



# Lecture 10: Environmental Issues in Development

HE3027: Development Economics

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# Learning Objectives

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By the end of this lesson, you should be able to:

- Discuss the correlation between environmental issues and economic development.
- Describe ways to model environmental issues.
- Explain the impact of urbanisation on environment.
- Analyse a case study on rain forest deforestation.



# Overview

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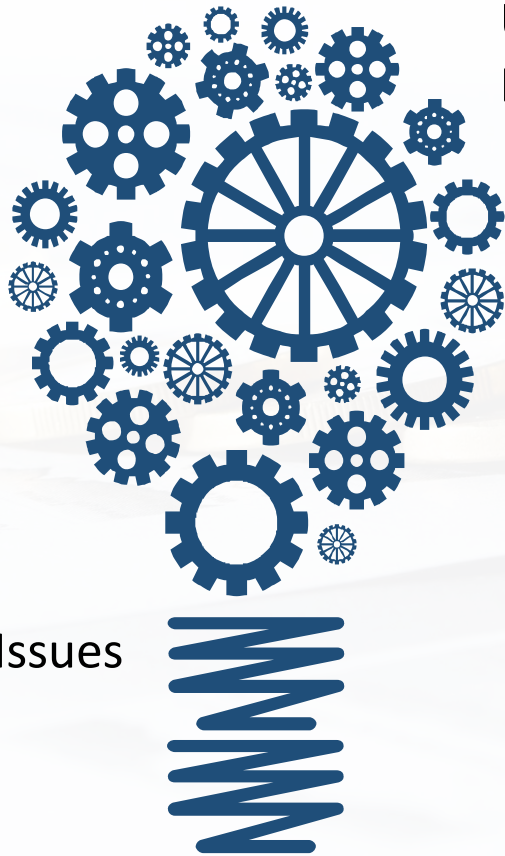
Modelling  
Environmental  
Issues

03

Urbanisation and  
Environment

01

Introduction to  
Environmental Issues





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# Introduction to Environmental Issues

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# Environment and Development

Environmental issues affect and are affected by economic development.

Classic market failures lead to too much environmental degradation.

Poverty and lack of education may also lead to non-sustainable use of environmental resources.

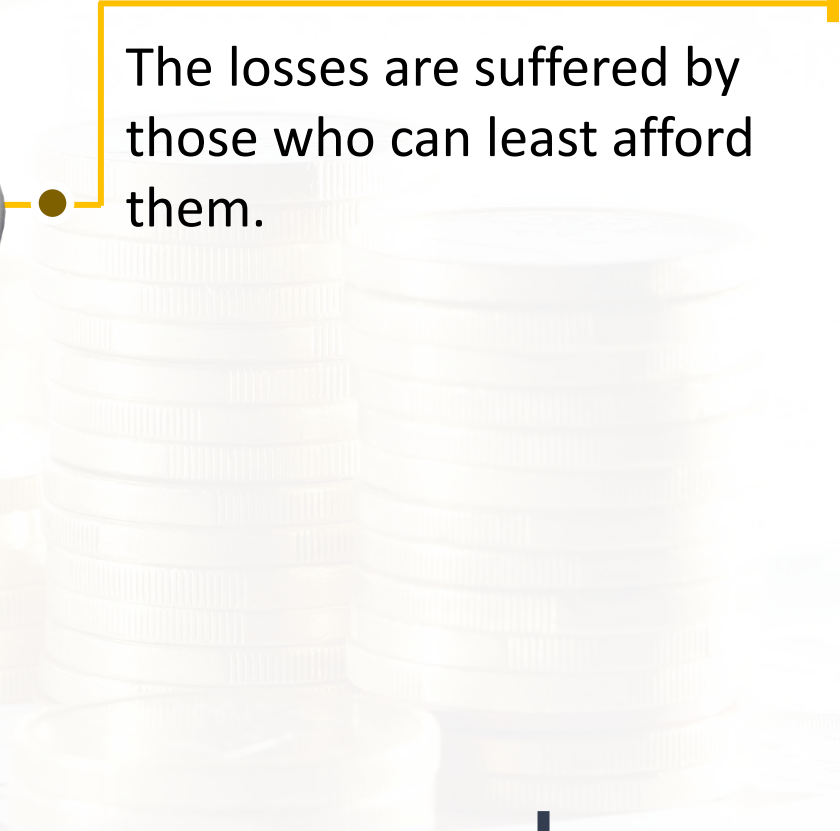
Global warming resulting in climate change is a growing concern in developing countries.





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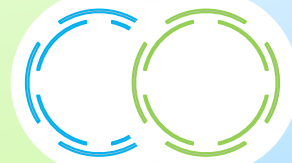
The losses are suffered by those who can least afford them.



The solutions to these and many other environmental problems involve enhancing the productivity of resources and improving living conditions among the poor to achieve environmentally sustainable growth which is synonymous to the definition of economic development.

# Sustainable Development and Environmental Accounting

Sustainable development has been defined as “meeting the needs of present generation without compromising the wellbeing of future generations”.



So, running down the capital stock is not consistent with the idea of sustainability.

