Background to understanding environmental and resource problems in LICs

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Literature used: Dinda (2004), Levinson and Taylor (200

Wagner and Timmins (2009):
https://link.springer.com/article/10.1007/s10640-008-9236-6

The Environmental Kuzents Curve Hypothesis

- EKC hypothesis implies a specific relationship between environmental quality and national per-capita incomes.

- When per-capita incomes grow, starting from a «low» level, environmental quality deteriorates, up to a point.

- When per-capita incomes grow further, environmental quality improves.

- EKC describes aspects of the tension between needs for material improvements through income growth, and life quality represented by environmental variables.

Basic explanations for the EKC hypothesis

1. Income elasticity and environmental quality demand: Environmental quality is a «luxury good» whose demand increases with income

2. Scale effects: Pollution increases with output (up to a point)

3. Composition effect: As incomes rise, relatively more demand and output gradually shifted to cleaner sectors (services)

4. Technology effect: Higher incomes leads to greater emphasis on technology developments for getting rid of environmental problems

Explanations based on international trade

- Displacement hypothesis: Poor countries may tend to specialize on dirty production, richer on clean production

- Pollution haven hypothesis: Related issue, but deals with moving of dirty activity from rich to poor countries

- Race to the bottom: A related issue but where poor countries compete to attract dirty industries.

Explanations based on market mechanisms

- Relative prices of natural resources tend to fall in higher-income countries; takes away emphasis on this type of production

- Market pressure through environmentally conscious behavior of producers and consumers

Regulation

- Formal regulation: Pollution will grow unless environmental regulation is strengthened

- Informal regulation: May substitute for formal regulation in many situations

- Property rights: Improved property rights may strengthen environmental and natural resource management in higher-income societies.

Empirics

- Empirical relationships between per-capita income and environmental quality variables have been estimated.
- Most show that a turning point exists at per-capita incomes between $3,000 and $10,000.
- EKC relationship depends on a) how necessary is a pollutant and b) how easy is it to substitute out or replace.
- For air quality and water quality evidence is mixed, but in many cases an EKC relationship.
- For climate emissions, no EKC relationship. (Carbon has been too difficult to substitute out, yet.)

Impacts

- Local versus global EKC: Estimated curves have been national. Question whether global relationships exist. This is different as, for national analyses, activity can shift between countries.

- Short-run or permanent: Less clear whether permanent relationships can be found.

- Several critiques can be raised against the EKC concept, such as n-shaped curve for some pollutants; development paths are different for different sets of countries thus producing different curves.

Development and pollution: Some general observations

- From EKC considerations: Pollution should first increase, then after some point be reduced, with higher level of development.

- This seems (at least superficially) to hold in the real world: As some countries rapidly develop their economies, pollution levels may rise rapidly as well. But the most advanced societies are avoiding the worst impacts of pollution.

