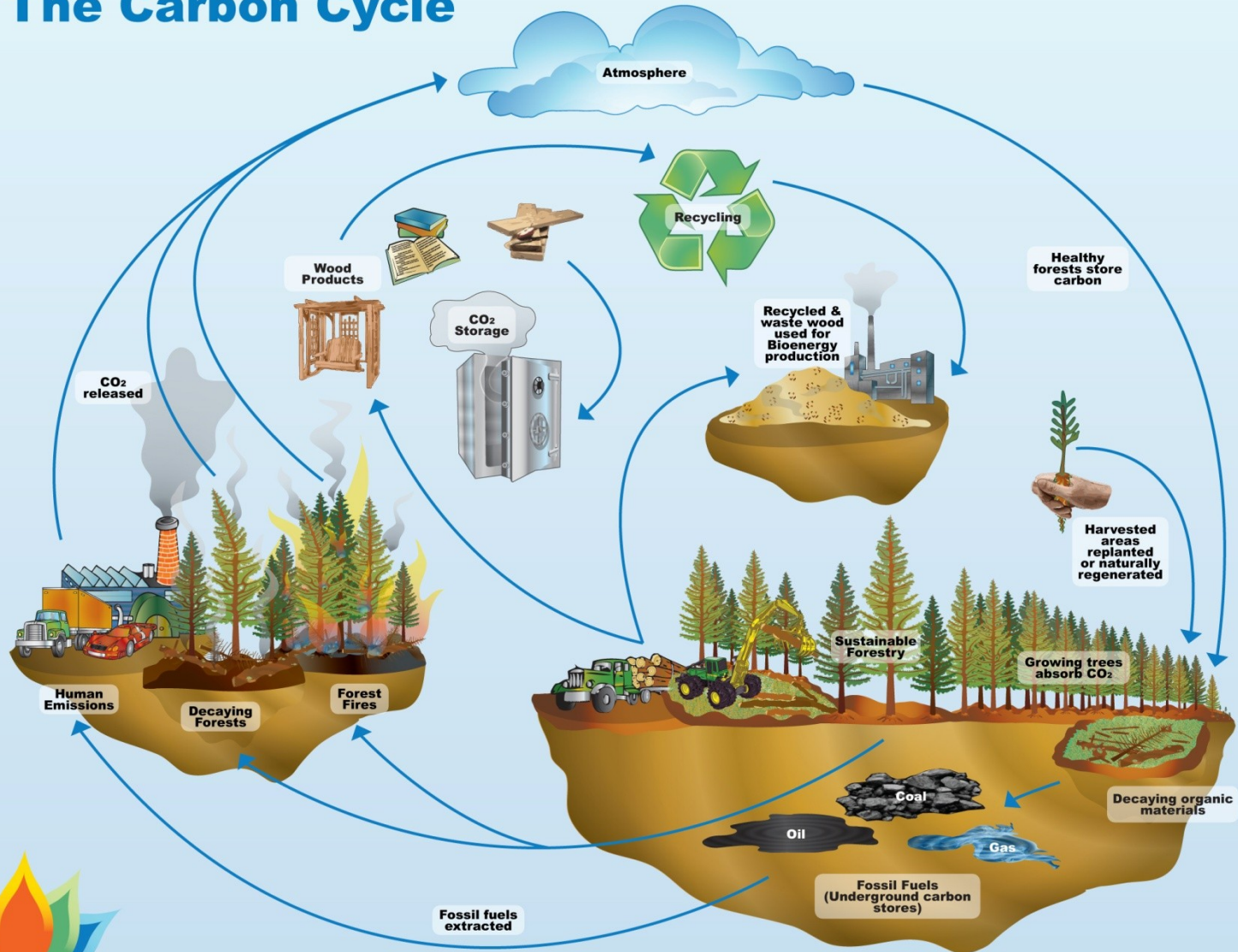
Legend
 Units: Petagrams (Pg) = 10^{15} gC
 • Pools: Pg
 • Fluxes: Pg/year



Global warming and the greenhouse effect

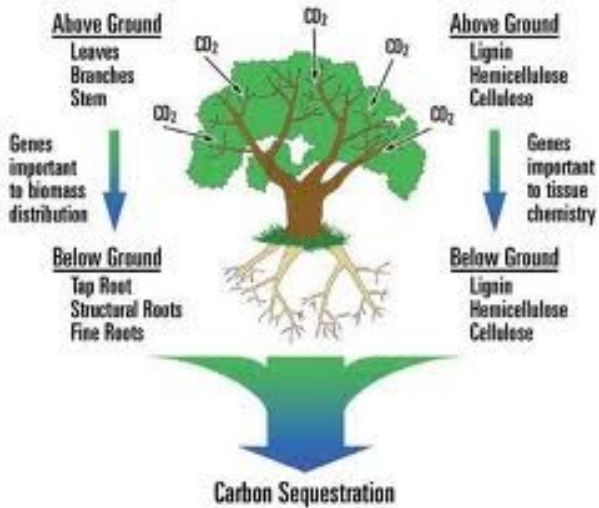
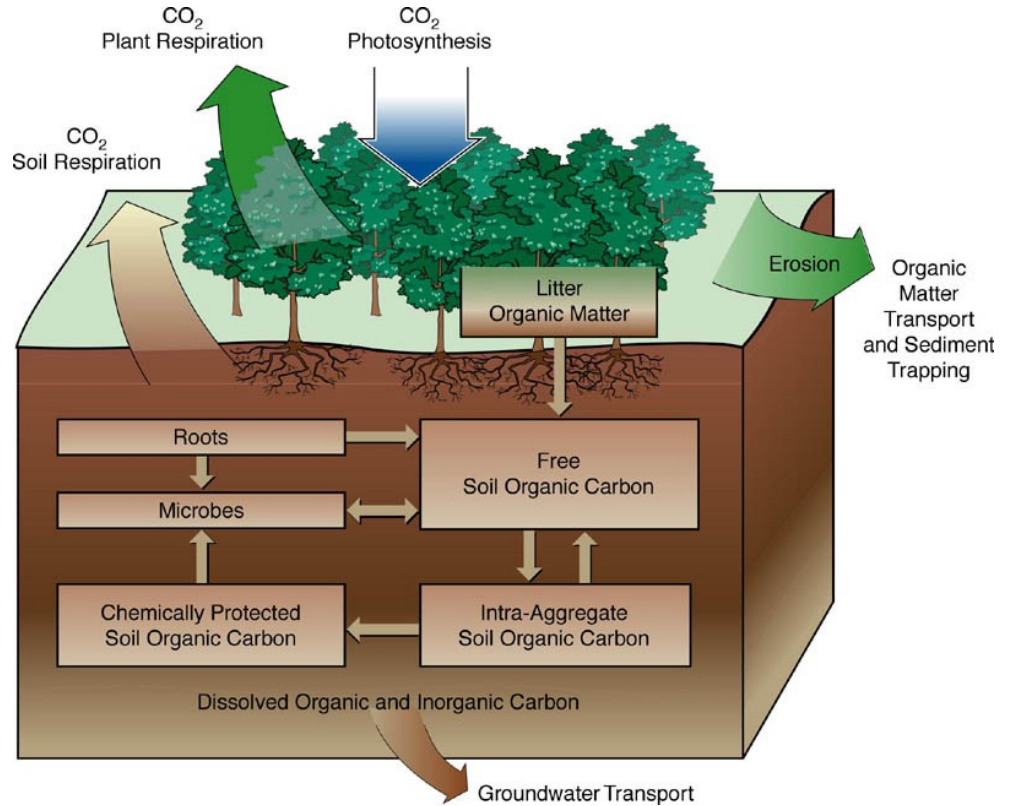
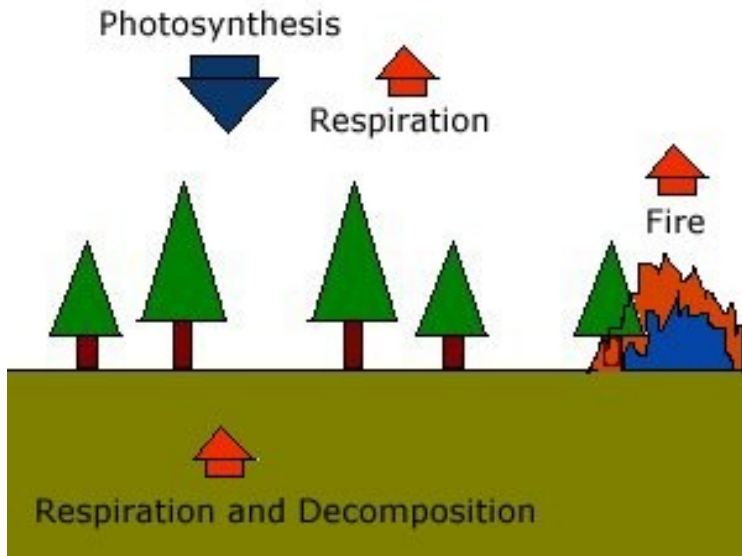


