Climate change, bioenergy and forestry

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Outline

- The Politics
- The Concerns
- Managing Carbon
- Kyoto and Beyond
- Reducing emissions
- Bioenergy – solution or threat?
- Sea to Sky

The Politics

Climate change

“We are already feeling the effects: increasing heat waves and related health problems, declining water levels in the Great lakes, changes in fish migration and melting polar ice caps, as well as insect infestations in British Columbia’s forests”.

Government of Canada
Climate Change Plan for Canada

However, are we working in a vacuum?

- Some argue that the climate change debate is a luxury of the rich countries
- Some argue that those advocating forestry-based solutions are completely out of touch with global problems
- Some argue that the bioenergy debate is restricted to a small group of scientists intent only on advancing their own research budgets

Global perspective

Key issues

The Millennium Development Goals

- Eradicate extreme poverty and hunger
- Promote gender equality and empower women
- Ensure environmental sustainability
- Develop a global partnership for development

Links

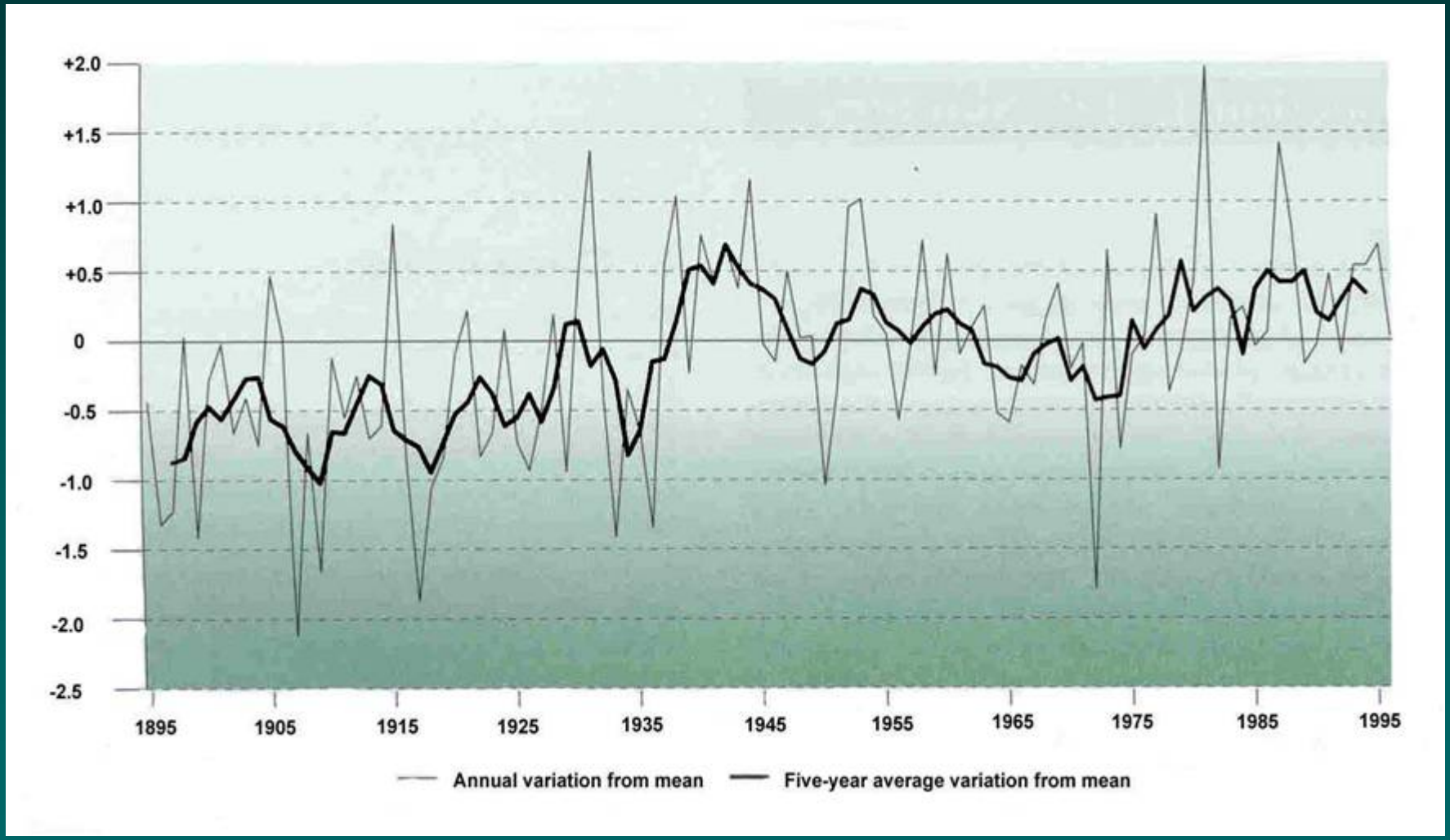
- **Poverty: there are clear links between poverty and the choice of fuels**
- **Gender: there are clear links between wood and gender issues**
- **Woodfuels may be sustainable**