Carbon emissions intensity (tons C per capita) by income (GDP per capita, PPP adjusted)
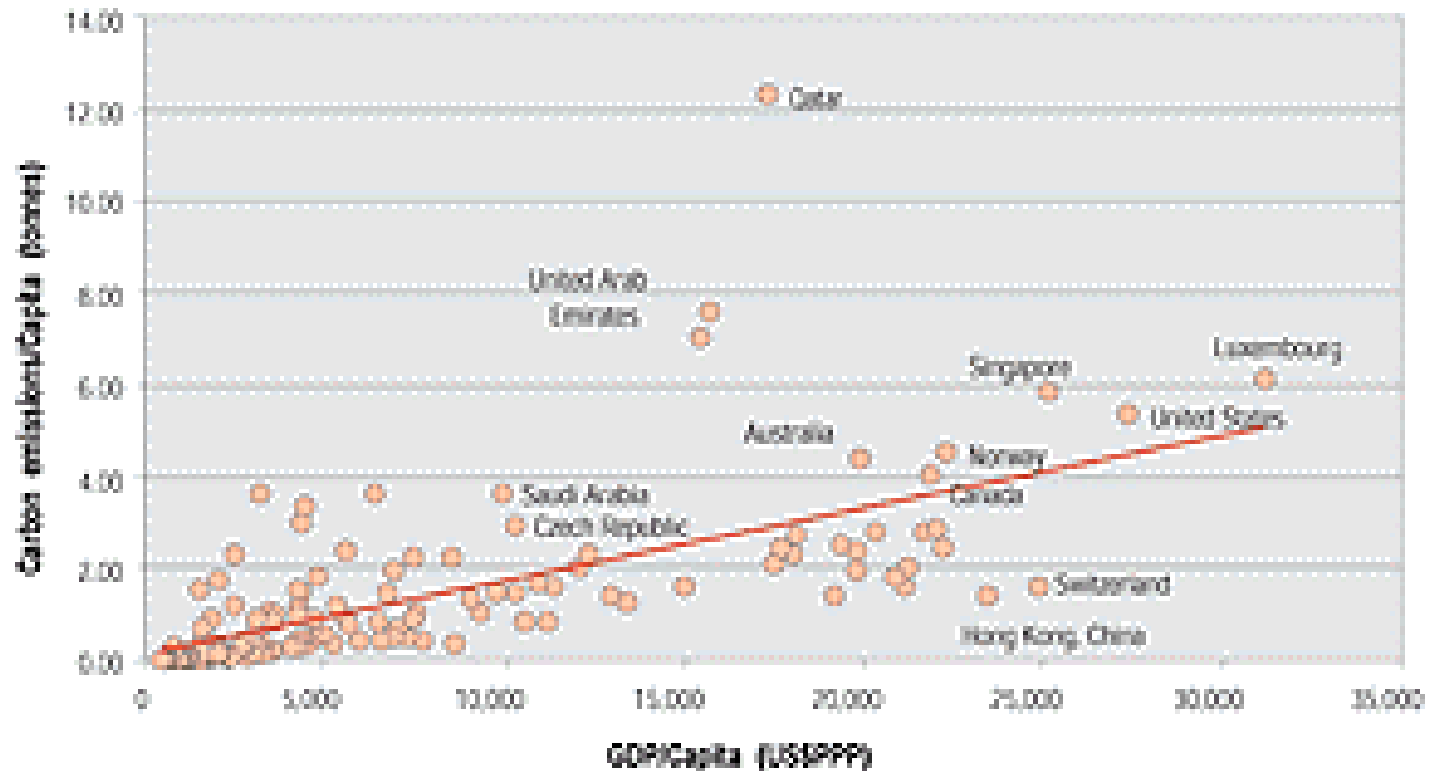
Figure in previous slide shows:

- Low-income countries generally have very low carbon emissions per capita

- Some middle-income countries (in particular those developing rapidly) have much higher emissions levels

- Most countries at the highest income levels have only moderate carbon emissions per capita. There are some exceptions, mostly net energy exporters.

Some recent developments for natural resources with particular relevance for LICs

- During the last 50 years we have witnessed deterioration of the state of natural resources globally, most so in certain lower-income countries (LICs).

- Deterioration has been experienced most in terms of degradation of previously undisturbed lands, in particular the loss of tropical forest.

- Also biodiversity has been and is being sharply reduced.

- Deterioration has been strongest in middle-income countries with strong growth and high pressure on resources, without similar concern for the protection of resources (South Asia; Latin America).