Environmental and other forms of capital are substitutes only to a degree; eventually they likely act as complements.



In developing countries, the environmental capital is generally a larger fraction of total capital.

To know whether environmental capital is increasing or decreasing, **environmental accounting** is required.

# Sustainable Development and Environmental Accounting



Tools used for environmental accounting

Do an appropriate valuation of **future** social benefits.

01

Pay proper attention to **market failures**.

02

Value natural resources explicitly as a form of **capital stock** rather than just a stream of consumption.

03

Future growth and overall quality of life are critically dependent on the quality of the environment.



# Sustainable Development and Environmental Accounting

Sustainable net  
national product

$$\text{NNI}^* = \text{GNI} - D_m - D_n$$

Where,

$\text{NNI}^*$ : Sustainable national income

GNI: Gross national income

$D_m$ : Depreciation of manufactured capital  
assets

$D_n$ : Depreciation of environmental capital

# Sustainable Development and Environmental Accounting

More **expansively**, sustainable net national product is:

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$$NNI^* = GNI - D_m - D_n - R - A$$

Where,

$NNI^{**}$ : Revised NNI calculation

GNI: Gross national income

$D_m$ : Depreciation of manufactured capital assets

$D_n$ : Depreciation of environmental capital

$R$ : Expenditure needed to restore environmental capital

$A$ : Expenditure needed to avert destruction of environmental capital

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**(Note:**  $R$  and  $A$  are components of GNI but not  $NNI^{**}$ .)

# Poor: Victims and Agents of Environmental Degradation

## Victims

The poor live in environmentally degraded lands which are less expensive because the rich avoid them.

People living in poverty have less political clout to reduce pollution where they live.

Living in less productive polluted lands give the poor less opportunity to work their way out of poverty.

## Agents

The high fertility rate of people living in poverty.

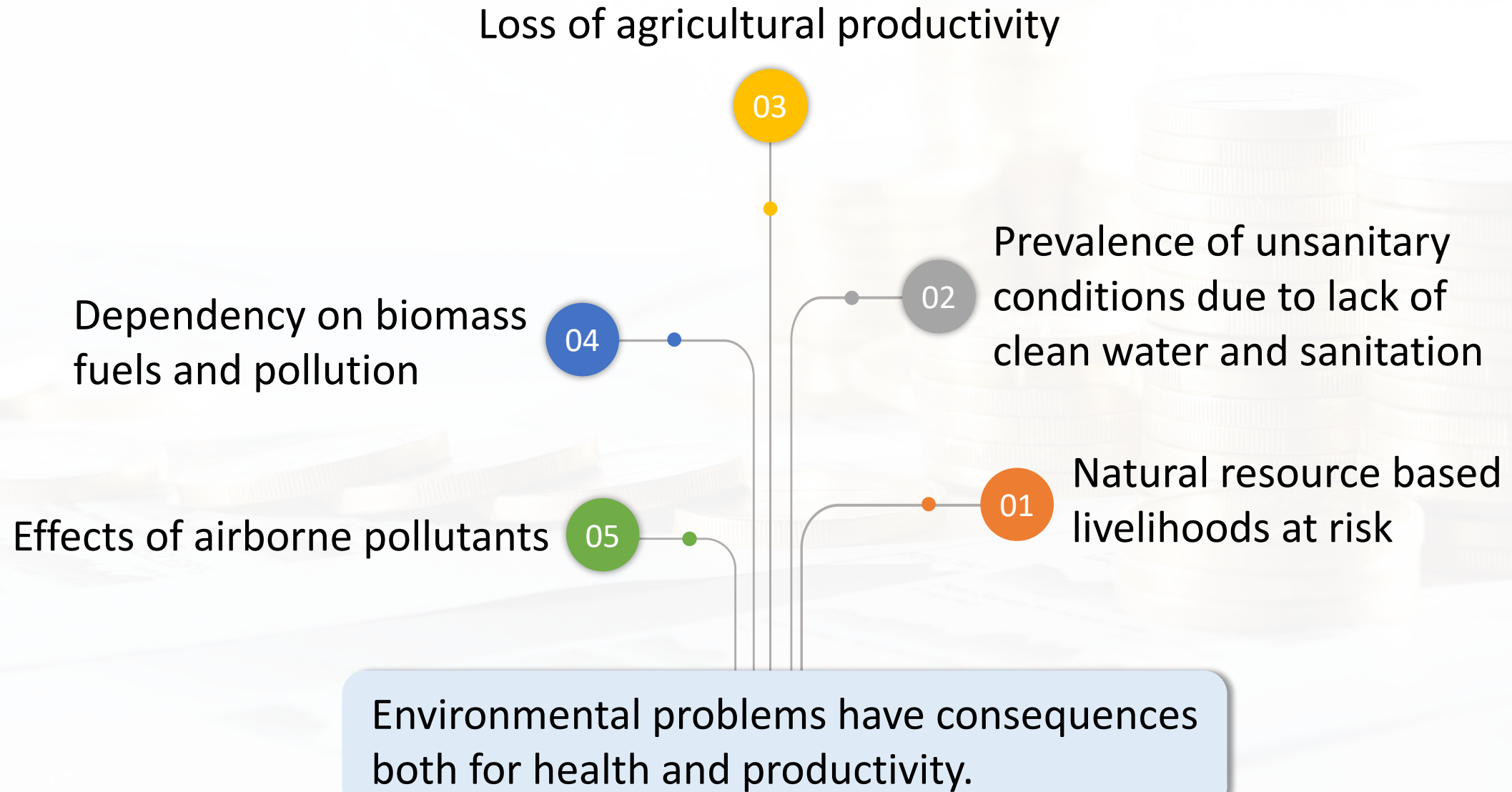
A short time horizon of the poor (by necessity).