Near Agra, India


Fujian, China

Is the concern about climate justified?

Long-term trend in temperature, Canada



In British Columbia

- During the 20th century, average annual temperature warmed by 0.6°C on the coast, 1.1°C in the interior and 1.7°C in northern BC
- The number of growing degree days increased 16% in ne BC, 13% on the Coast and in the southern interior, and 5% in the central interior
- Precipitation increased in southern BC by 2 to 4% per decade
- Lakes and rivers became ice-free earlier in the year
- Fraser River water temperatures increased

Riggs Glacier, Alaska, 1941

Riggs Glacier, Alaska, 2004

Possible forestry impacts in BC

- Upward movement of treelines
- Expansion of Bunchgrass and Ponderosa pine zones
- Reconstruction of plant communities
- Changes to ground cover
- Increased fire frequency
- Increased outbreaks of pests (e.g., bark beetle and white pine weevil) and diseases

Already seen

- Increases in boreal forest productivity (Ciais *et al*. 1995; Myneni *et al*., 1997)
- Accelerated seasonal development of some insects (Fleming and Tatchell 1994)
- Changes in the distribution of insect pests
- Provenances from slightly warmer areas out-compete local provenances

We need to think about

- Allowing even longer seed transfers from warmer to cooler environments
- Adjustment of long-term growth estimates
- Restoration of forest structure and composition in intensively managed areas
- Managing forest density to reduce drought stress
- Using pre-commercial thinning, prescribed burning and other techniques to reduce risk of large, high-intensity disturbances

Managing carbon

Carbon

- Globally, between 1850 and 1998, ca. 270 Gt C were released into the atmosphere from fossil fuel burning and cement production
- About 136 Gt C came from land-use change, mainly forest ecosystems
- Atmospheric concentrations have increased by 176 Gt C

Potential net change in global C stocks in 2010 (Mt C yr^{-1})

Forest management	170
Cropland management	125
Grazing land management	240
Agroforestry	26
Rice paddies	7
Urban land management	2
Land-use change	425

Carbon pools in Canadian forests

- Total stock of 88 Gt (12 Gt in standing biomass and 76 Gt in soil and peat)
- Canadian forest sector absorbs about 2.8 Gt / year of carbon, and releases an equivalent through respiration and fires

Net losses in carbon pools in Canadian forests occurred 1990-94

- The greatest ecosystem losses of carbon were in the boreal east (45.4 MtC yr^{-1}) and subarctic (24.3 MtC yr^{-1})
- The greatest biomass losses of carbon were in the boreal west (15.6 MtC yr^{-1}), subarctic (14.5 MtC yr^{-1}) and cordilleran (7.6 MtC yr^{-1})

Kyoto and beyond

Canadian carbon

- Canada has committed to reducing its GHG emissions to 6% below 1990 levels.
- This represents an annual reduction of 270 Mt in the 2008-2012 period.

Canadian (lack of) action

- Canadian 3-stage plan (replaced by Project Green in April 2005)
- Project Green – no trace on Environment Canada's website as of 29 August 2006

Canadian (lack of) action

“The Government of Canada Climate Change site is currently unavailable.

Le site Web sur les changements climatiques du gouvernement du Canada est actuellement non disponsible”.