The Carbon Cycle

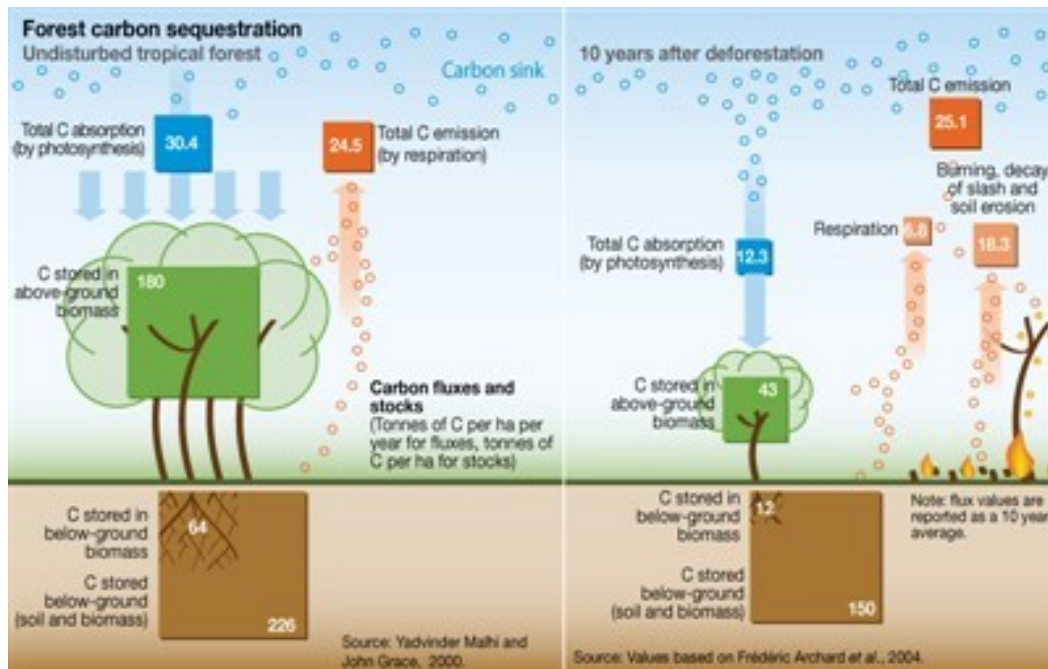
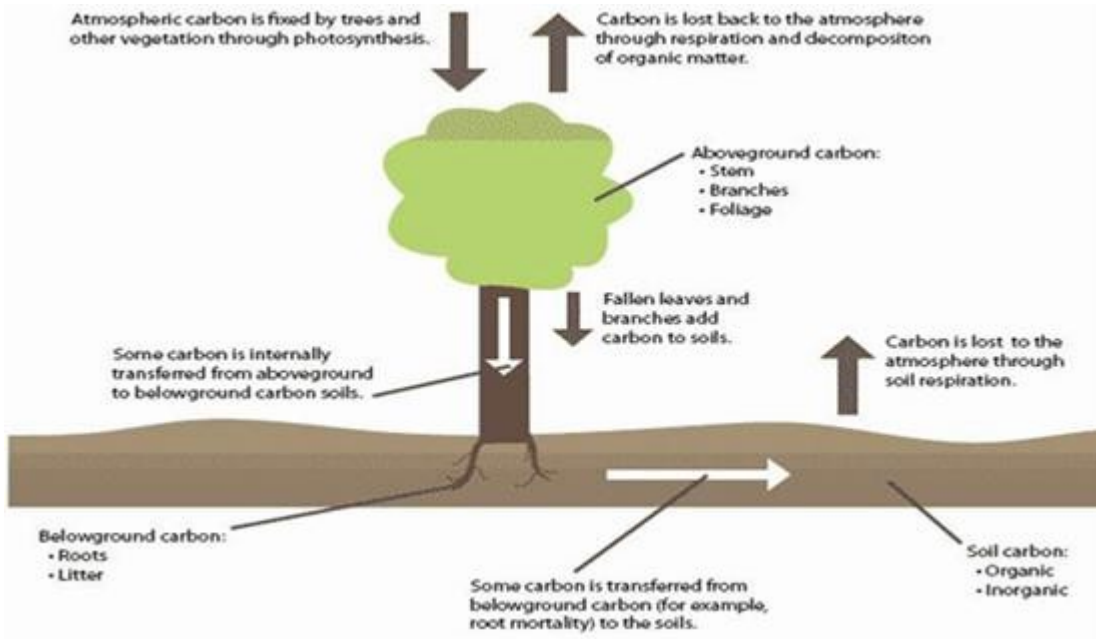


