Bärkraftiga mat- och fibersystem
Föreläsning II

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Innehåll:

- Karakteristika hos de globala fibersystemen (virke, papper, textilier, etc)
- Strategier för mer bärkraftiga fibersystem

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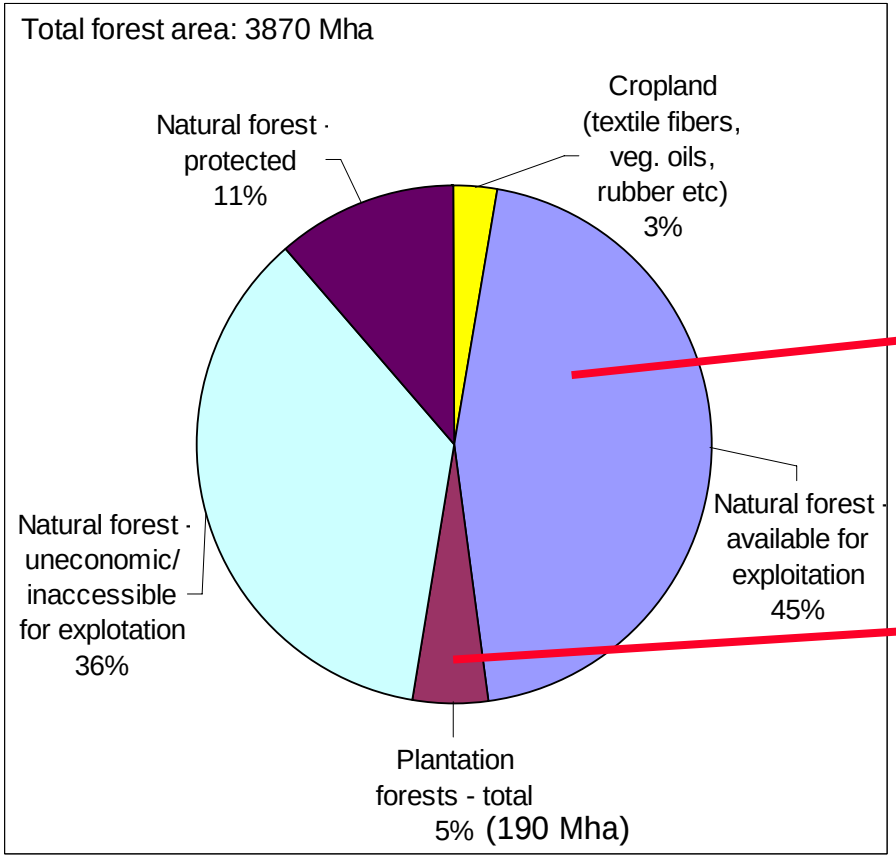
Overview of present global land and biomass use for food, fiber and energy

	Land area use	Biomass use (harvested/grazed)
Food:	**5.1** Gha	~**10** Pg DM/yr (180 EJ)
Fiber:	~**2** Gha (approx. used forest area)	~**0.9** Pg DM/yr (18 EJ)
Energy:	Small dedicated use in energy plantations (~0.01 Gha)	~**2-2.5** Pg DM/yr (35-50 EJ) (includes 20-40 EJ of residues from the food and fiber systems)

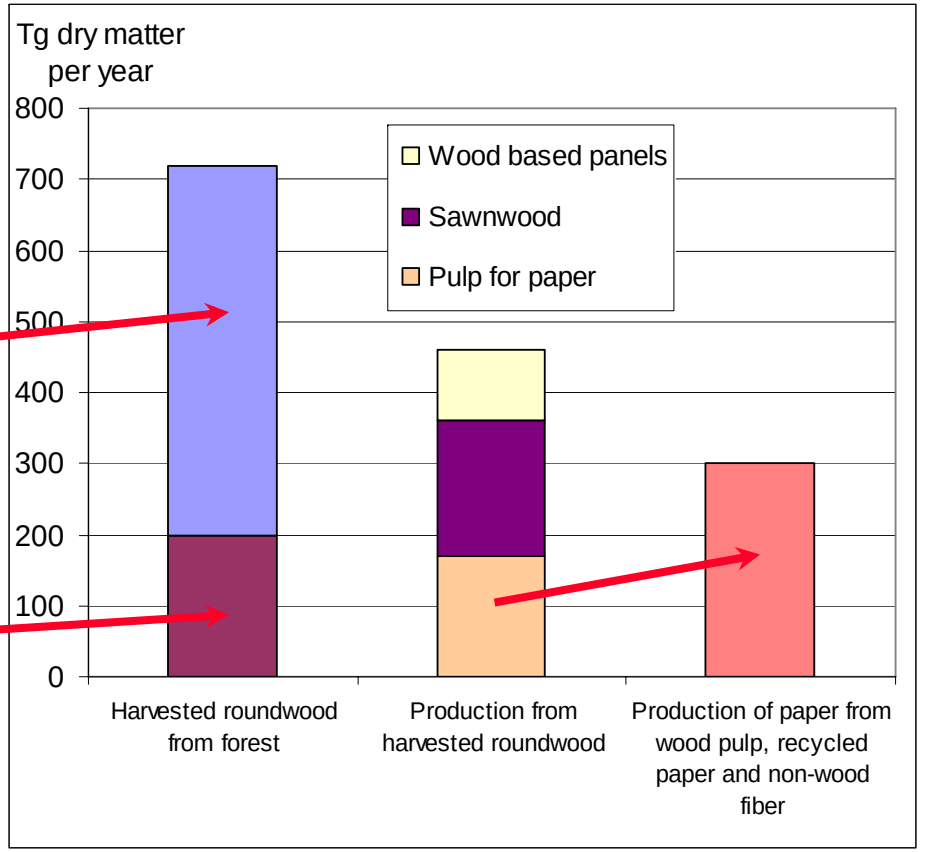
For comparison: Use of fossilized biomass (coal, oil and gas) is about 300 EJ/year

Fiber: Land use and biomass flows in global fiber systems (data for 2000)