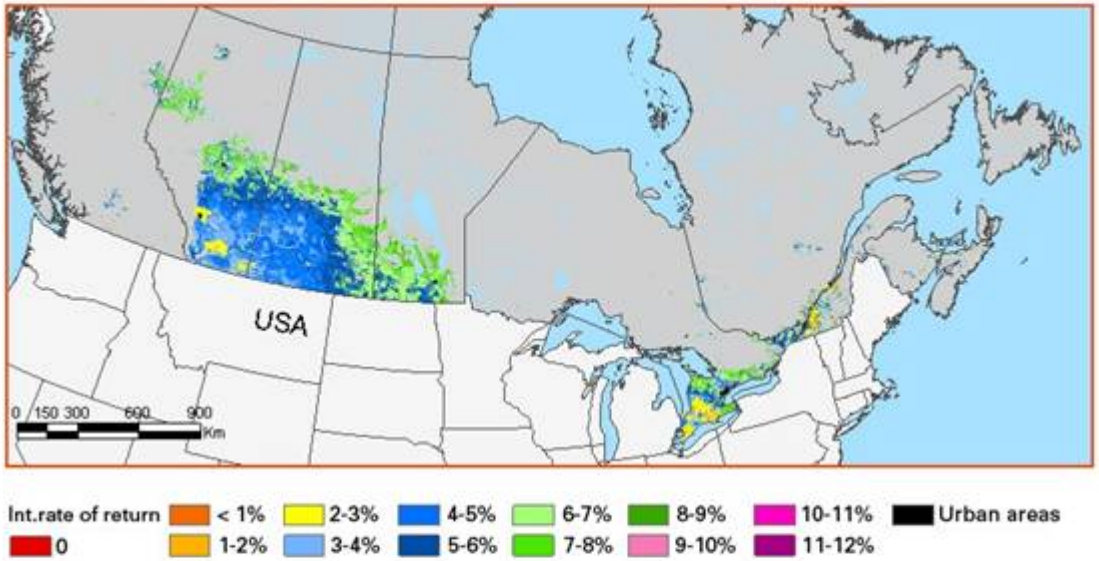
29 August 2006

Canadian forestry actions

- Action Plan 2000 encourages farmers to plant shelterbelts (website no longer functioning)
- Greencover Canada will expand the area under perennial cover and trees
- BIOCAP Canada has funded studies looking at the potential of enhancing forest sinks.
- The Feasibility Assessment of Afforestation for Carbon Sequestration project is analysing the potential for creating large-scale new forests.