Adapted from: <http://www.calforestfoundation.org/pdf/carbon-poster.pdf>

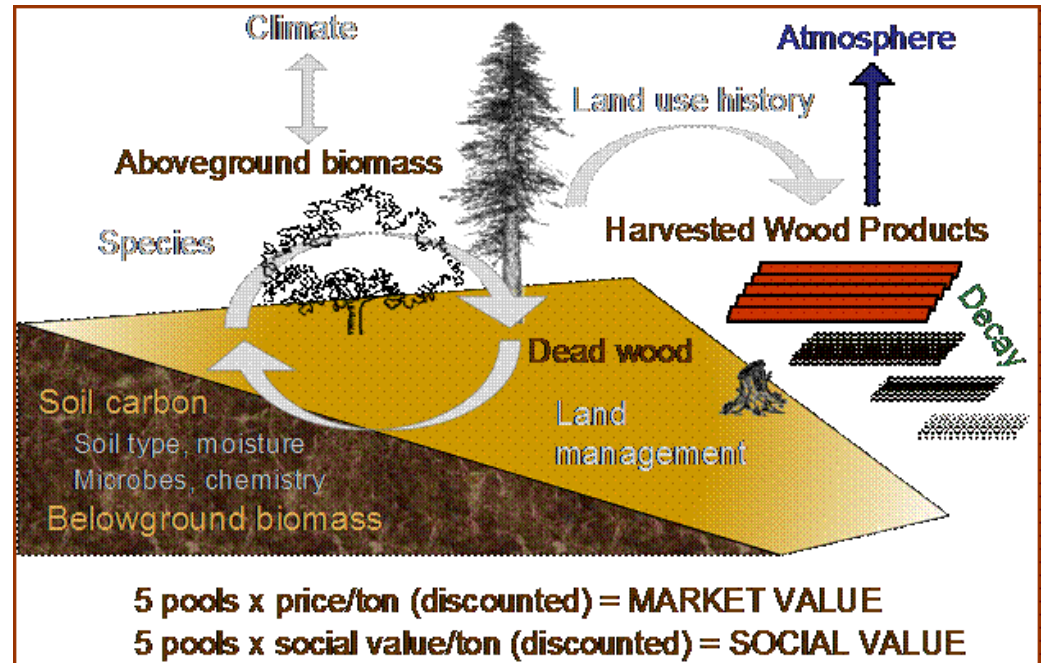
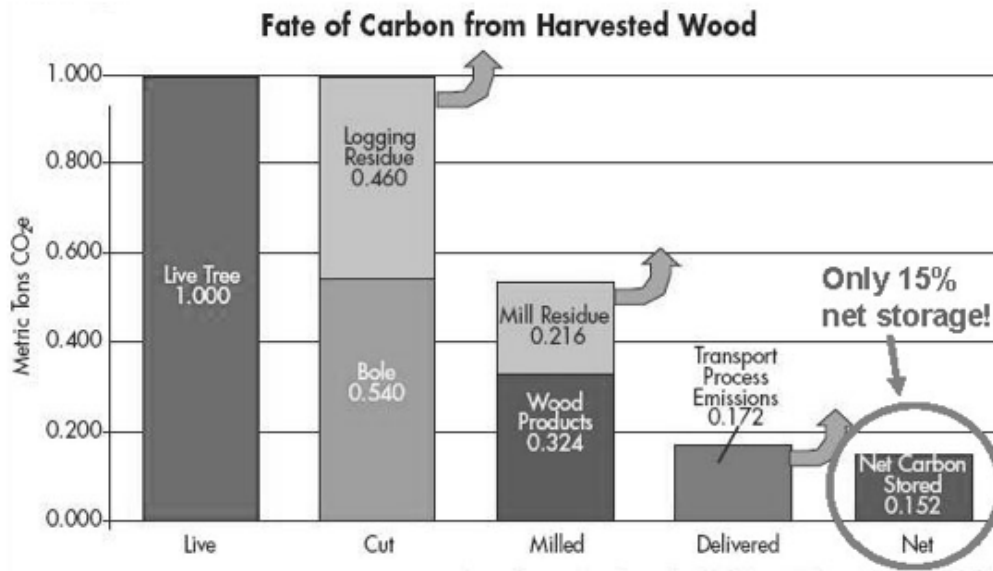
Ecosystem Carbon Sequestration



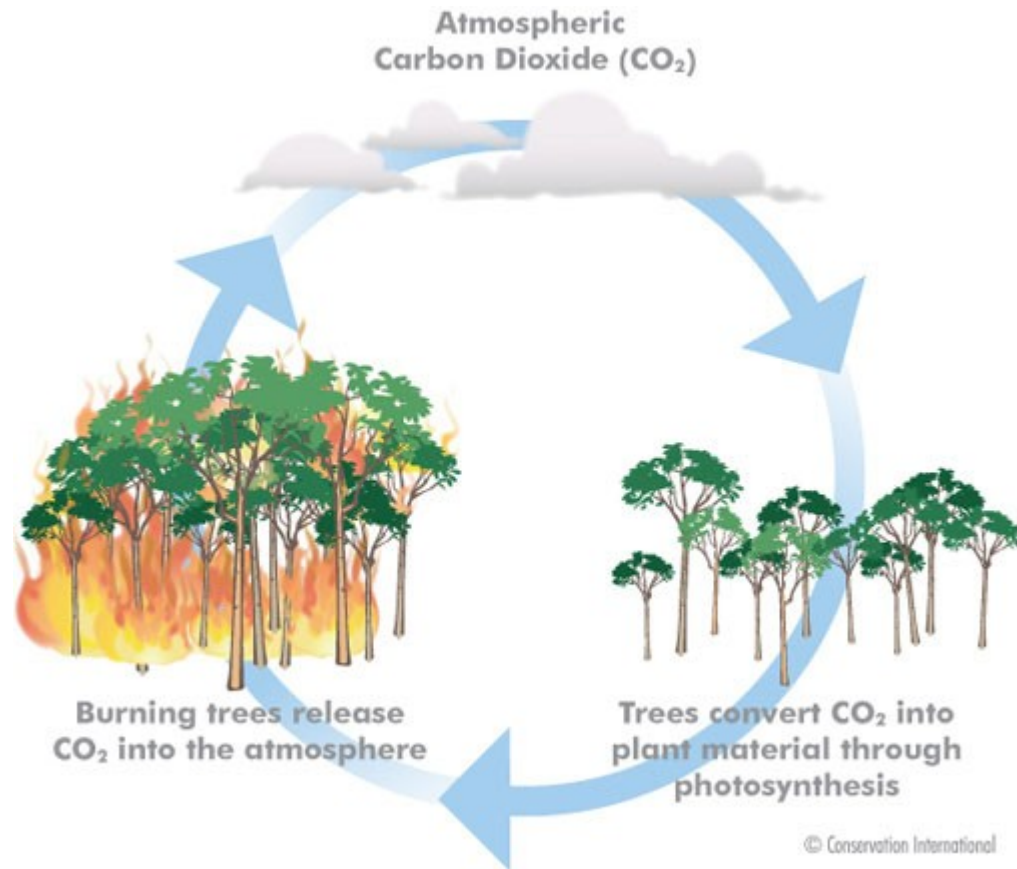
Importance of Forests for Carbon Sequestration