- The problem is somewhat less in the poorest areas (Sub-Saharan Africa), but also there the pressure is also increasing, with economic growth.
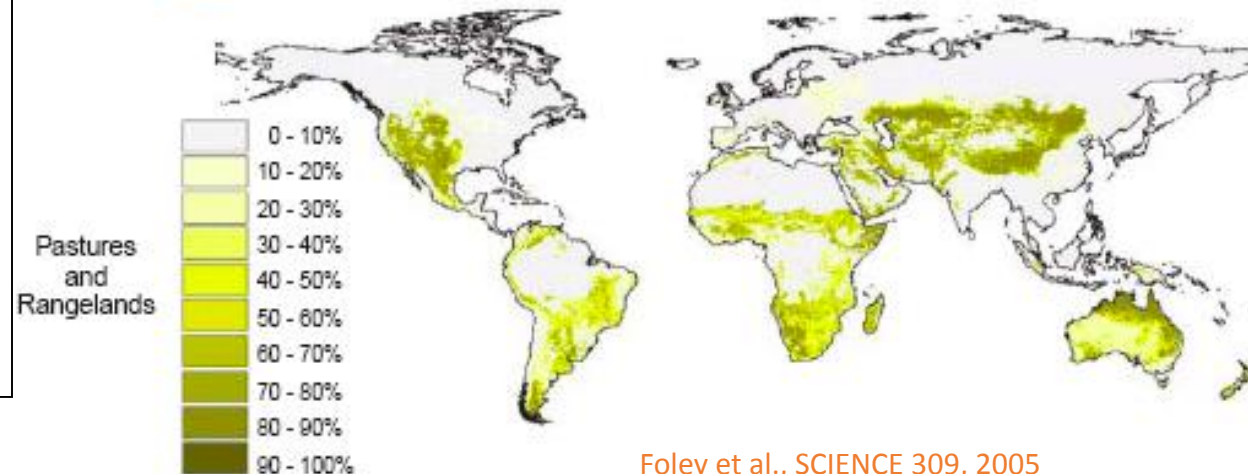