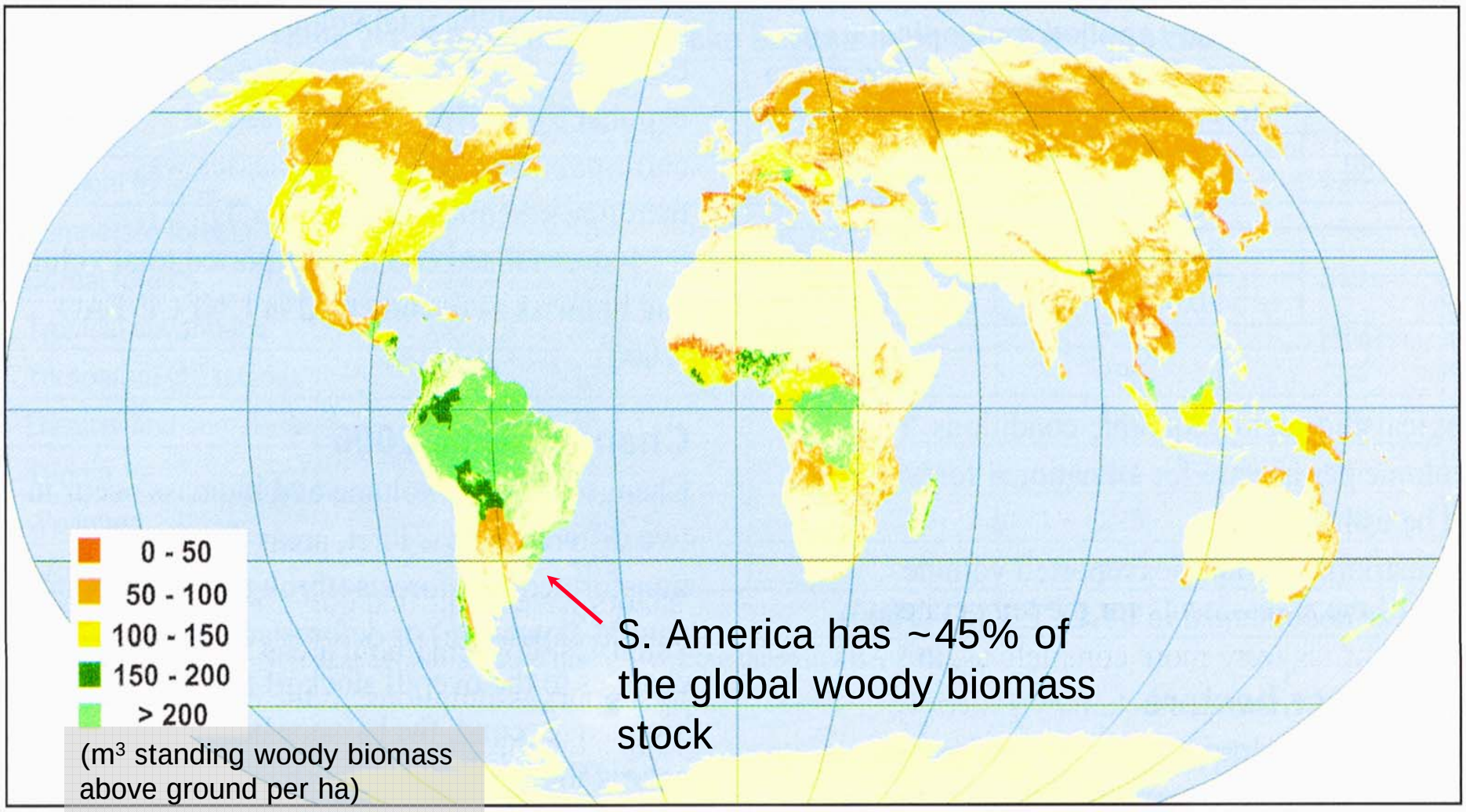
Use of forest and cropland area for fiber production:



Production of wood-based materials:

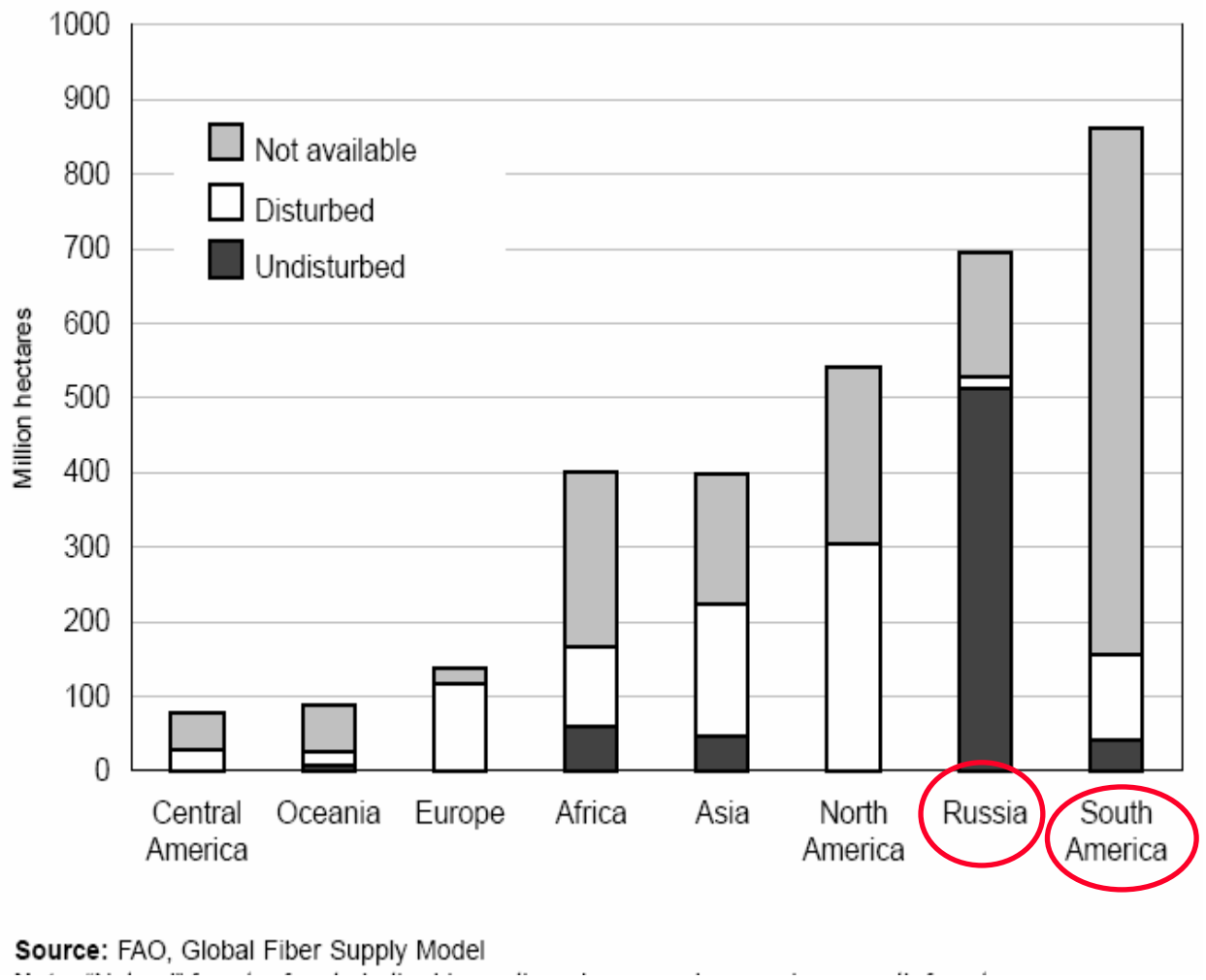


Major characteristic of the wood fiber system: I. Very large regional differences in **stock** and **productivity** of woody biomass