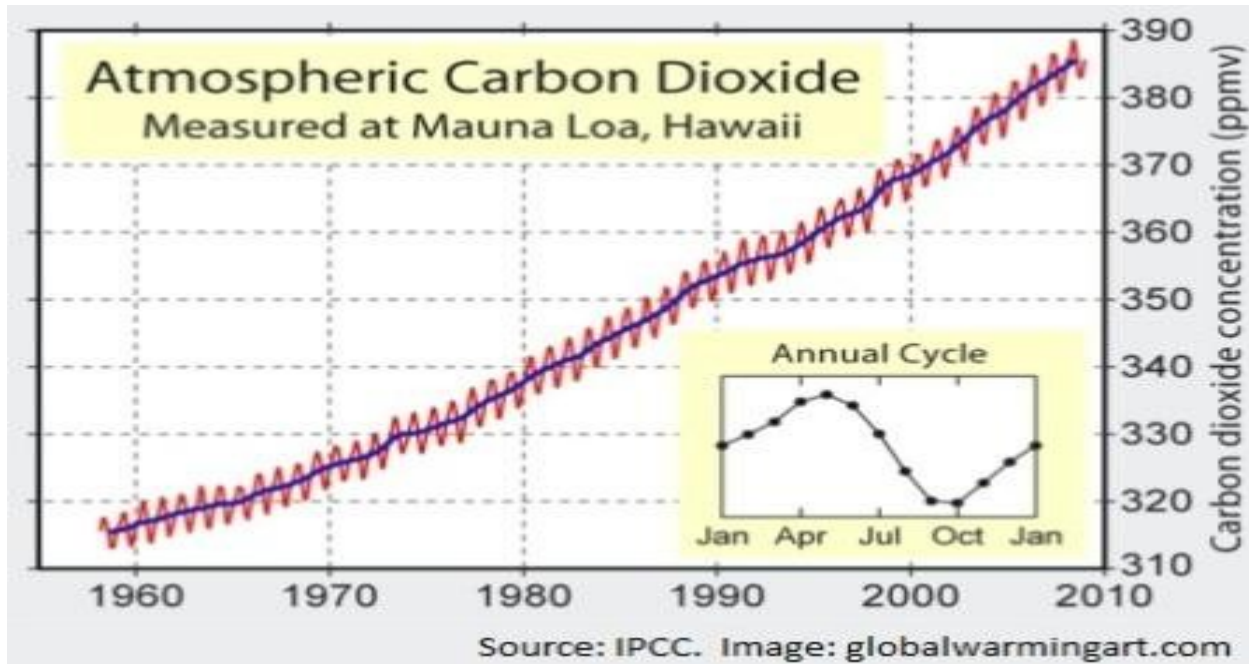
Fate of Carbon



Forest - climate interaction and global climatic changes



CO2 concentration 1960-2010

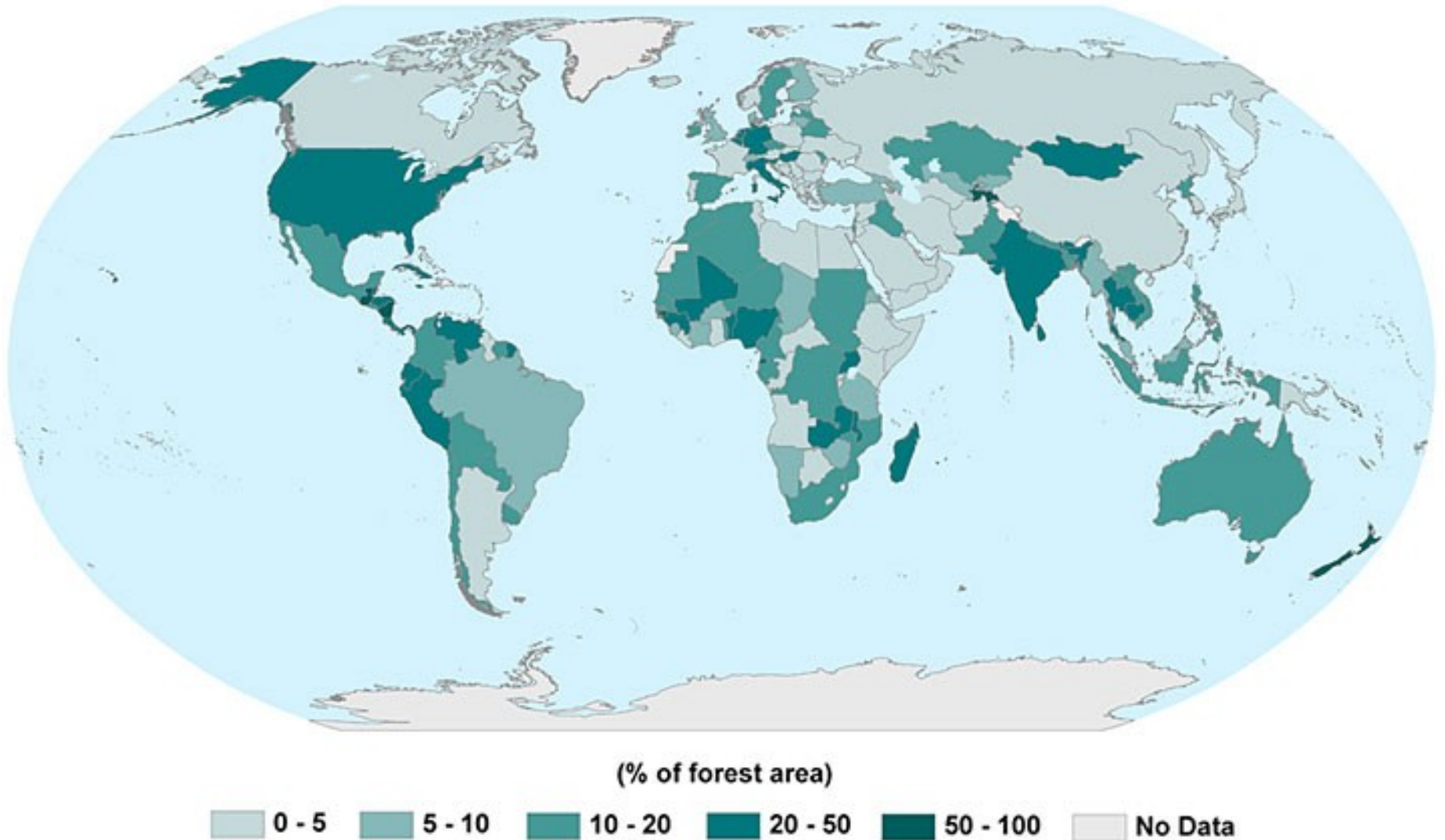


Sustainability and global biodiversity conservation

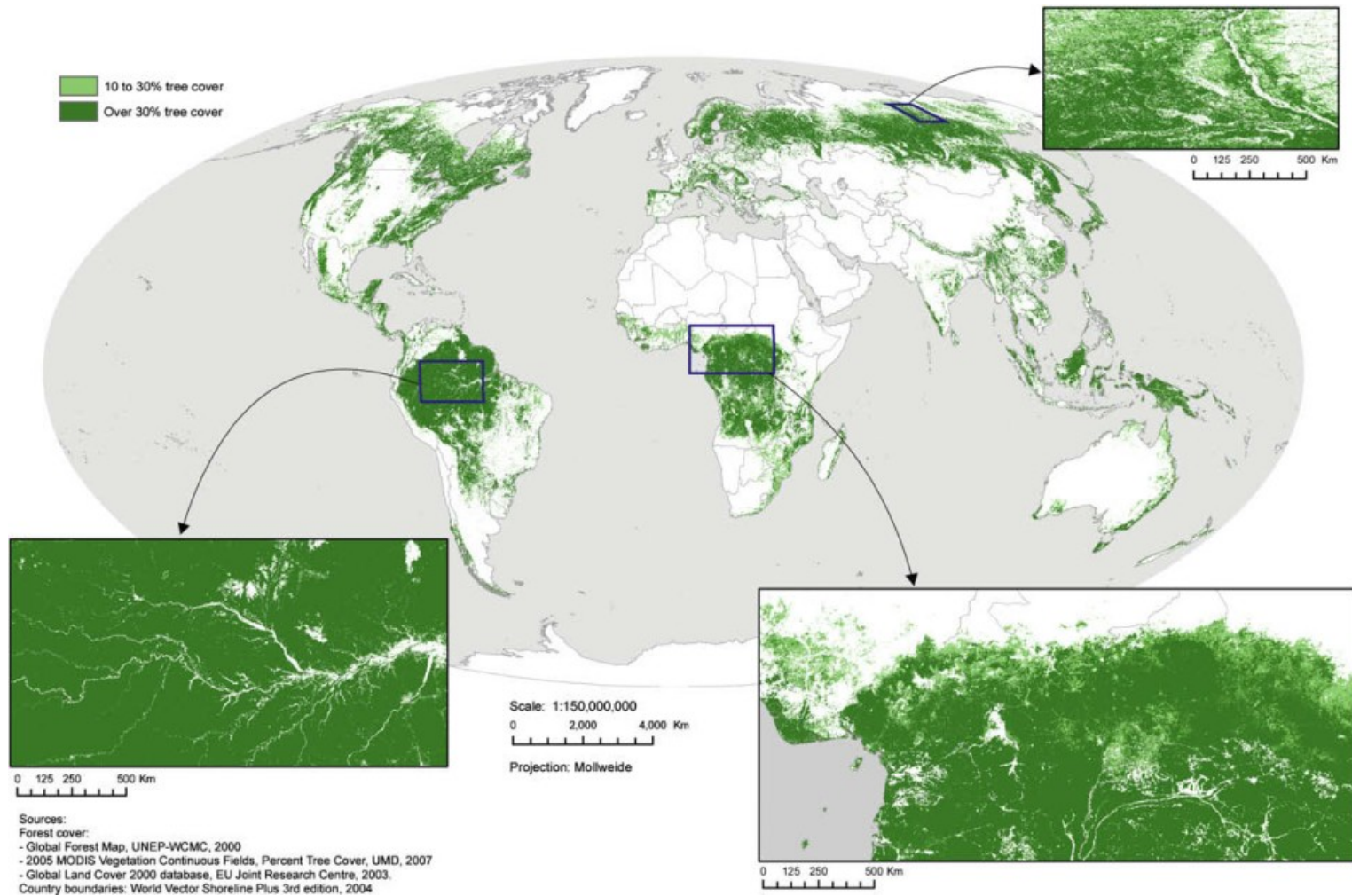
- **Twelve percent of the world's forests are designated for the conservation of biological diversity.**
- The area of forest where conservation of biological diversity is designated as the primary function has increased by more than 95 million hectares since 1990, of which the largest part (46 percent) was designated between 2000 and 2005.