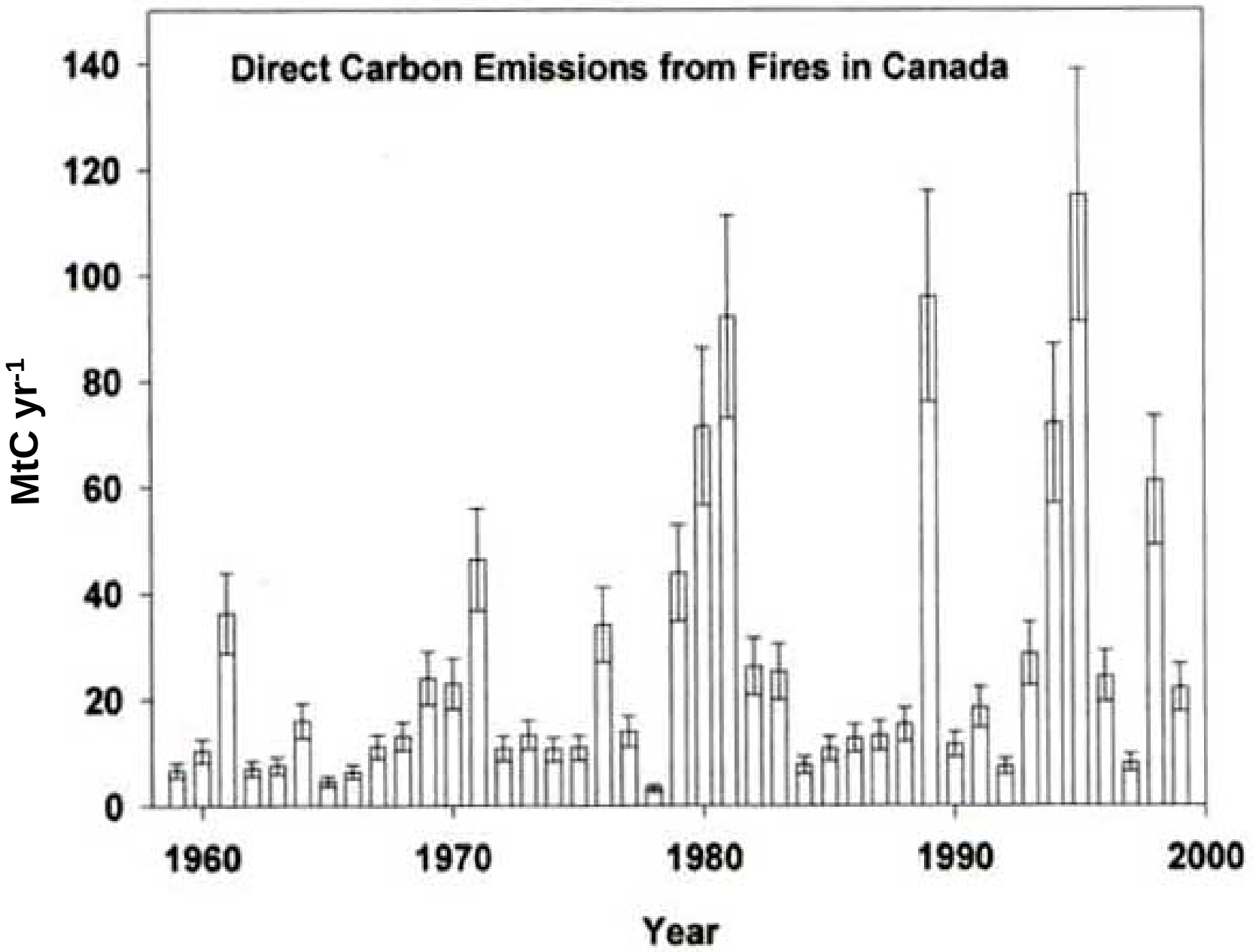
Feasibility Assessment

Estimated Internal Rate of Return from Afforestation Projects on Kyoto Eligible Lands in Canada



Source: NRCan

Reducing Emissions


Direct Carbon Emissions from Fires in Canada
MtC yr-1
140
120
100
80
60
40
20
0
1960
1970
1980
1990
2000
Year

Forest Products Industry

- Responsible for 40% of energy consumed by the manufacturing sector in Canada.
- Responsible for 12% of CO_2 emissions (because CO_2 emissions from biofuels don't count in GHG inventories).

The B.C. forest industry has already reduced its GHG emissions below 1990 levels. It has done so by:

- **Replacing fossil fuel energy with biomass energy**
- **Increased efficiency of processes**
- **Less GHG-intensive fuels (e.g., natural gas) have replaced Bunker C oil**
- **Closing down**

Bioenergy

Solution or Threat?