There is land tenure insecurity.

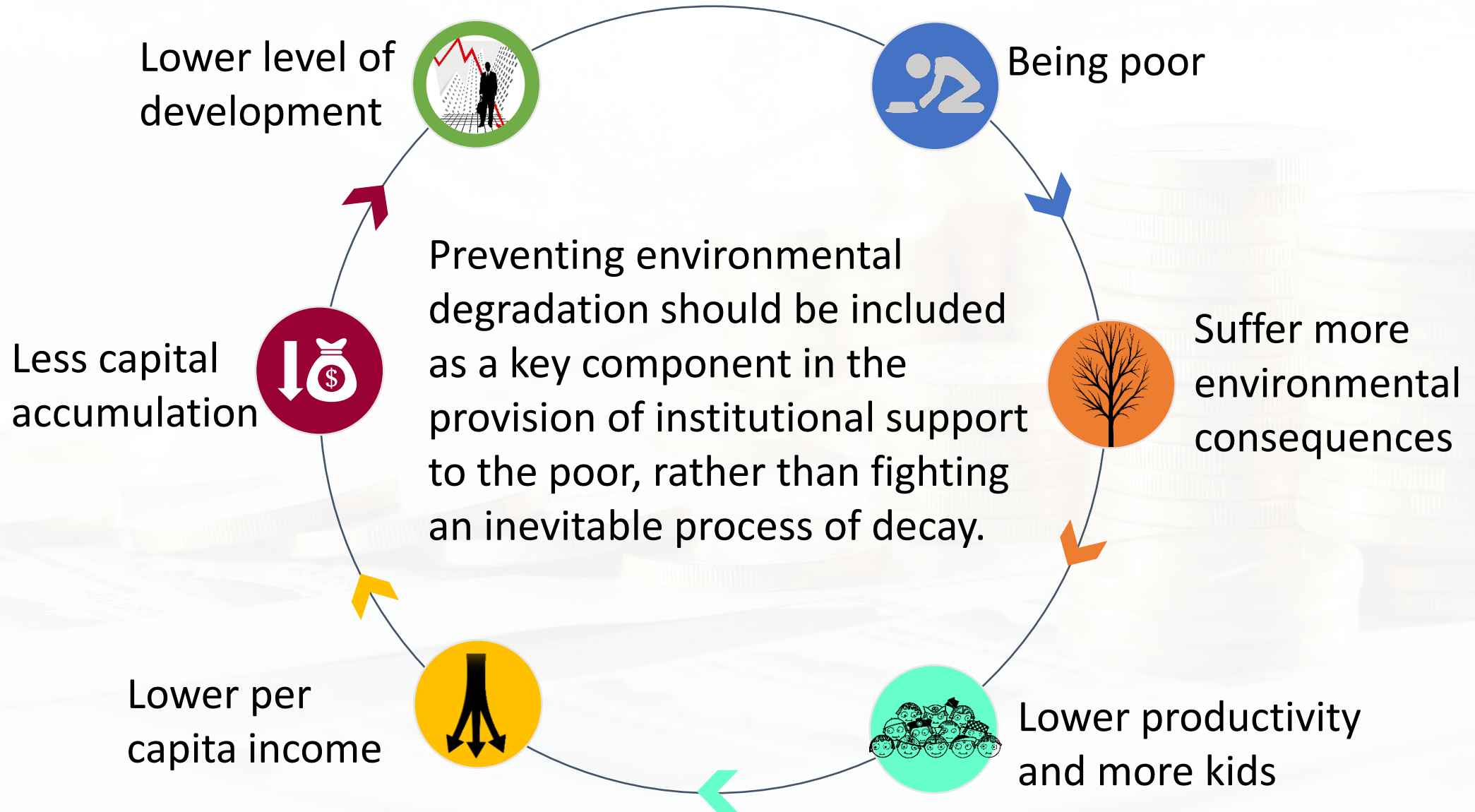
The incentives for rainforest resettlement.