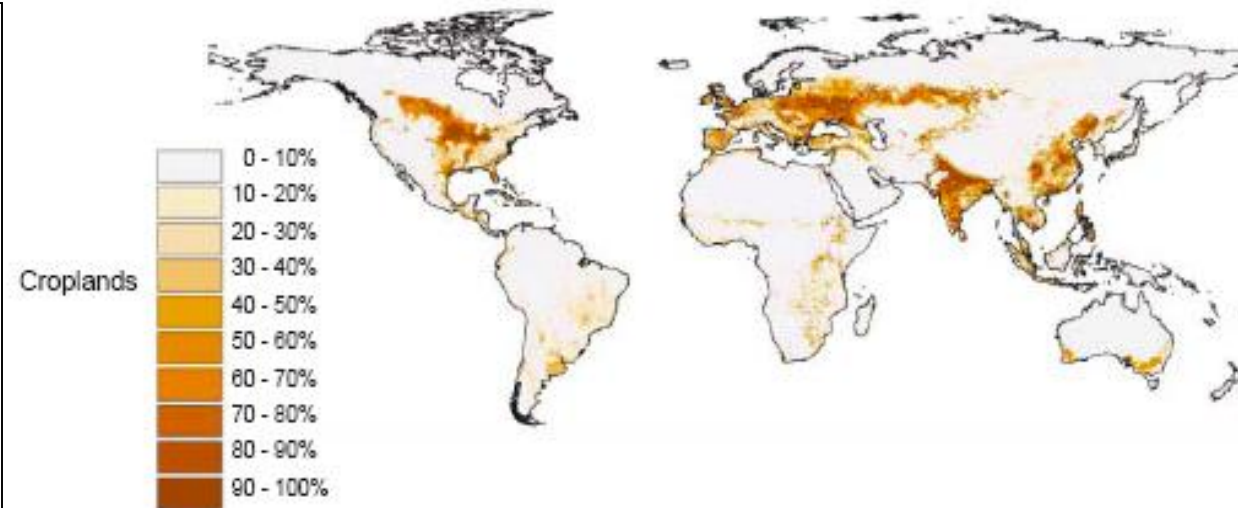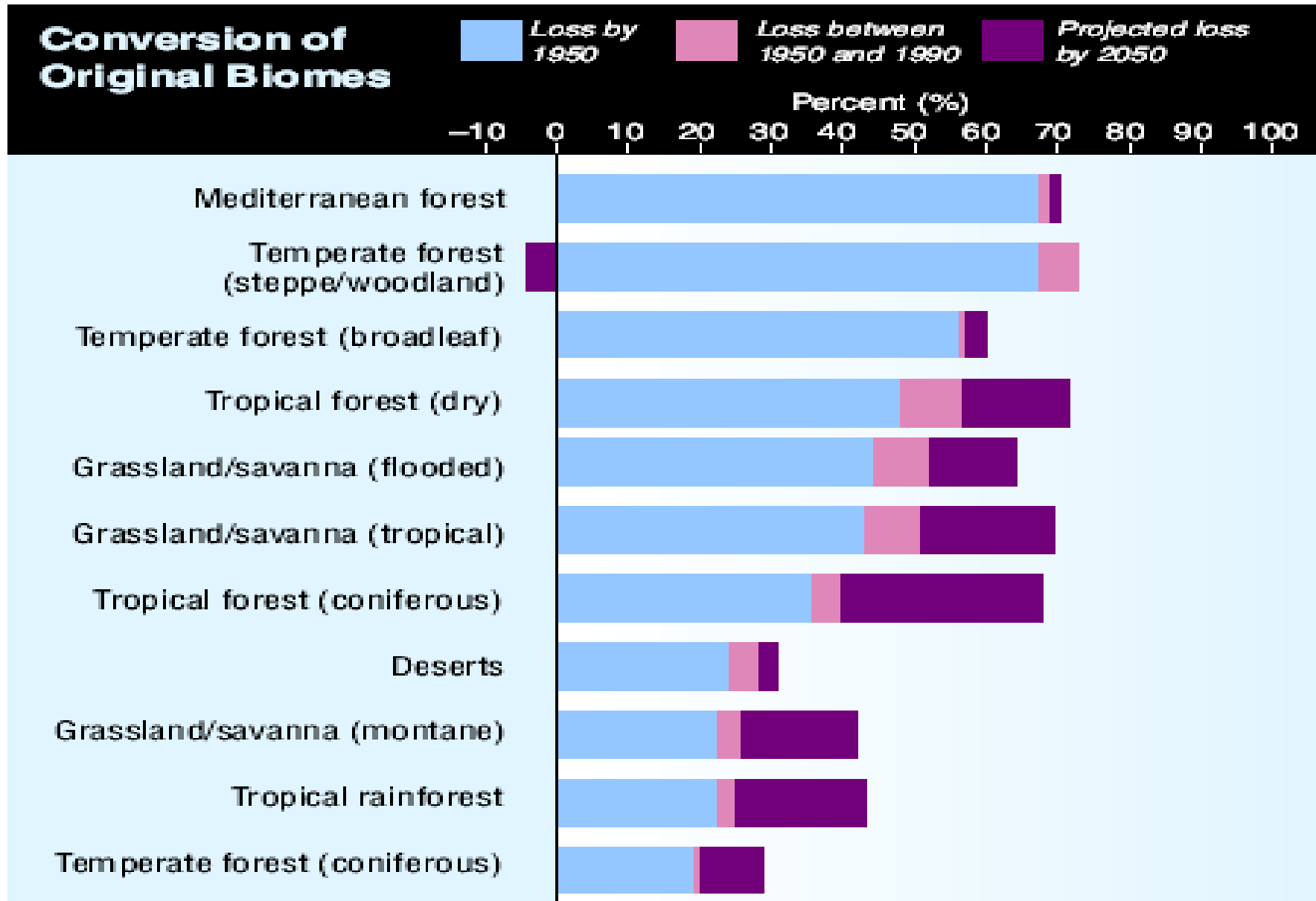
The competition for land
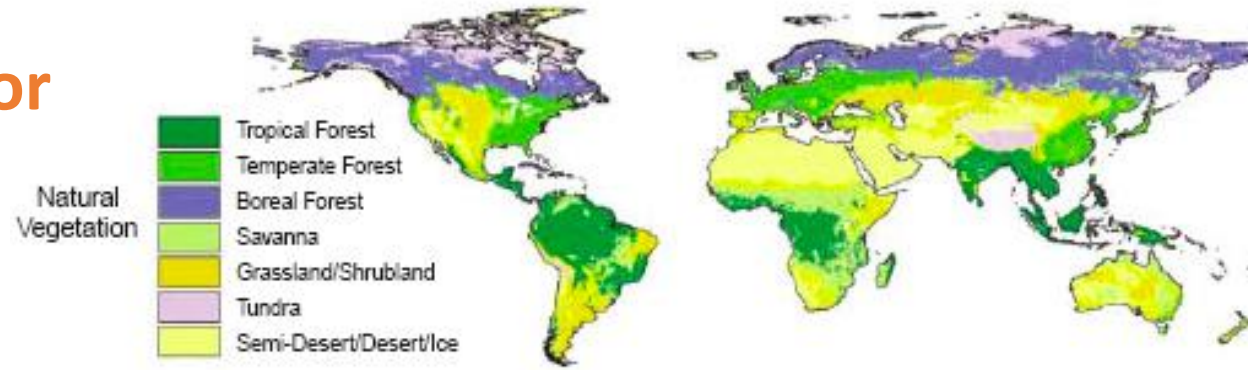
Croplands & pasture-lands now cover ~40% of world land area.