- These forests now account for 12 percent of the total forest area or more than 460 million hectares. Most but not all of them are located inside protected areas.
- **Legally established protected areas cover an estimated 13 percent of the world's forests.**

Forests and biodiversity conservation

Proportion of forest area designated for conservation of biodiversity by country, 2010



Sustainability and global biodiversity conservation and wood supply

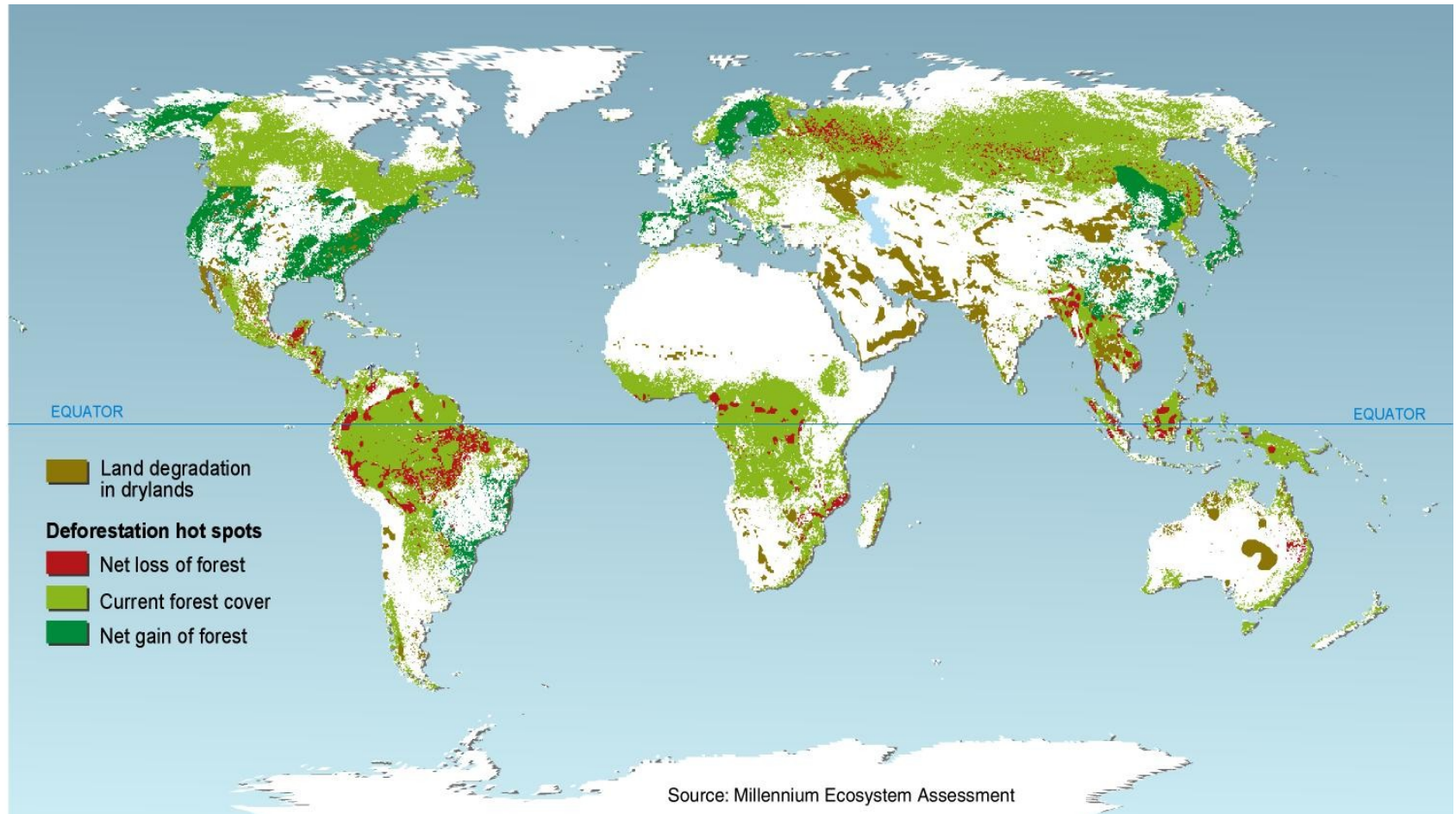


Other ecological and societal aspects of forests protection

- Productive function of forest resources
- Protective functions of forest resources
- Socio-economic functions of forest resources
- Progress towards sustainable forest management