# Poor: Victims and Agents of Environmental Degradation

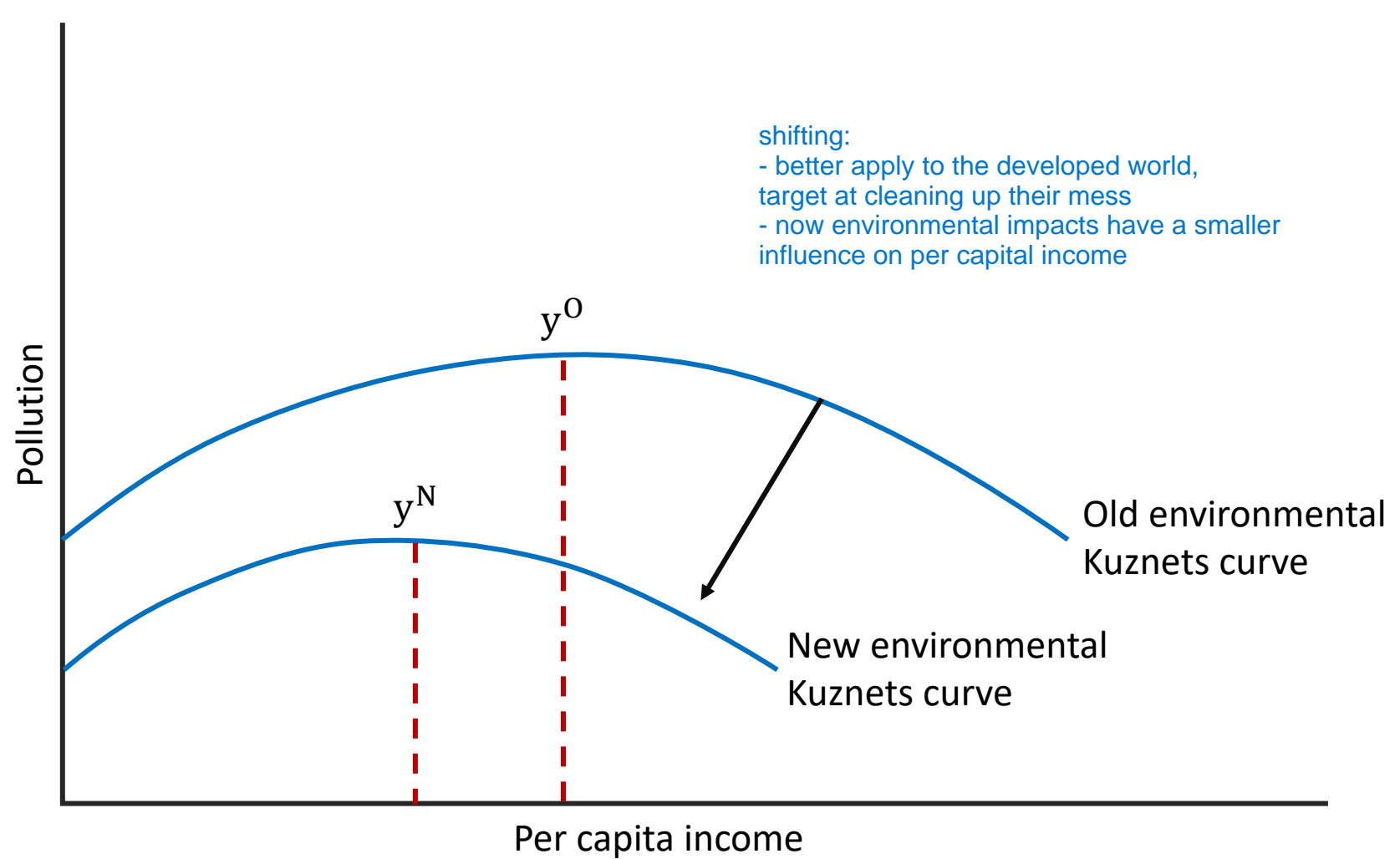


# Poor: Victims and Agents of Environmental Degradation



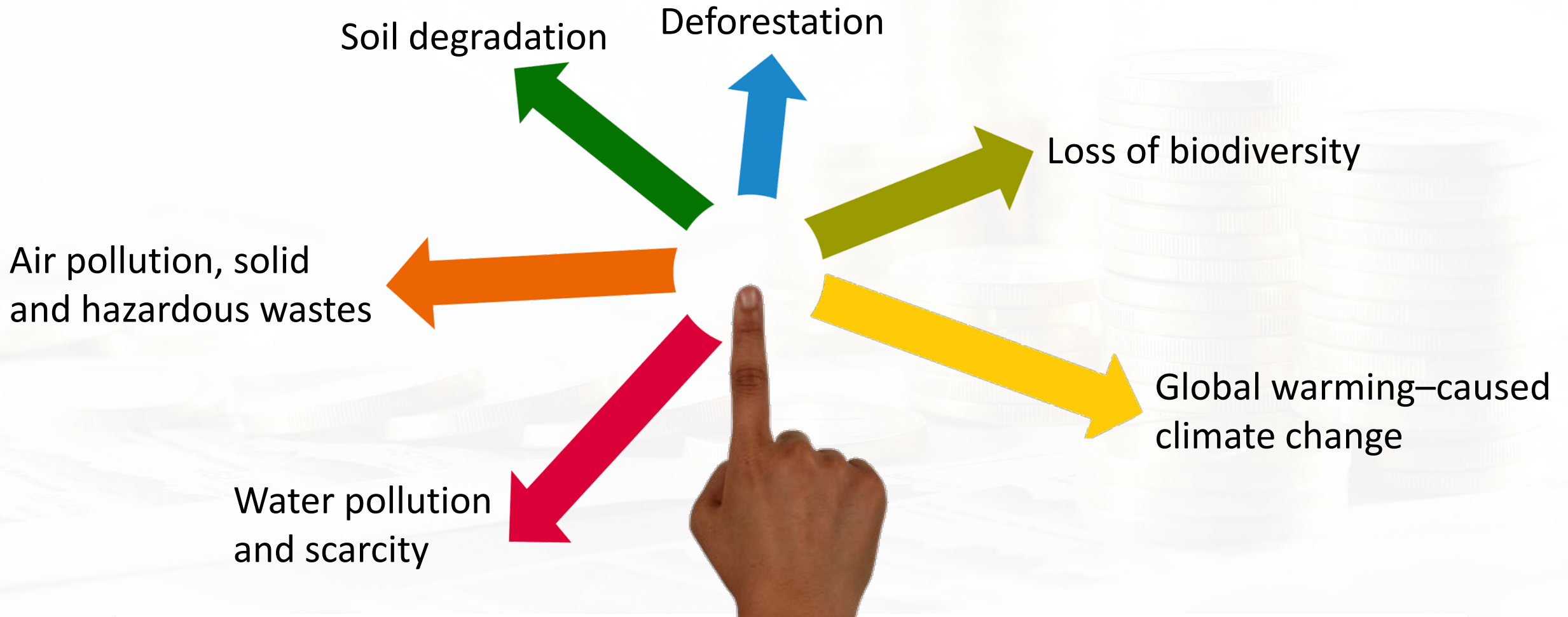
# Growth and Environment

Environmental pollution itself may cause slow economic growth; or third factors, such as bad institutions, can lead to both high pollution and low income per capita.





# Scope of Domestic Origin Environmental Degradation



The principal health and productivity consequences of environmental damage.



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# Modelling Environmental Issues