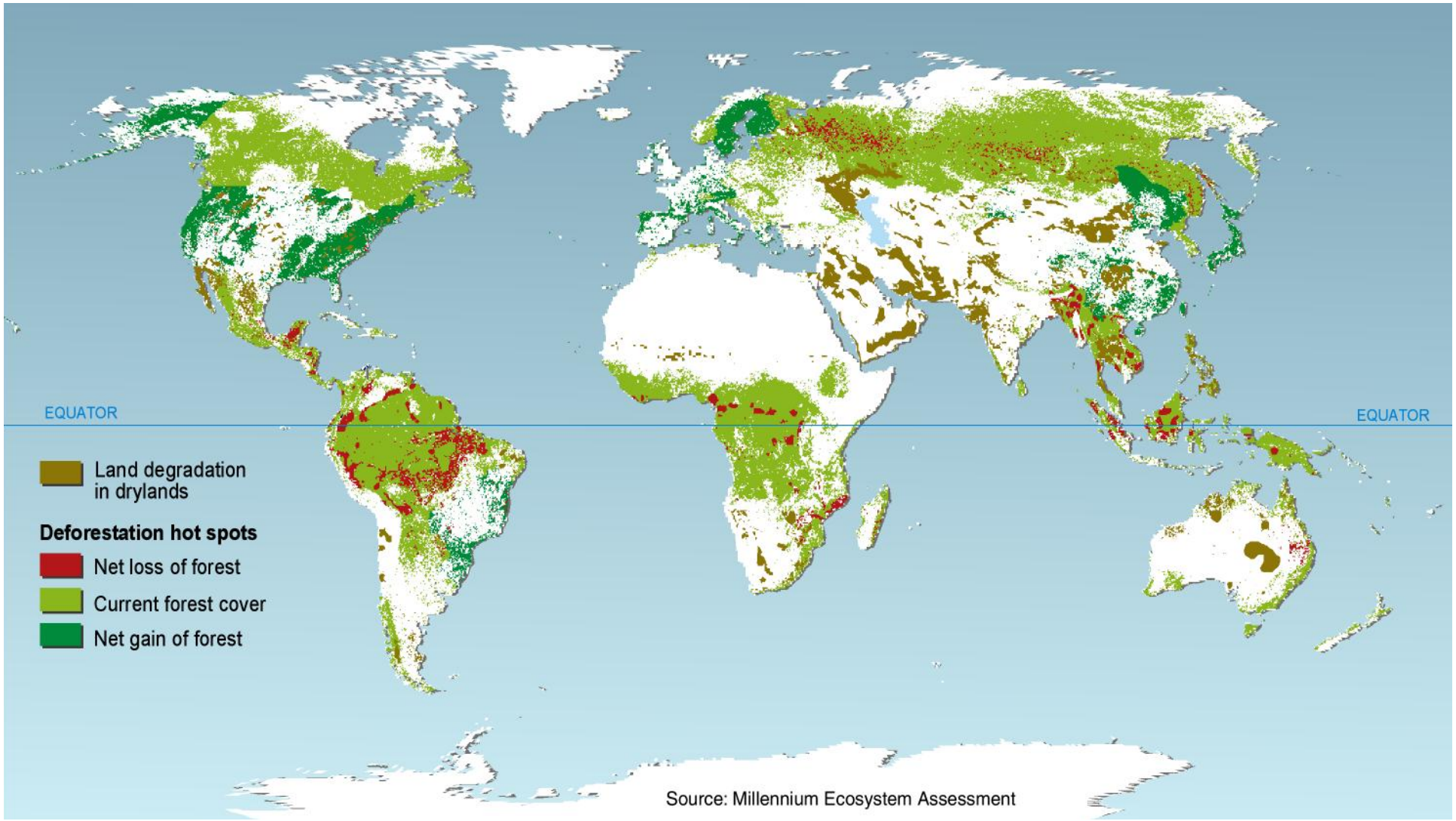
Source: FAO (2001)