Other ecological and societal aspects of forests protection



Productive function of forest resources

- Thirty percent of the world's forests are primarily used for production of wood and non-wood forest products.
- The area of planted forest is increasing and now accounts for 7 percent of total forest area.
- Three-quarters of all planted forests consist of native species
- Wood removals increased between 2000 and 2005, following a fall in the 1990s
- More than 10 million hectares per year are afforested or reforested each year.
- Food is the largest category of NWFP (non-wood forest products) removals globally.

Protective functions of forest resources

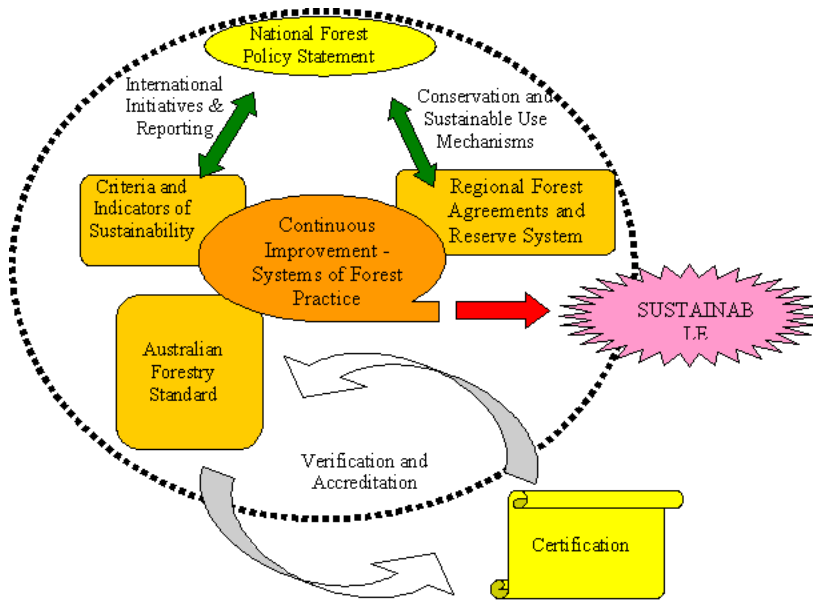
- Eight percent of the world's forests have protection of soil and water resources as their primary objective.
- Around 330 million hectares of forest are designated for soil and water conservation, avalanche control, sand dune stabilization, desertification control or coastal protection.
- The area of forest designated for protective functions increased by 59 million hectares between 1990 and 2010, primarily because of large-scale planting in China aimed at desertification control, conservation of soil and water resources and other protective purposes.

Socio-economic functions of forests

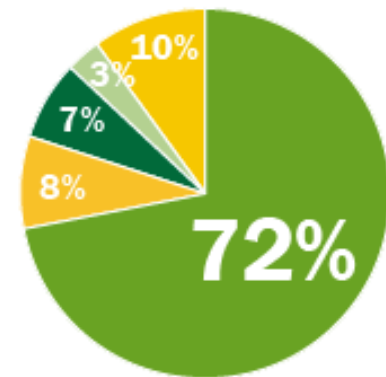
- Eighty percent of the world's forests are publicly owned, but ownership and management of forests by communities, individuals and private companies is on the rise.
- Governments generally spend more on forestry than they collect in revenue.
- **The value of wood removals is high, but fluctuating.** Wood removals were valued at just over US\$100 billion annually in the period 2003–2007.
- **The value of NWFPs remains underestimated** (US\$18.5 billion for 2005)
- Around 10 million people are employed in forest management and conservation – but many more are directly dependent on forests for their livelihoods.
- The management of forests for social and cultural functions is increasing, but the area is difficult to quantify (4% globally)

Progress towards sustainable forest management

- four additional variables to illustrate the status of forest management:
 - the area of forest in protected areas;
 - the area of permanent forest estate;
 - the area of forest with a management plan;
 - the area of forest under sustainable forest management.



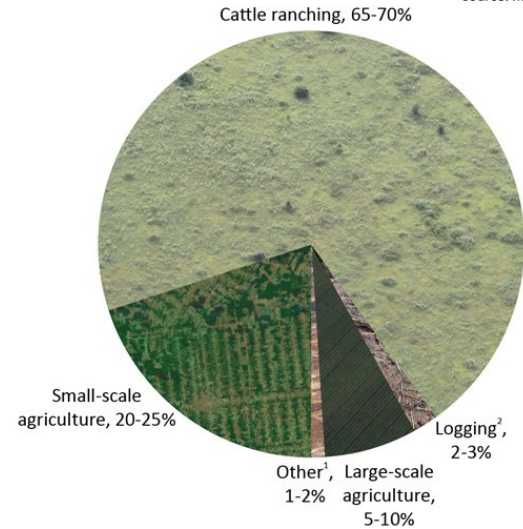
2012 FORESTRY RESEARCH SPENDING



- Forest health and productivity
- Water quality
- Fish and wildlife
- Ecosystems and biodiversity
- Other