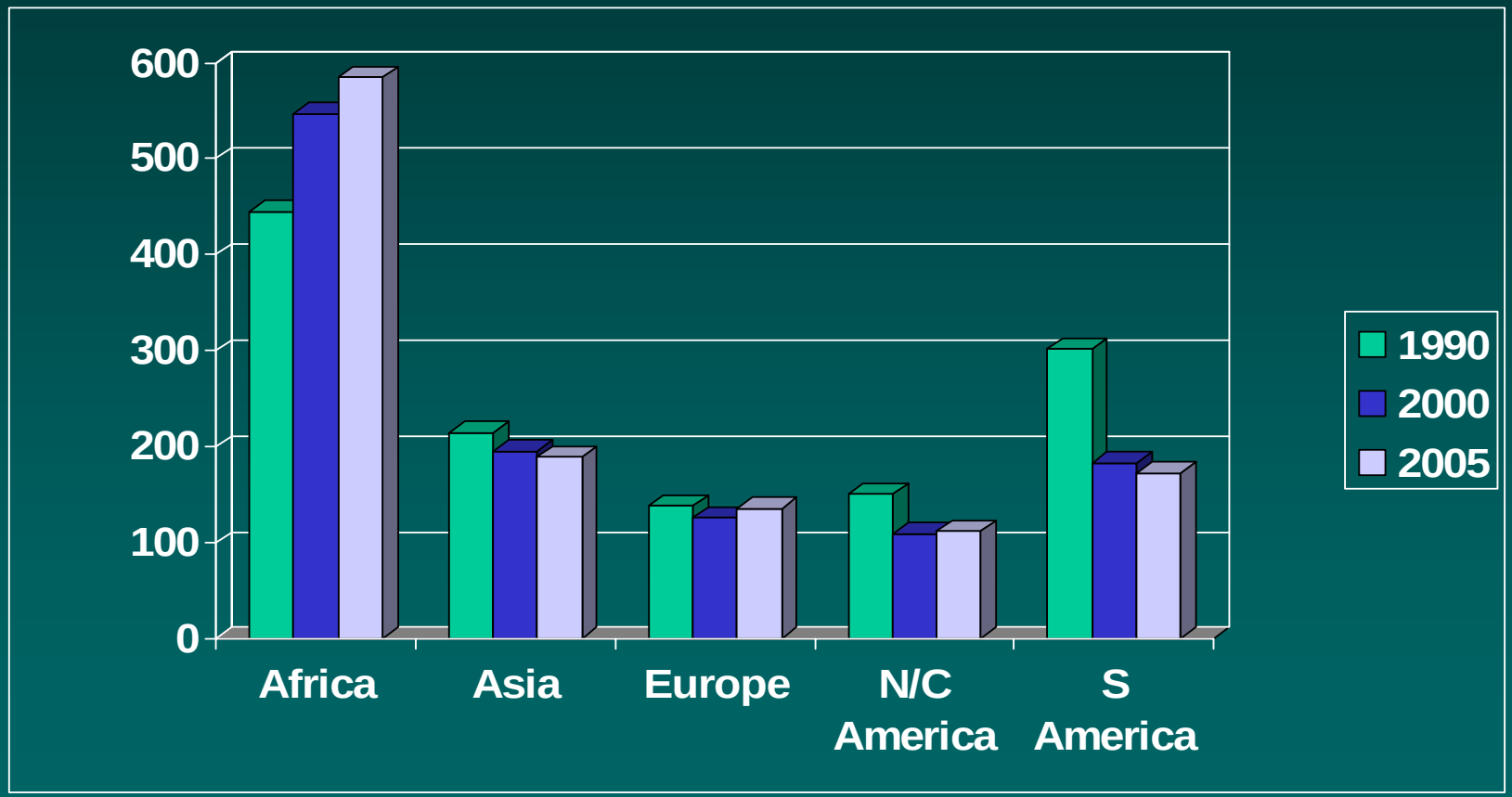
Source of fuel

- Biofuels are the primary source of energy for a significant proportion of the world's population
- 80% of the World's rural population rely on biofuels to satisfy their cooking energy needs
- 40% of all wood removals from forests are for fuel, with additional removals from non-forest areas. This proportion has remained constant since the 1980s

	Fuelwood (million m^3)	% of total removals
Africa	591	88
Asia	189	52
Europe	139	20
North/Central America	112	13
Oceania	10	15
South America	173	44
World	1214	40