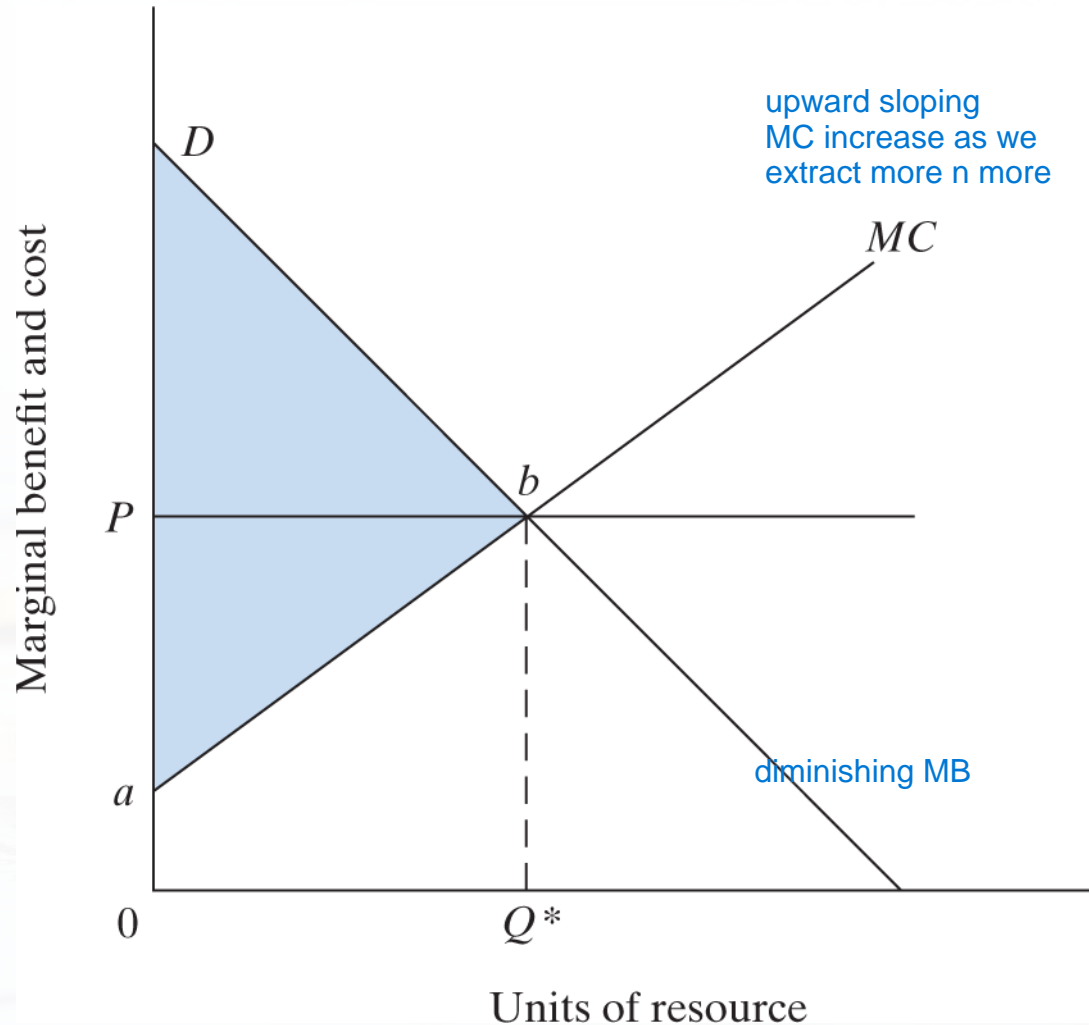
# Modelling Environmental Issues

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- Inefficiencies are likely to result from imperfections in property rights. Why?
- “Perfect” (complete) property rights are characterized by
  1. **Universality** —all resources are privately owned.
  2. **Exclusivity** or “excludability” —it must be possible to prevent others from benefiting from a privately owned resource.
  3. **Transferability** —the owner of a resource may sell the resource when desired.
  4. **Enforceability** —the intended market distribution of the benefits from resources must be enforceable.