Forest area has declined by ~10 million km2 (about 20%) in the last 300 years, with most of the loss in the last 50.

Desert & near-desert land has **increased** by nearly as much.

Cities, roads, & airports now cover 2% of world land.

Foley et al., SCIENCE 309, 2005

Conversion of Original Biomes

Legend: Loss by 1950 · Loss between 1950 and 1990 · Projected loss by 2050

Percent (%): −10, 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

- Mediterranean forest
- Temperate forest (steppe/woodland)
- Temperate forest (broadleaf)
- Tropical forest (dry)
- Grassland/savanna (flooded)
- Grassland/savanna (tropical)
- Tropical forest (coniferous)
- Deserts
- Grassland/savanna (montane)
- Tropical rainforest
- Temperate forest (coniferous)
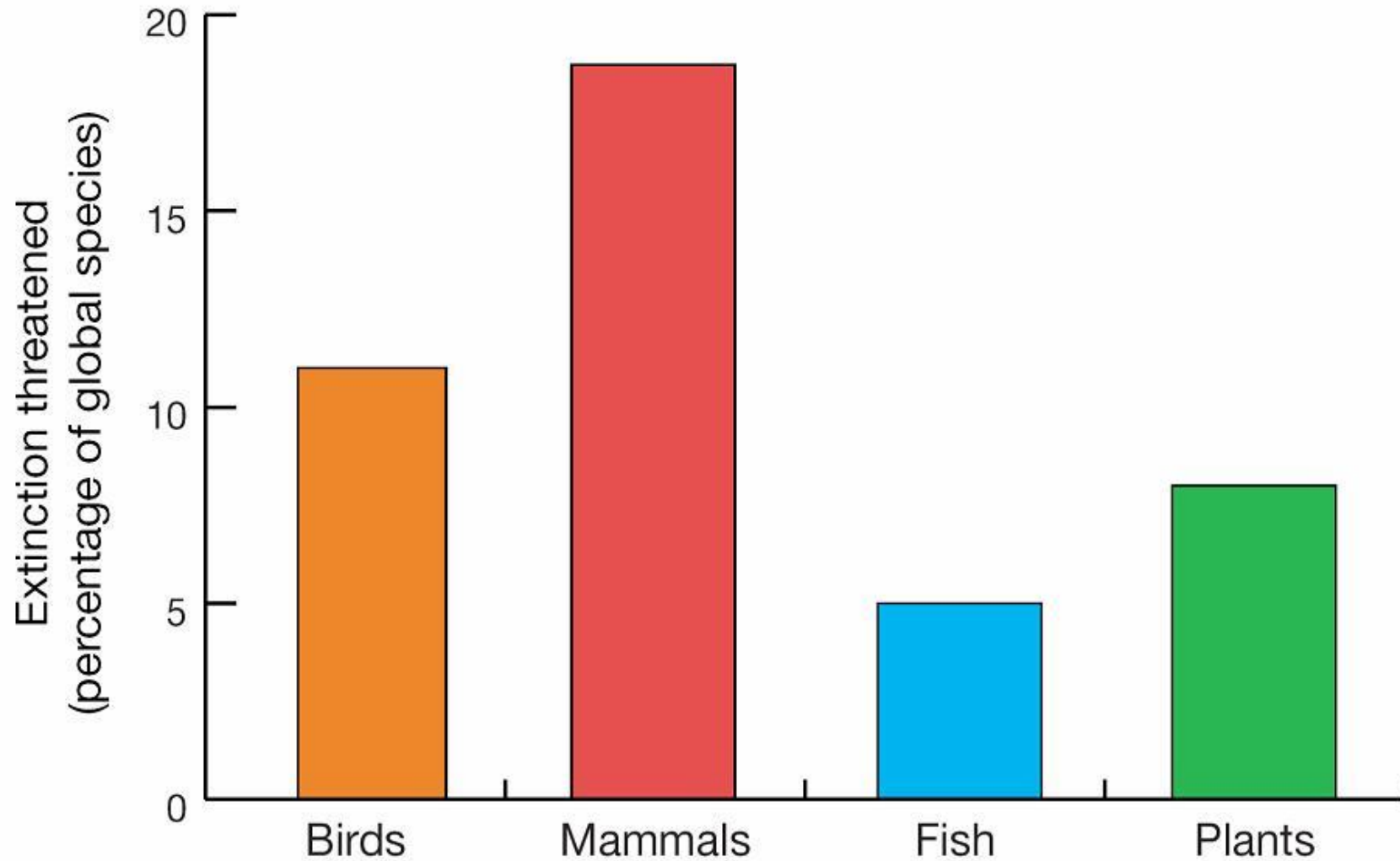
Millennium Ecosystem Assessment 2005
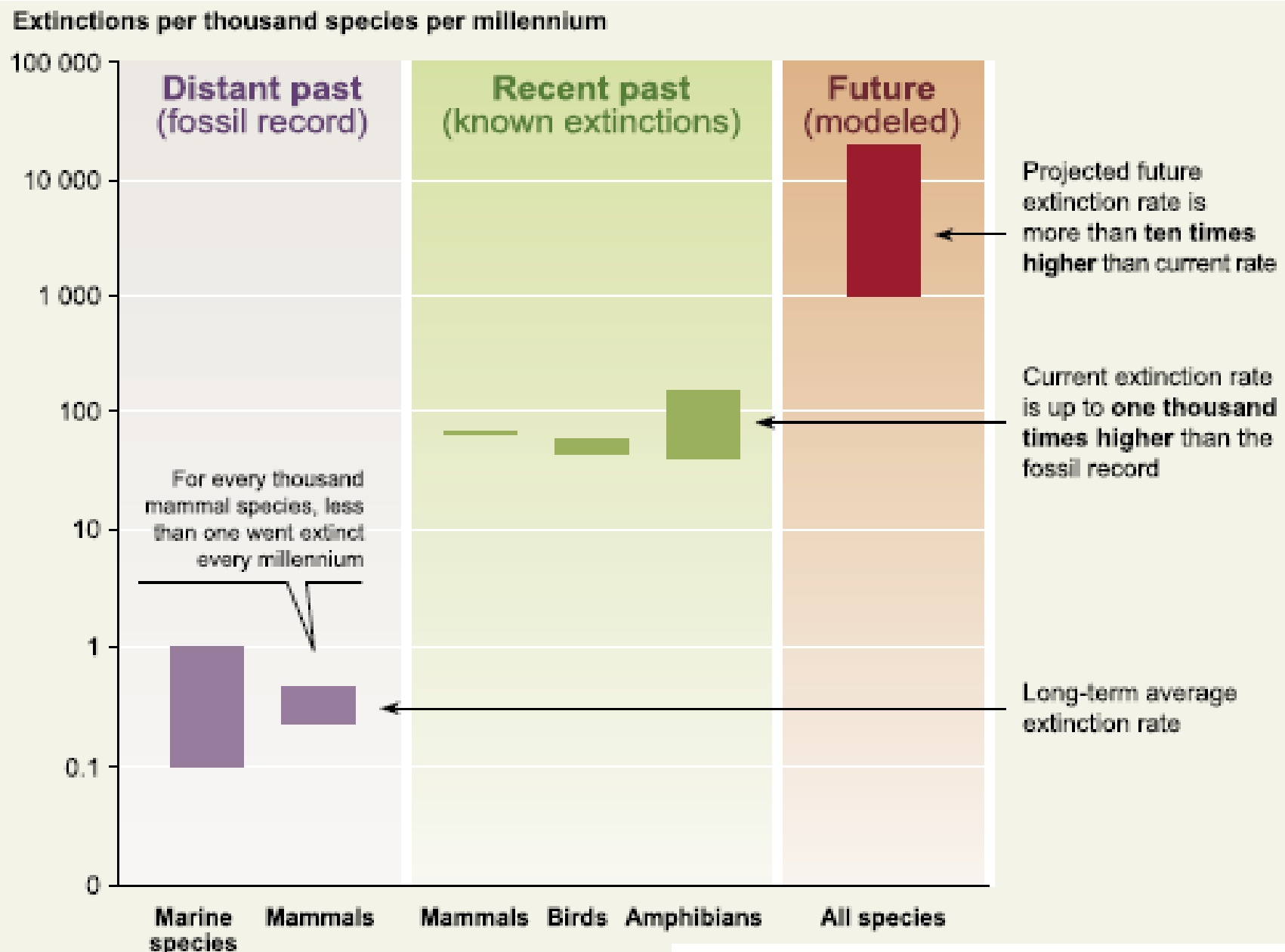
Previous slide shows