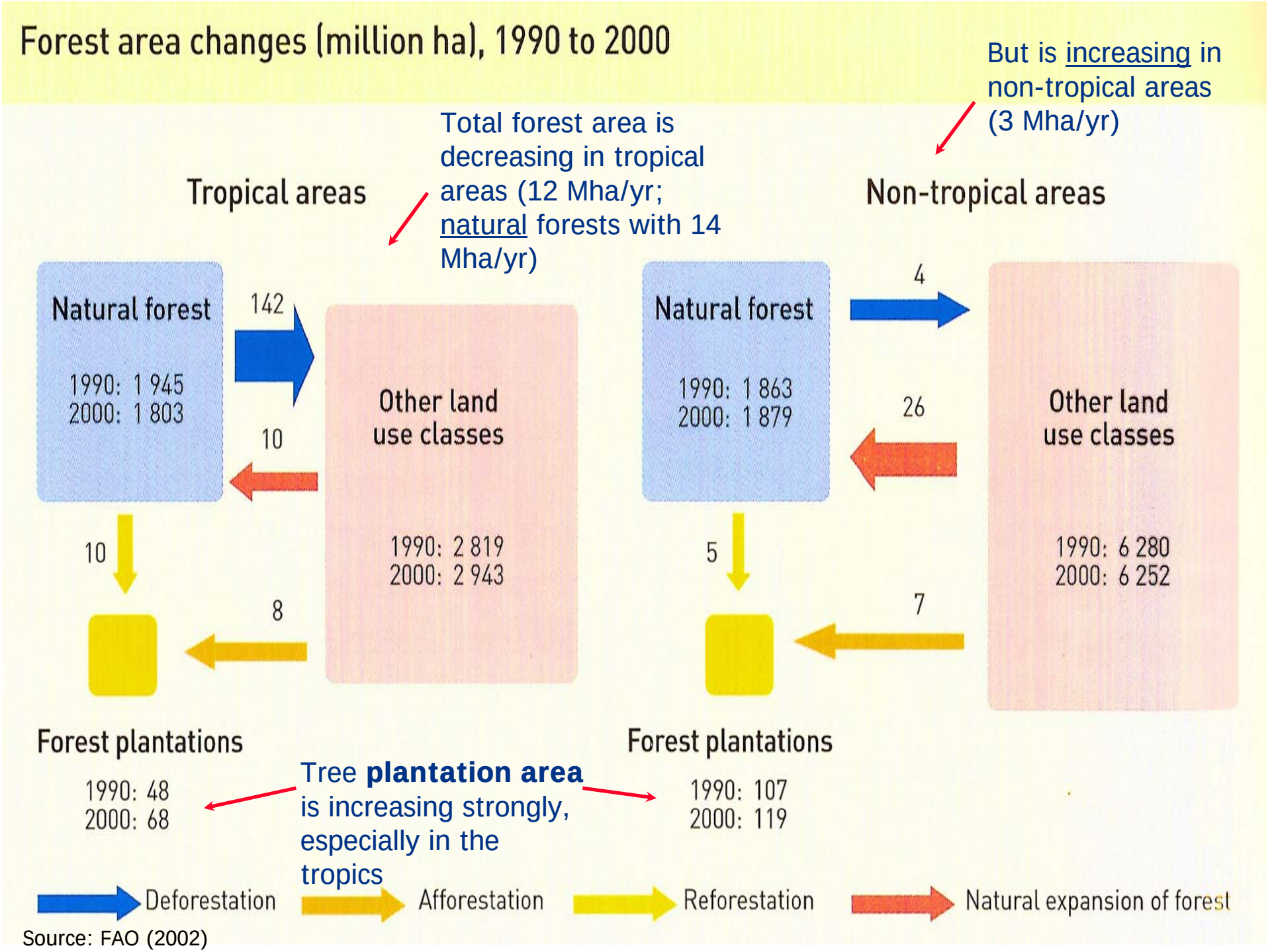
Major characteristic of the wood fiber system: II. Large regional differences in forest **area accessible** for wood harvest (around 2000)



Source: FAO, Global Fiber Supply Model

Skogsutbredning och dess förändring under 1980-2000





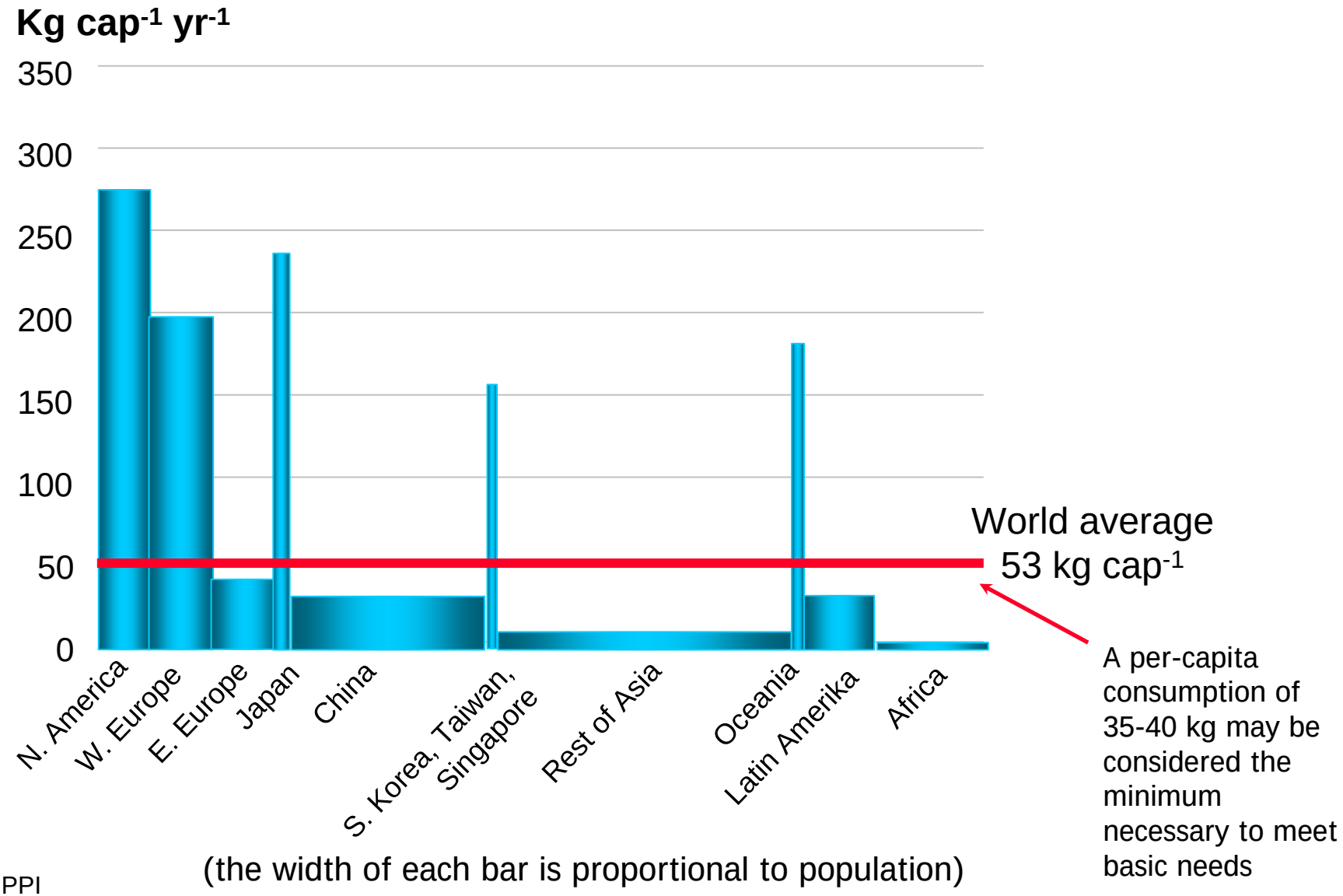
Source: FAO (2002)

Factors determining resource use and environmental impacts of the fiber and forestry system: Overview