- Example: Weak property rights for farmers who do not have land titles of the plots that they are farming on. What are the concerns?
  1. Appropriability of returns – might not be able to receive returns from land;
  2. Unwilling to invest – inefficient use of resources;
  3. Unable to receive credit using property as collaterals;
  4. Over-farming/hunting – depletion “tragedy of the commons”. E.g over-fishing, deforestation



# Recapping: Allocative efficiency (static)



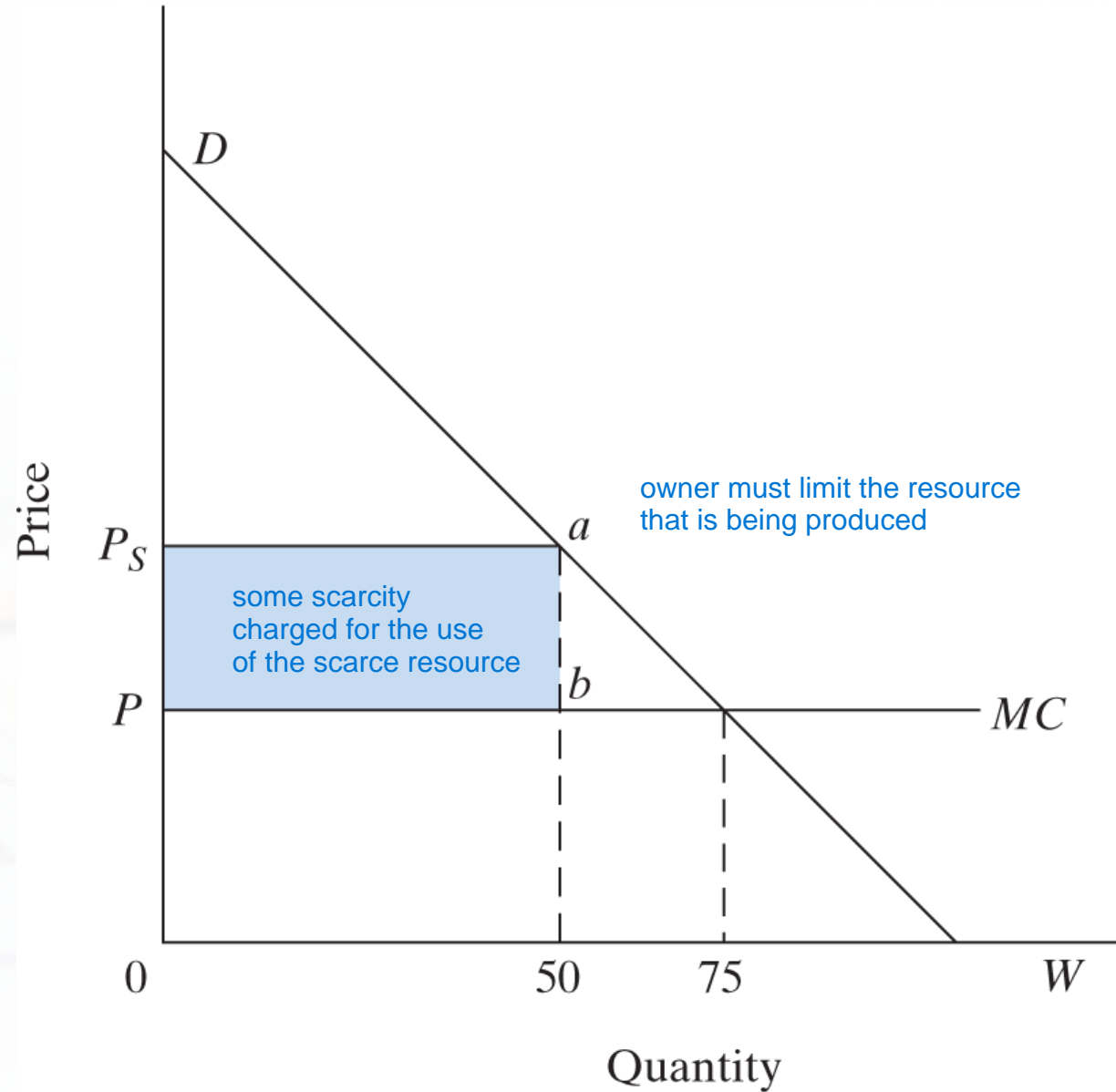
Neoclassical theory (1) to determine the optimal consumption of natural resources (2) illustrate how market failures cause inefficient allocation (3) how these distortions can be corrected.