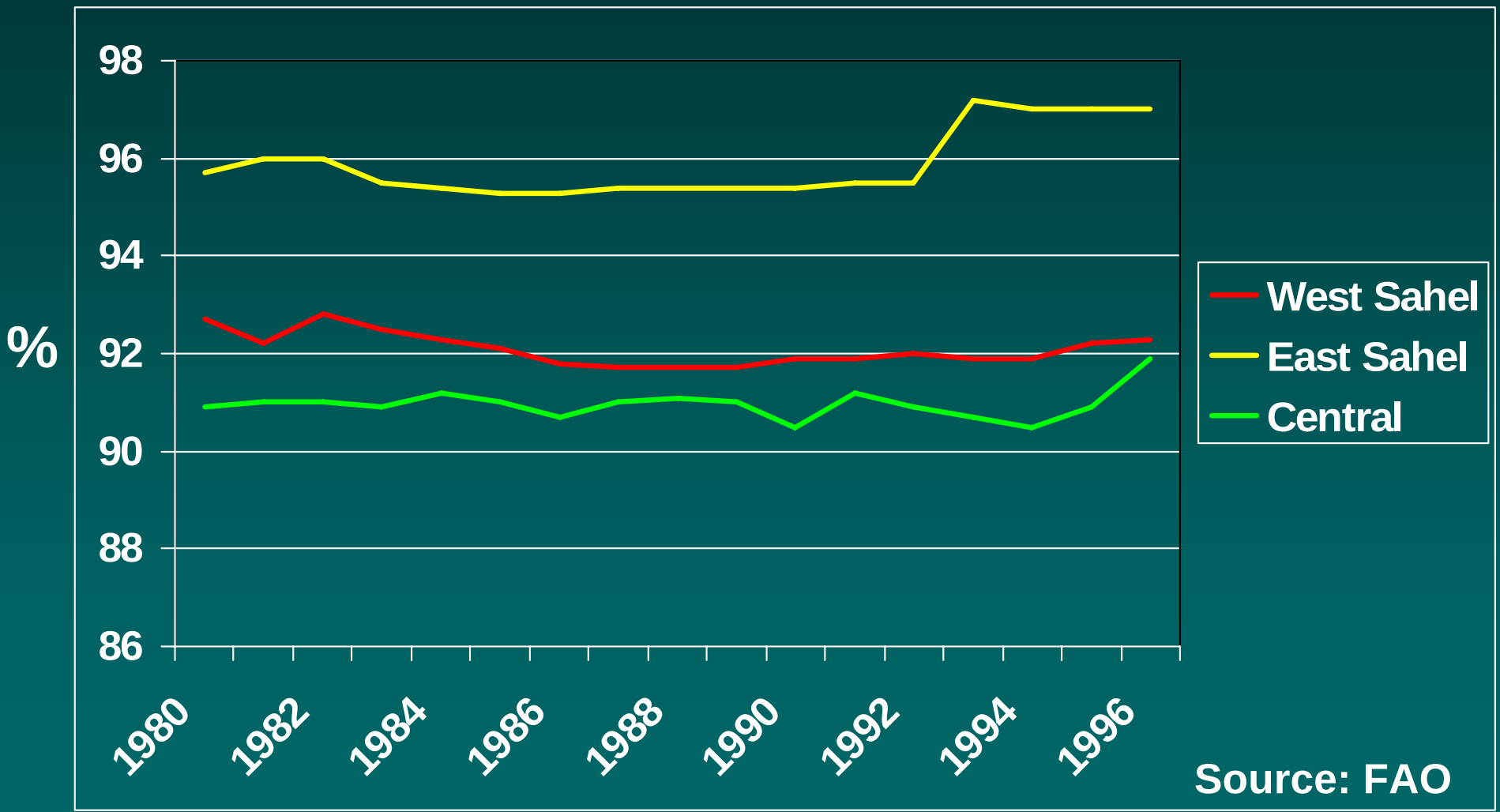
FAO

Fuelwood Consumption



Source: *Global Forest Resources Assessment 2005*

Fuelwood trends in Africa (% of total wood removals)




Near Agra, India

Afforestation

- Large areas of land available for afforestation
- Could be combined with environmental improvements
- Potential adverse ecological effects
- Potential adverse effects for water supply
- Role of genetically-modified crops


Fujian Province,
China


Casuarina plantation
Egypt

Afforestation, Paeroa Forest, NZ

Sabie, South Africa


Sabie, South Africa


Nechako Lumber Company Ltd.
L&M Lumber Ltd.
567-4701
TRUCKS WANTED
VANS or FLAT DECKS
for Vancouver and Edmonton
PHONE (250)563-3423
PREMIUM PELLET LTD.