- Major factors determining land use and turnover of biomass of the fiber system include:
  - **consumption** per capita of fiber products, especially of paper
  - post-consumer paper **recycling**
  - use of **by-products** from saw and plywood mills in the production of paper and fiber/particle boards
  - **process yields** in production of sawn wood, wood panels, paper
  - wood **yields** per ha
  - area of high-yielding **plantations**

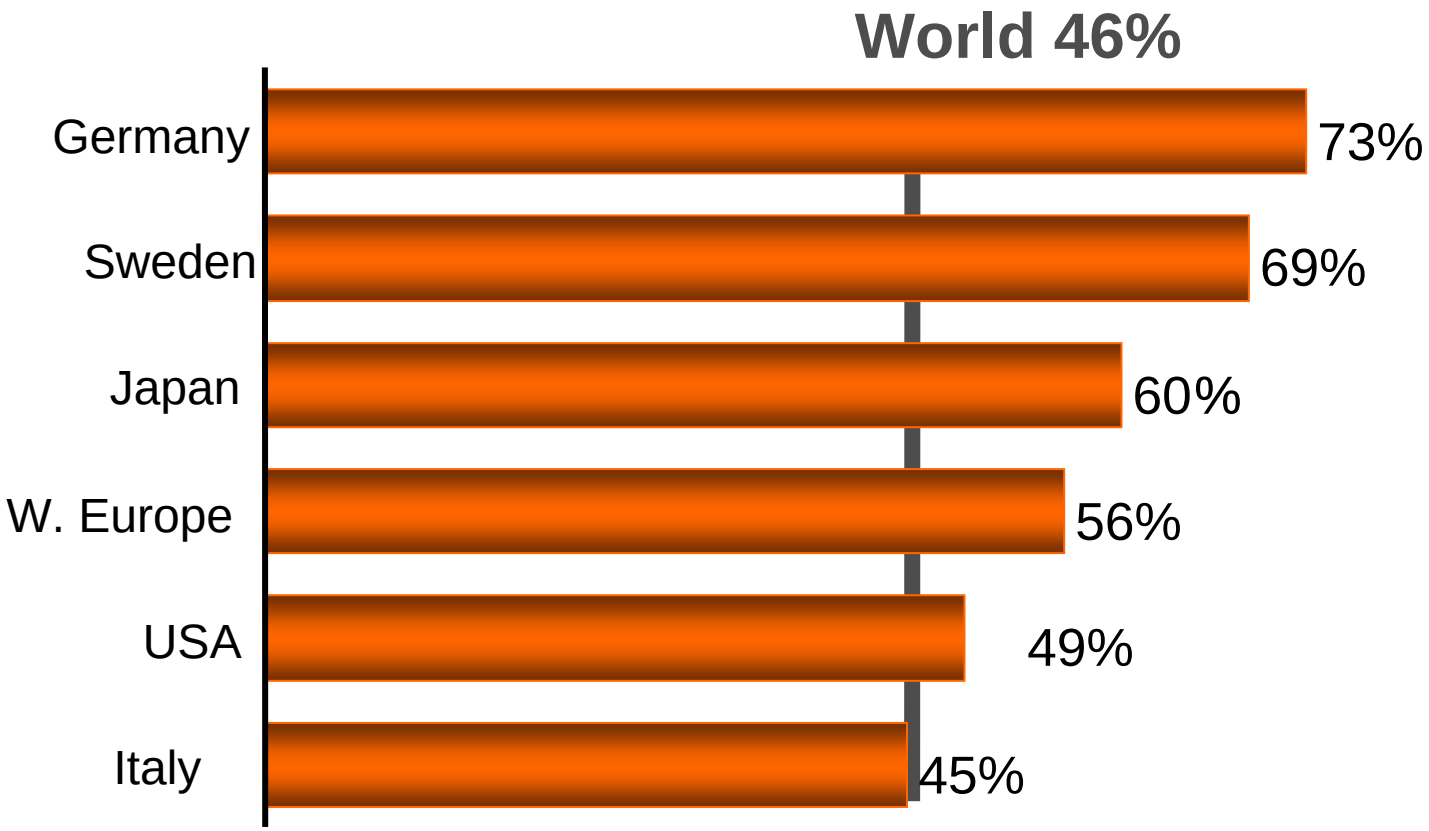
- Fiber system resource use and environmental impact are largely correlated to the total land use and biomass turnover (the smaller the area/flows, the smaller the impact)

Major factor steering the resource use of the wood fiber system: Paper consumption per capita (2002)



Source: PPI

Post-consumer recycling of paper (data for 2002)

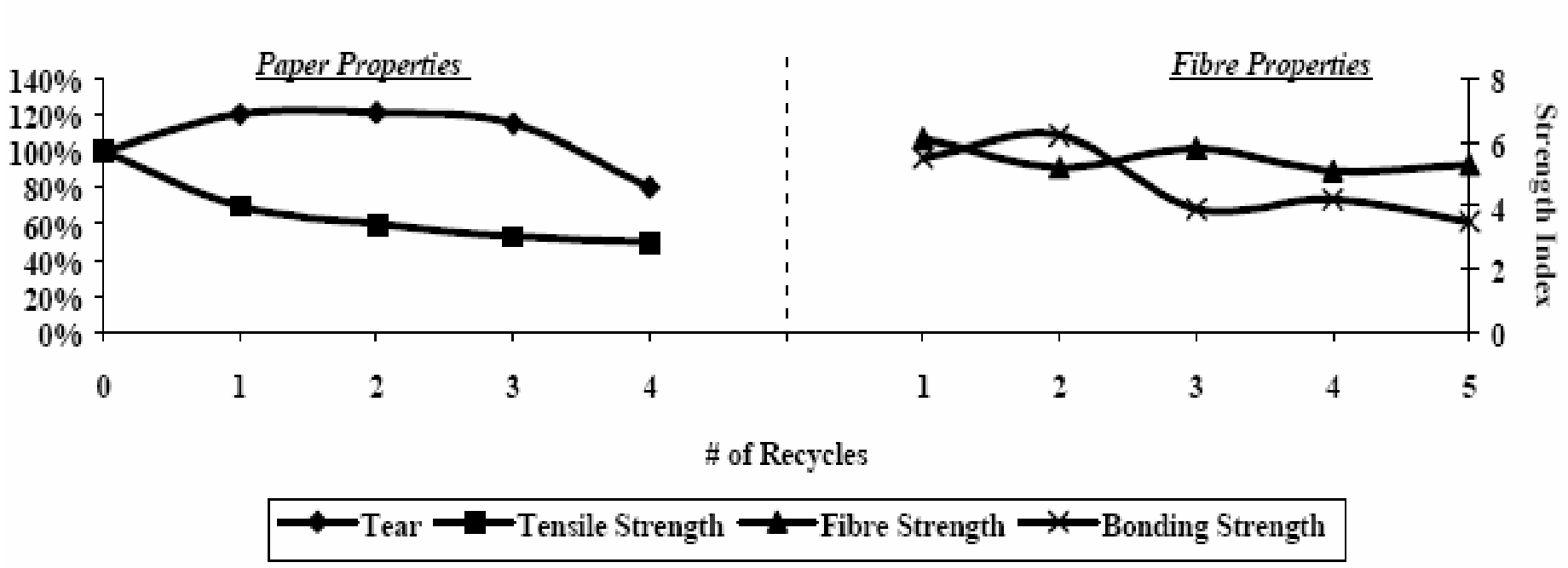


Source: Swedish Forest Industries Federation (2004)