Allocative efficiency: a.k.a pareto efficiency: maximizing the total net social benefits from the (at  $Q^*$ ) – when the marginal cost (S) of producing/extracting one unit of resource = marginal benefit (D) to the consumer.

Upward sloping MC due to increase marginal extraction cost; Downward sloping MB due to diminishing marginal returns.

Producer surplus:  $abP$  ; Consumer surplus:  $PbD$ ; Social surplus:  $Db a$  (maximized)

# Allocative efficiency over time



When resources are scarce, and are rationed over time, scarcity rents (blue area  $P_S abP$ ) may arise. Scarcity rents = premium charged for the use of a scarce/limited resource by the owner.

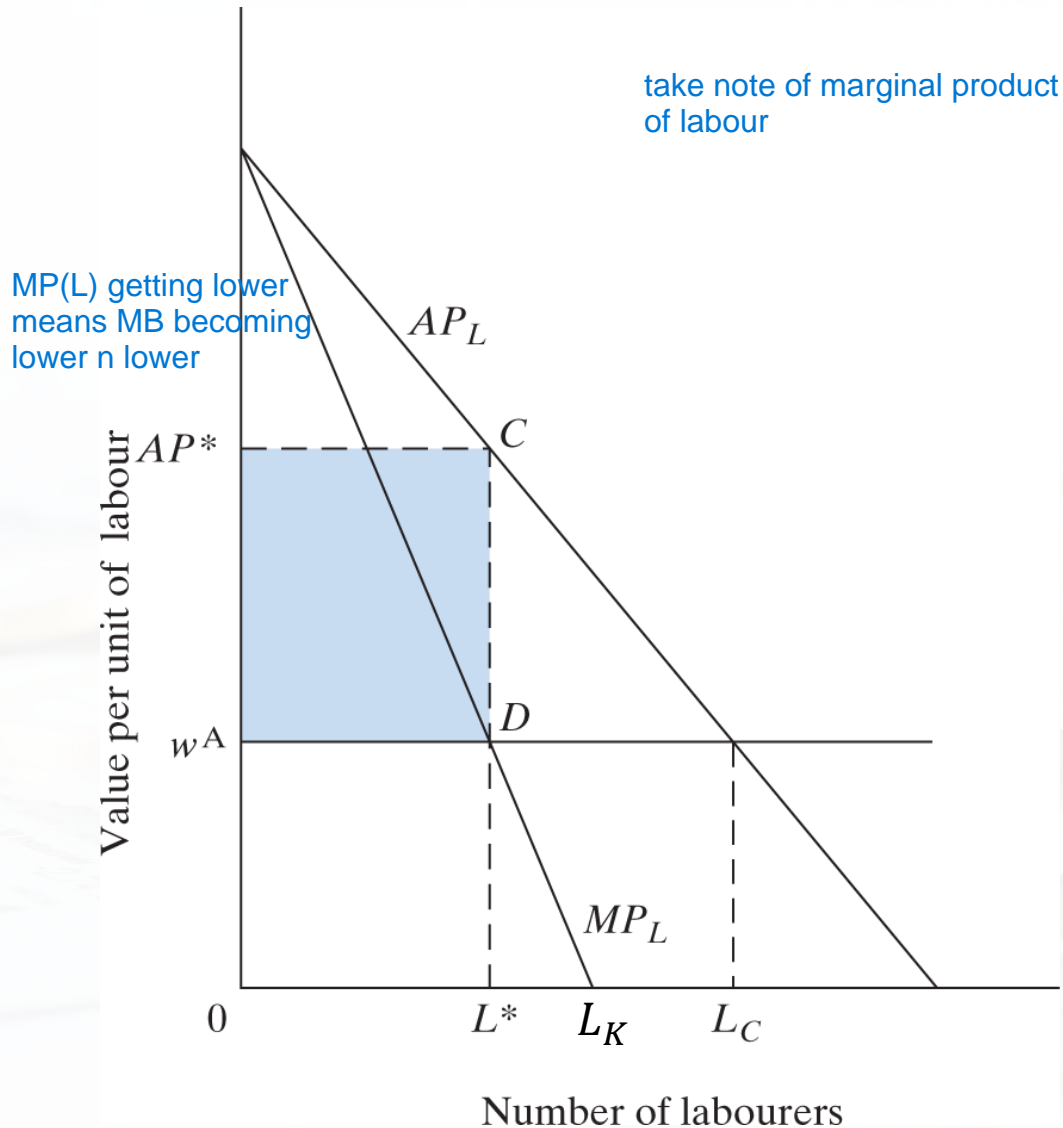
Owner could sell 75 units now or could ration 25 units and charge a higher price ( $P_S$ ).

To achieve allocative efficiency, the price of the resource must equate to the present value of marginal net benefits of last unit consumed in each period. → that is, consumer must be indifferent between consuming last unit in this period or in another period.