Deforestation in the world

Causes of Deforestation in the Brazilian Amazon, 2000-2005
source: mongabay.com

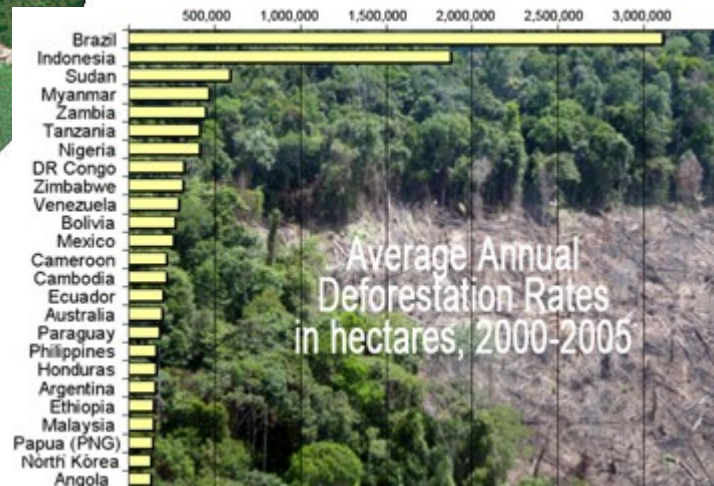
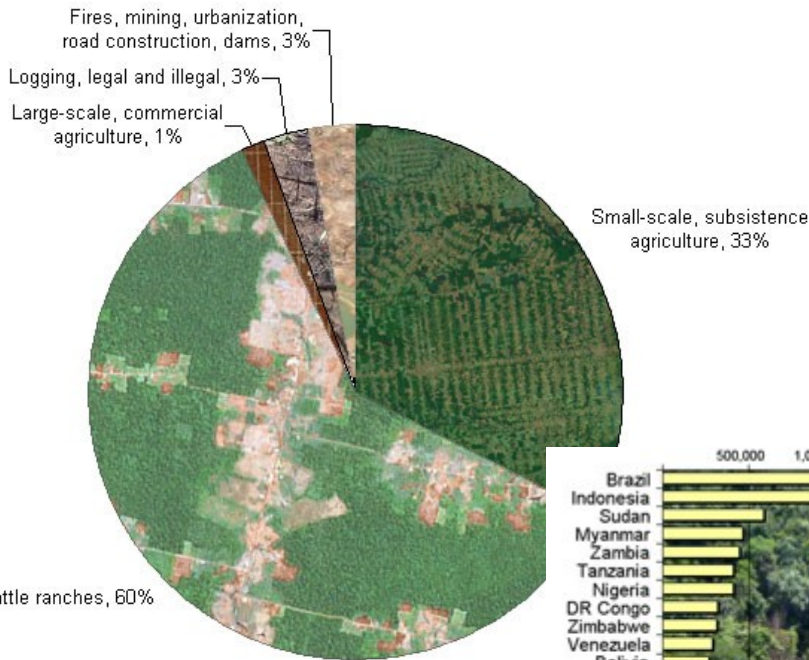


Share of deforested land ultimately converted for extensive agriculture³

1980s	80%
1990s	60%

¹ Includes fires, mining, urbanization, road construction, dams; ² Logging generally results in degradation deforestation, but is often followed by clearing for agriculture; ³ Data from Holly Gibbs 2009

Causes of Deforestation in the Amazon, 2000-2005



Deforestation

the multiplication effect

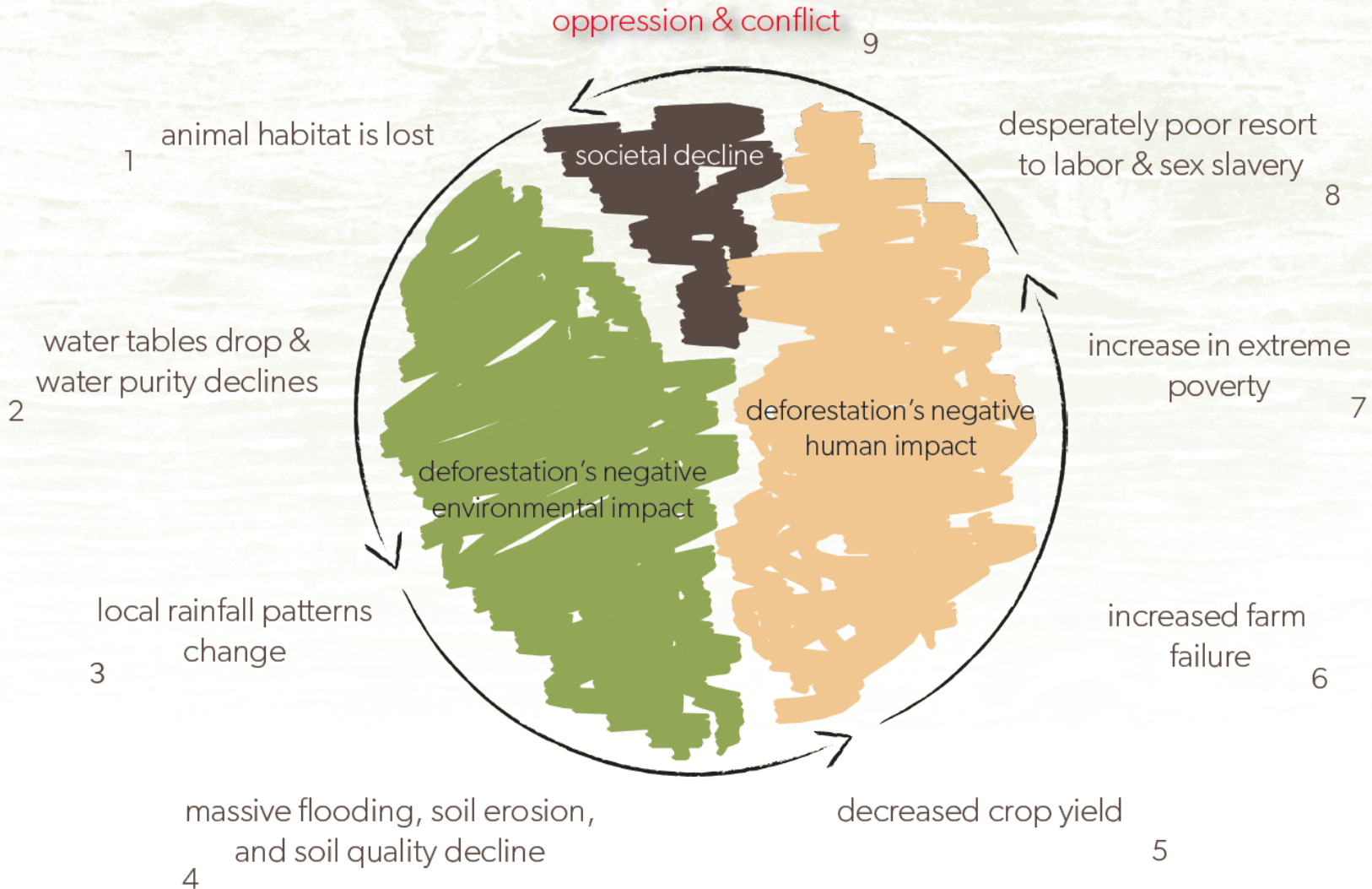
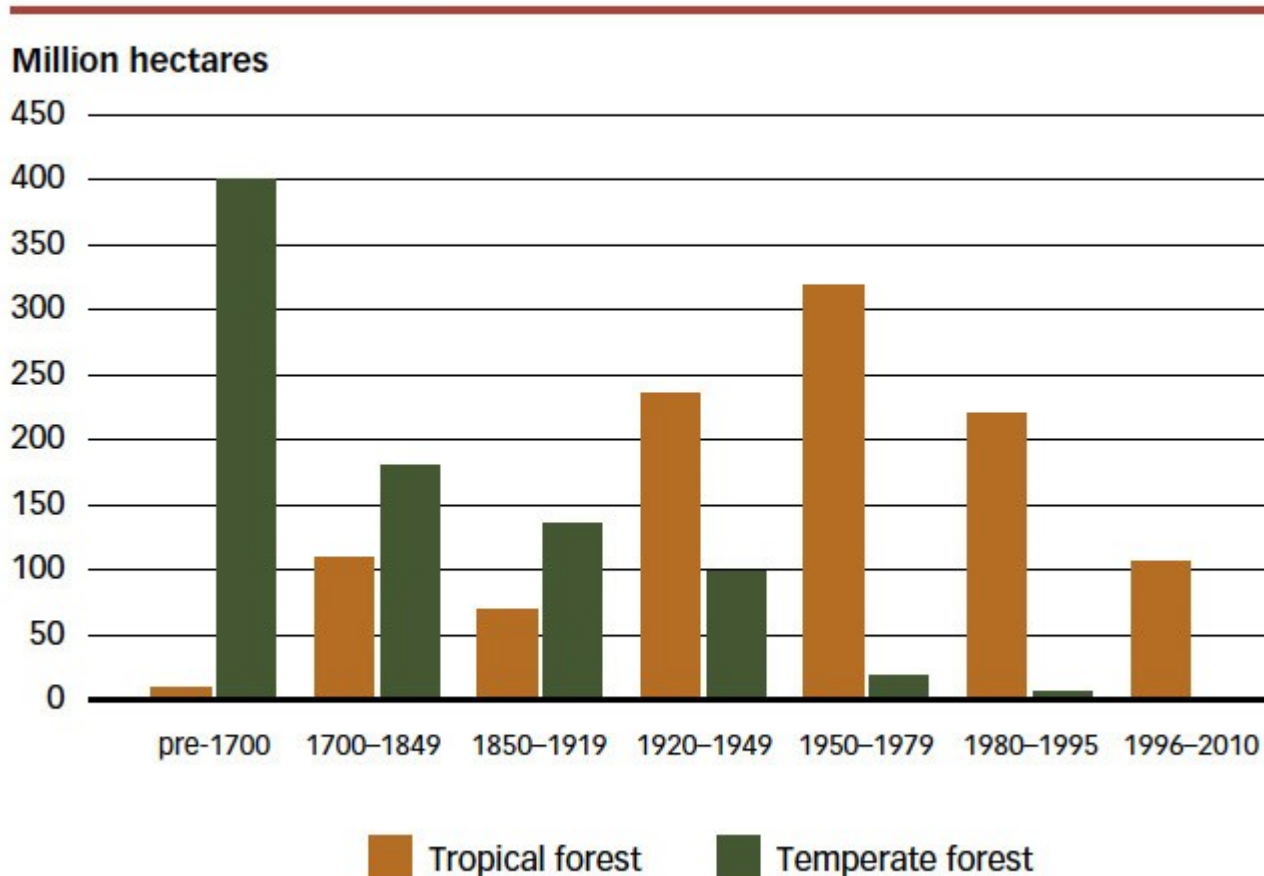