Effect of recycling on fiber and paper properties

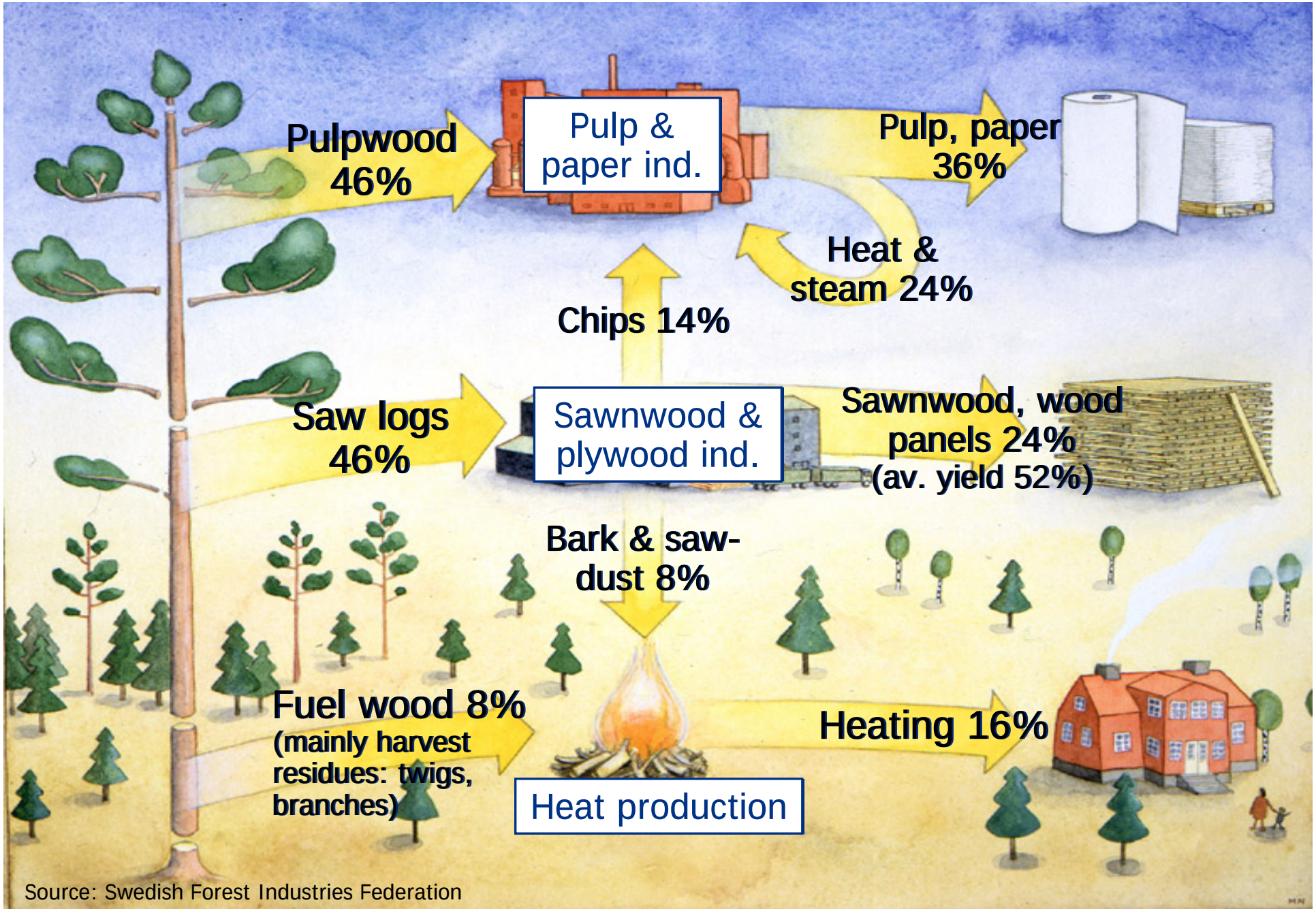
- In general, fiber and paper **loose quality** when recycled, but changes tend to level out after 4-5 cycles (see figure below)

- In each re-cycle, there is also a certain **loss of fiber mass**, due to shortening of fibers in the process → some fibers become too short and are filtered away