- Much forest land already lost by 1950, in particular in Europe and North America, but also elsewhere

- Between 1950 and 1990, more forest was lost in LICs

- As projection up to 2050, much more forest will likely be lost in LICs, in particular tropical rainforests which are most biodiverse

Percentage of species threatened with extinction

Chapin et al., 2000

Comparing past, present, and future extinction rates

Extinctions per thousand species per millennium

Distant past (fossil record)

Recent past (known extinctions)

Future (modeled)

Projected future extinction rate is more than **ten times higher** than current rate

Current extinction rate is up to **one thousand times higher** than the fossil record

For every thousand mammal species, less than one went extinct every millennium

Long-term average extinction rate

Marine species · Mammals · Mammals · Birds · Amphibians · All species

Source: Millennium Ecosystem Assessment

What factors contribute to the distribution of polluting activity between HICs and LICs?

- Roughly speaking, environmental pollution and other serious environmental problems are over time driven by two main factors (or, at least, this is the way it has been so far):

- 1. *Economic activity*. The countries with the highest activity have traditionally had more pollution burdens than countries with less activity. Industrialization in the 19th and early 20th century led to pollution mainly in HICs (UK, US, rest of Europe), where most industrial activity was.

- 2. *Efforts to deal with, and get rid of, the problems related to pollution*. Initially, these HICs did little to deal with pollution. From, roughly, around 1950 on, however, cleaning up in these countries has become a high priority. This has led to (vastly) reduced pollution loads in these countries.

What factors have contributed to the increase in pollution and pollution damages in LICs?

- Increased industrial production, mining activity, in LICs: Has led to pollution stemming from this prodction

- Increased consumption in LICs: This has implied increased electricity production based on fossil fuels (mostly coal which is most polluting), more transport activity (gasoline and diesel consumption)

- Possibly: Absorpiton of some of the most polluting industrial activity that previously was located to HICs. The theory or hypothesis that this is a significant effect is called the «Pollution Haven Hypothesis».

Is there any empirical support for the «Pollution Haven Hypothesis» (PHH)?

- There is some support, although the data are not extremely clear.
- One mechanism: Stricter environmental regulation in one HIC may lead to pressure on the country's most polluting industries to move out and locate elsewhere, to countries with less strict regulations.
- The relationship might potentially be studied by considering relationships between FDI and environmental regulations, either across countries or across sectors in a given country.
- Another way is to study trade flows for particular sectors. If there is a strong increase in imports, it could indicate that own firms have moved out to other countries.
- For a given country, stricter environmental regulations will have most impact on those industries that pollute the most at the outset.
- Another factor is how mobile the sectors are: Do they produce mainly for, or have their raw materials from, the home market? If so, it is less likely that the PHH is verified for that sector.

Empirical support for the PHH exists, but is not overwhelming (this is difficult to demonstrate!). Examples are as follows.

- Wagner and Timmins (2009) find strong evidence in favor of the PHH for the German chemical industry (as FDI is large), but not for certain other sectors (metals and paper), which are about similarly polluting. A key factor seems to be that the latter sectors are more domestically oriented than the chemical industry. It is more costly for them to locate abroad.

  (U. J. Wagner and C. D. Timmins, Agglomeration effects in foreign direct investment and the pollution haven hypothesis. Environmental and Resource Economics, 43, 2009, 231-256.)

- Levinson and Taylor (2008) show that, for those industries where environmental abatement costs increased the most in the US from 1977 to 1986, net imports from Mexico and Canada increased the most. This indicates that activity in the sectors had been moved to these other countries.