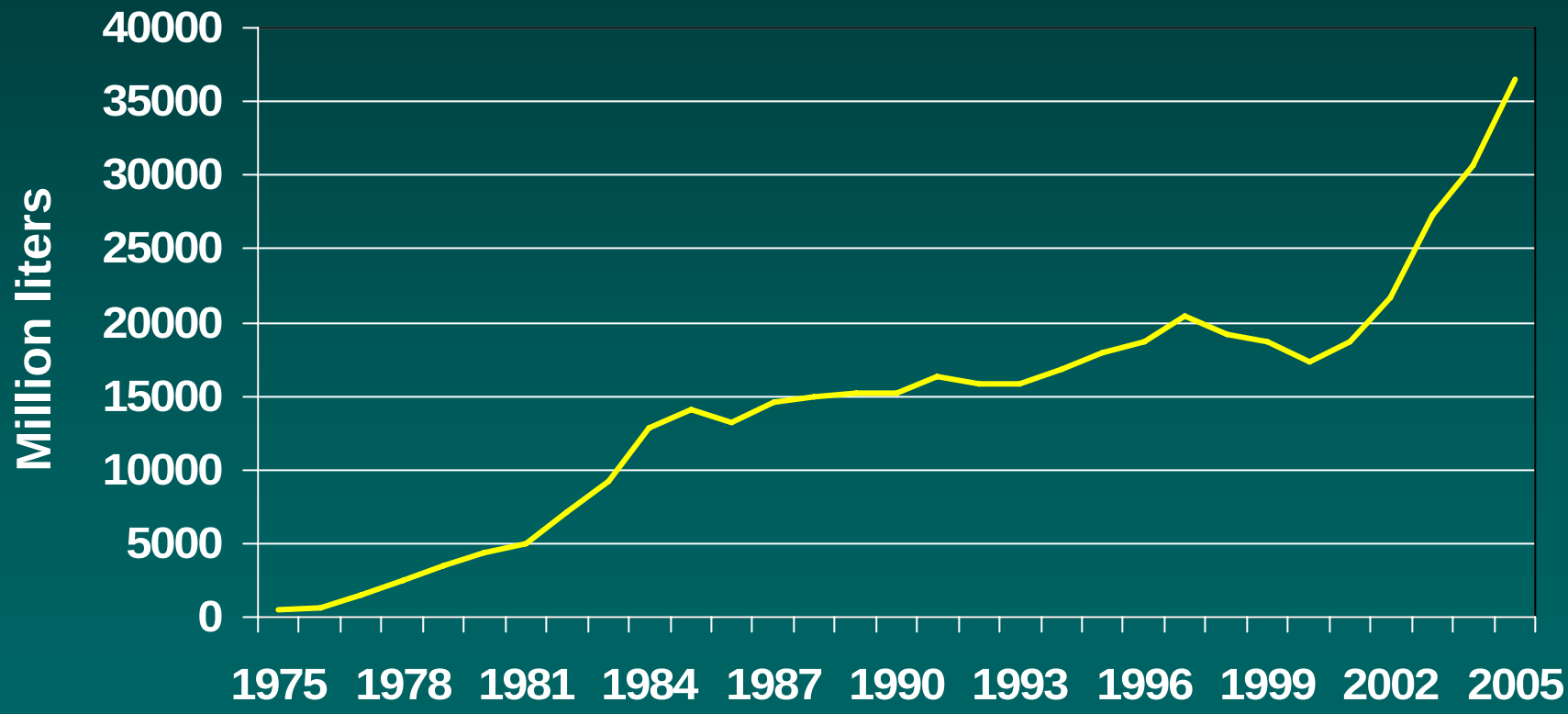
Ethanol production

“Converting wood to ethanol consumes 57% more energy that it produces”.

Pimental and Patzek (2005)

***Natural Resources Research* 14, 65-76**

Ethanol production



Source: *F.O. Licht's World Ethanol & Biofuels Report*

Sea to Sky

Mangroves and mountains

Mangrove deforestation

- Current rates are high, but FAO statistics suggest overall rate of loss has decreased over the past 20 years
- 18.8 million ha in 1980, 15.2 million ha in 2005
- Rate of loss has decreased from 1.7% a year in 1980-1990 to 1% a year from 1990-2000

Charcoal

- Charcoal is the main mangrove product in Thailand, Peninsular Malaysia, Sumatra, Myanmar and southern Vietnam
- Used for cooking and small-scale industries

Fuelwood

- While mangroves are used to make charcoal for cooking in Asia, in Africa, the wood is used directly for cooking and smoking fish and other products.
- In Africa, fuelwood is also used in boiling brine to produce salt.

Firewood production, Sierra Leone

Mangroves and the 2004 tsunami

“The loss of many lives and destruction of property and natural resources by the recent tsunami has brought into focus the importance of conserving coastal habitats. The scale of the damage may have been significantly lower if mangrove ecosystems and coastal forests had been nurtured and protected”

Statement from Commonwealth Forestry Conference, 28 February – 5 March 2005.