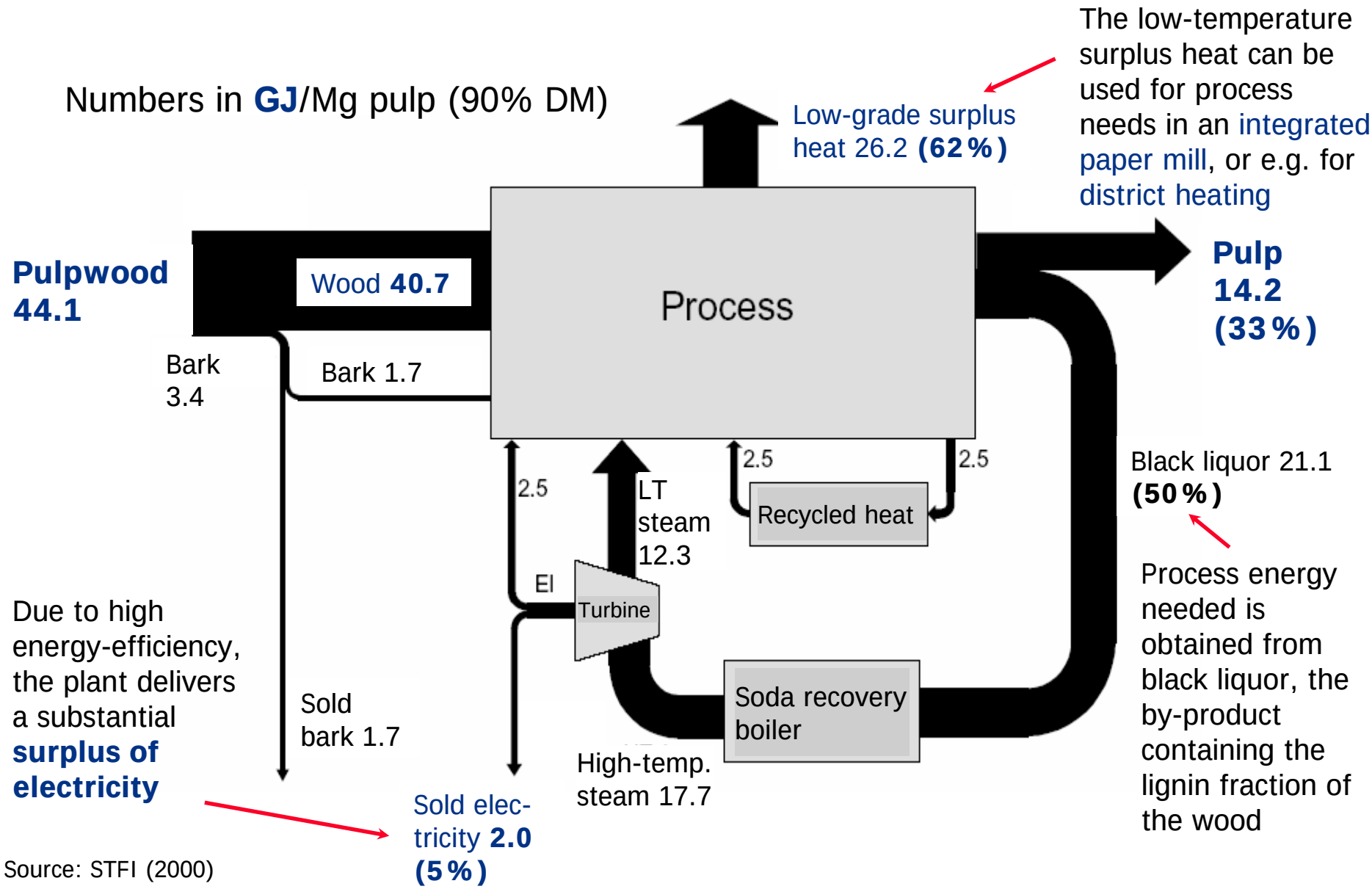
Source: Mabee & Pande (1997)

Biomass flows in the Swedish wood fiber system (2002)



Source: Swedish Forest Industries Federation

Biomass and energy flows in a high-efficient **chemical-pulp** process (best available technology in 2000)

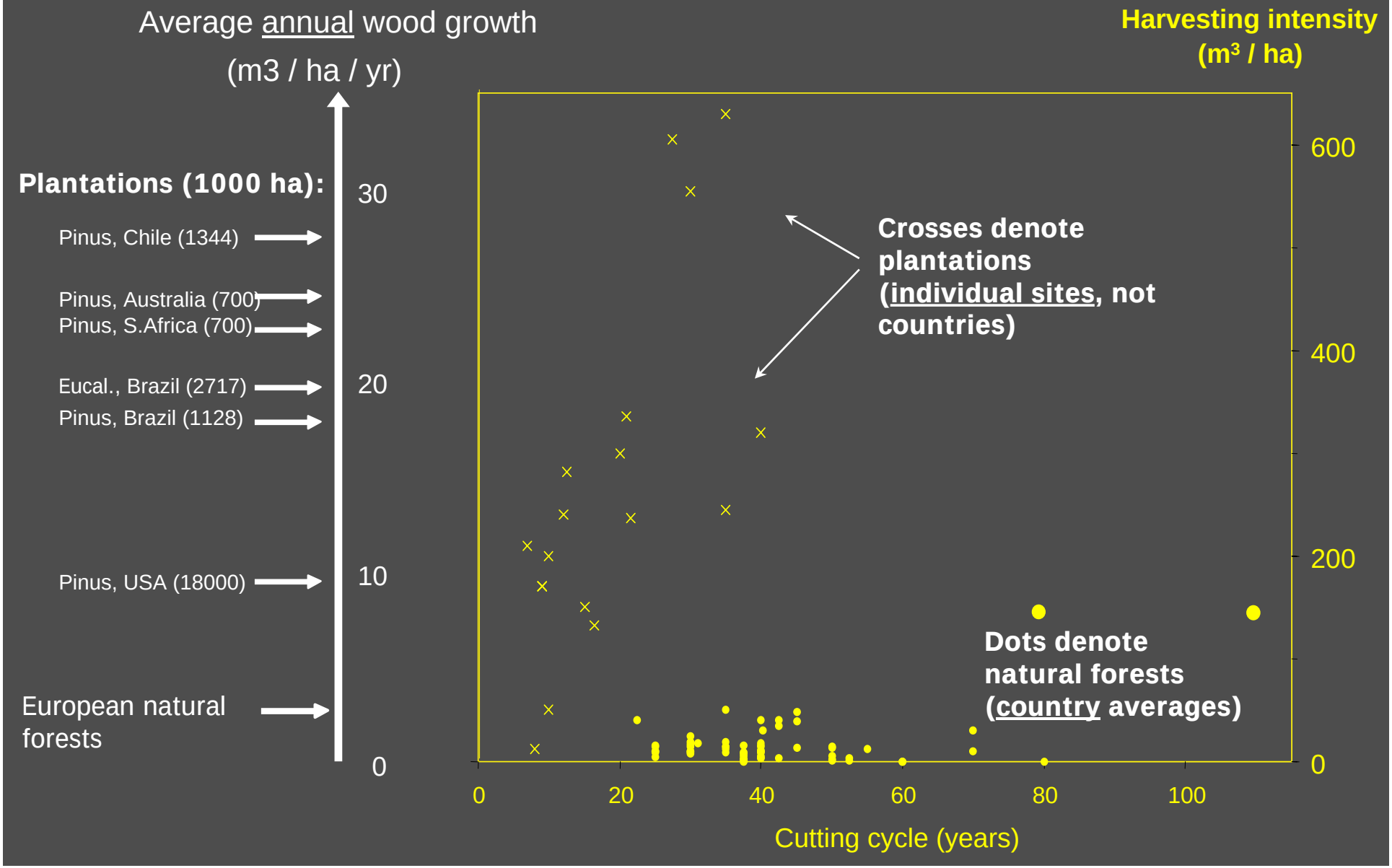


Source: STFI (2000)