Figure 2: Estimated deforestation, by type of forest and time period



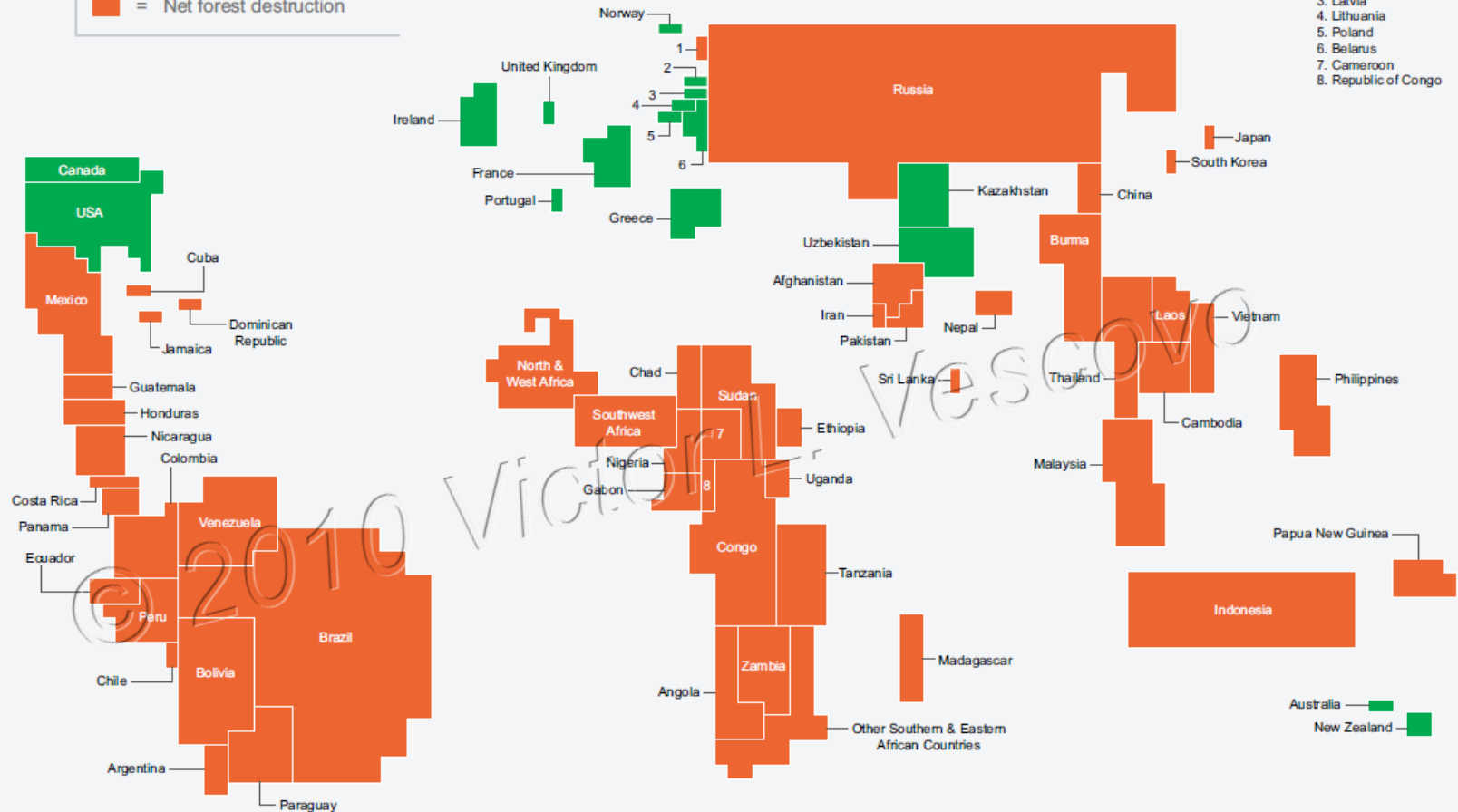
Source: Estimates based on Williams, 2002; FAO, 2010b.

World Deforestation (1990-1995)

LEGEND

- = Net forest growth
- = Net forest destruction

1. Finland
2. Estonia
3. Latvia
4. Lithuania
5. Poland
6. Belarus
7. Cameroon
8. Republic of Congo



Estimated net total world deforestation (1990-1995) = 749,000 square kilometers

Source: UNESCO, *World Culture Report 1998* (Table 28: Environment)
 Note: The deforestation rate for Russia is an aggregate estimate based on the total forest area in 1990 and an assumed deforestation rate equal to Brazil's for the period of 1990-1995.

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