Gale
Sri Lanka







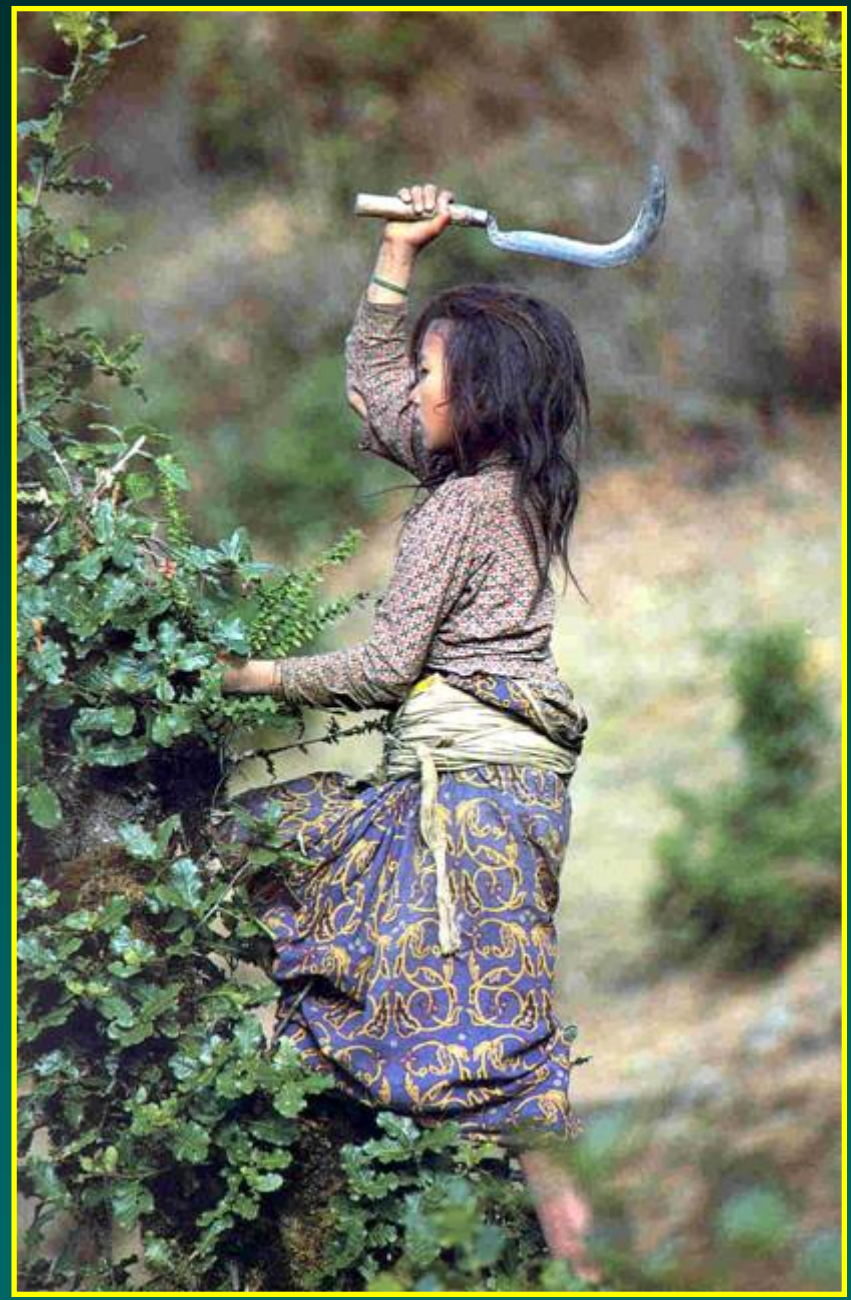


Mountains

- 570 million people live in mountain areas
- Majority of these are in developing countries
- Densities exceed 450 people km^{-2} in some areas: the highlands of Papua New Guinea, the Vale of Peshawar in Pakistan, the Virunga region of Rwanda, and Mount Kenya
- Many are entirely dependent on bioenergy

Dependent on forests

- Fuel
- Fodder
- Shelter
- Protection
- NTFPs



Solan, India


Songpan, China


Kyoto, Japan

Bioenergy and IUFRO

- 1.03.02 Applied temperate short-rotation forestry
- 1.03.03 Applied tropical short-rotation forestry
- 5.07.00 Energy and chemicals from forest biomass
- 5.07.01 Wood carbonization
- 5.07.02 Chemicals from wood

With the exception of 1.03.02, all show little sign of activity

Conclusions

- The use of bioenergy has been proposed as a potential solution to some of the problems related to climate change
- For wood energy, there has been a lack of integration with forestry
- Potential adverse environmental and socio-economic effects need careful consideration