Biomass use in wood and paper production: Summary of characteristics

	Yield (dry matter basis, excl. bark)	**Principal feedstocks**	**By-products generated**	**Use of by-products**
Sawnwood, plywood	40-60 (70)%	Saw logs	Wood chips & shavings (30-50%) saw dust (5-15%), bark	Paper or fiber/particle board or energy
Fiber / particle board	90-95%	Various low-grade wood fibers (saw-dust etc)	None except bark	
Mechanical pulp	~95%	Pulpwood, wood chips, used paper	None except bark	
Chemical pulp	40-50%	Pulpwood, wood chips, used paper	Black liquor, bark	Energy for pulp process (and sold)

Yields of **plantations** and **natural** forests
(Note: These are two separate diagrams)



Yields and cutting cycles of plantations and natural forests: Summary of typical numbers

	Yield (m^3 ha^{-1} $year^{-1}$)	**Rotation** (years)
Temp. & boreal conifer forests		
Canada average	1.0-1.5	
Northern Europe (Sweden, etc)	2-3	60-100
Siberia (Russia)	1-1.5	70-200
Tropical forests		
Tropical high forest (managed)	0.5-7	
S.E. Asia *Dipterocarp* forest (managed)	up to 17	~50
Plantations - Conifers		
Brazil (*Pinus* spp)	15-35	15-35
New Zealand (Monterey pine)	18-30	20-40
Plantations - Eucalyptus		
Brazil	30-45+	7-20
South Africa	15-20	10
Spain, Portugal	10-15	8-15

Source: Evans (1992), Sedjo (1999)

Strategies for sustainable fiber and forestry the coming 50 years: Overview (for the ecological dimension)

I: Keep down the increasing production requirements of wood and other fiber biomass, by

- increasing the **use of wood residues** from sawmills and plywood mills as feedstock in paper/fiberboard production (largest potential in developing countr.)
- increasing the process **yields in wood and paper industry**, especially in sawmills and plywood mills (largest potential in developing countries)
- increasing paper **recycling** (large potential in most countries)
- keeping down the per-capita consumption of wood products

II: Due to the expected growth in demand, supply of woody biomass still must be increased the nearest 50 years. For sparing undisturbed, natural forests, overall strategy for increasing supply should be:

- increasing the yields, through more intensive management, **on already disturbed forest areas**
- increasing the area of high-yielding tree **plantations**
- strongly limiting the harvest in relatively undisturbed forests; increase the area of **protected forests** protected from harvest

Intensively managed tree plantations: Benefits and critical aspects

- Factors driving the transition towards intensification in wood production include:
  - rising costs for harvesting natural forests, due to large infrastructure costs for accessing remaining areas of natural forests
  - increased productivity and yields from tree plantations, due to improved technology
  - rising social and political pressure to preserve natural forests

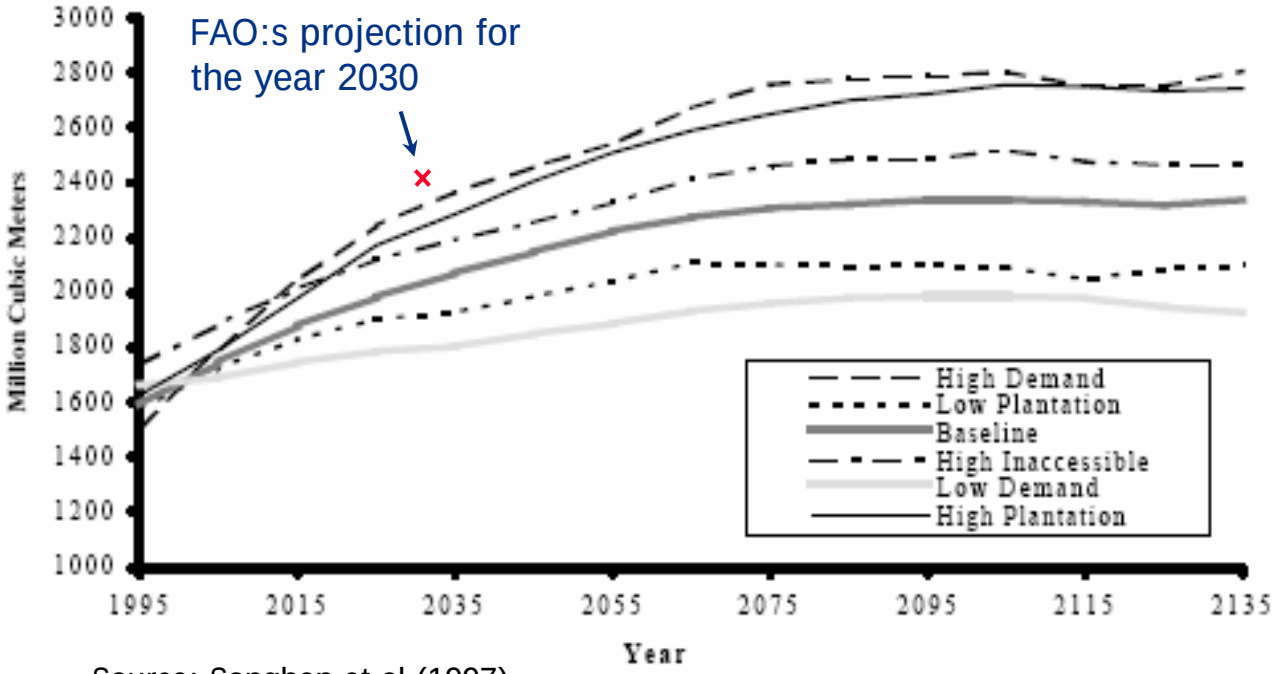
- Some critical considerations are:
  - sites for plantations must be chosen carefully, taking into account needs and rights of local communities, and avoiding destroying valuable habitats
  - tree species must be selected carefully, indigenous species are preferable, (although exotic species like *eucalyptus* and *pines* may be a suitable option in many areas)

Projections and long-term scenarios of global land use and supply of roundwood for fiber

• Most of the increased supply is expected to come from existing and newly established plantations (FAO:s projection for 2030: a doubling in plantation supply from today's 400 Gm^3 to 800 Gm^3)

• Conversion of tropical rainforest to sustainable forestry is estimated to be **6-18% of current remaining area** (in the year 2135)

Global roundwood supply under different scenarios, using cost minimization modeling (Songhen et al 1997):



Source: Songhen et al (1997)