It is the owner's ability to collect this rent that creates the efficient allocation of resources over time.

However, if owners are unable to enforce property rights and resources are scarce, there could be over-extraction of resources.

# (1) Common property resources



**Misallocation of resources under common property system** – collectively/publicly owned and unrestricted access to resources. Example: farmers access to forest; fisherman access to lakes/rivers/sea.

**Marginal and average product of labour**; Wages ( $W^A$ )(Y axis), number of workers (X axis).

**With property rights:** owner will hire  $L^*$  workers till the marginal product = wages. Workload is share between  $L^*$  workers and average product =  $AP^*$ . Scarcity rents =  $AP^*CDWA$ .

**W/O property rights:** Each worker shares the total output and receives the average product. Income will continue to exceed wages till  $L_C$  workers enter the workforce such that  $AP^L = W^A$ .

**Tragedy of the commons:** why? Total output could fall as labor  $> L_k$  as  $MP^L < 0$ . These workers could work elsewhere (e.g manufacturing) with productivity  $> W^A$ .

illegal logging,  
labour force over saturation  
creating harm to env

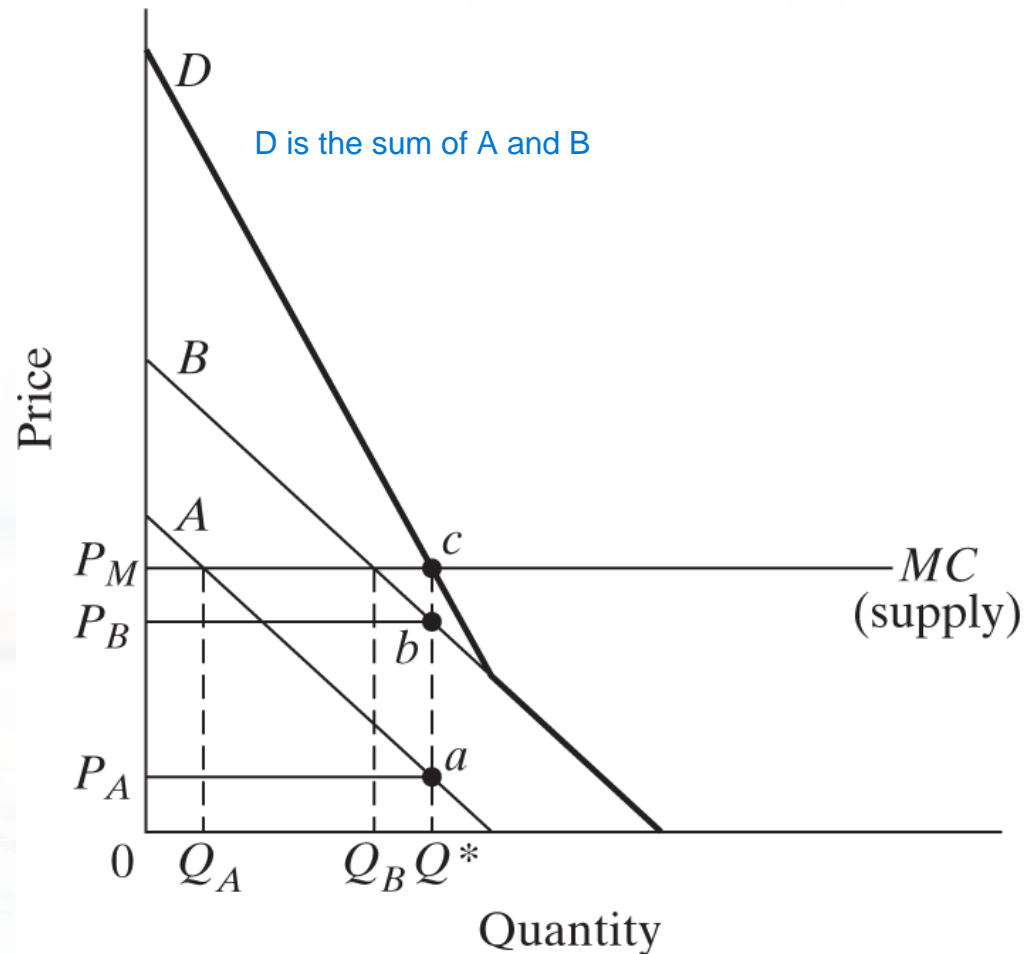


# Common property resources: some remarks

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- Privatisation of resources could increase aggregate output with a more efficient allocation of resources. But when privatise, who should buy?
- Model focus on efficiency, but not equity. Scarcity rents earned by a few owners could exacerbate income inequality.
- Solutions:
  1. Lump sum taxation on owners for redistribution - but what if authorities (government officials) = owners?
  2. Local social enforcement mechanisms with social enforcement mechanisms based on common property design principles (such as clear defined boundaries, active monitoring and accountability) – but hard to maintain.

## (2) Public goods/bad & free rider problem



(a) Public good (vertical summation)

Externality: an action taken by one party that generates a cost or a benefit to others. Yet, the externality generator does not incur the cost or enjoy the benefits.

Example: Deforestation cause by subsistence slash-and-burn farmers in Indonesia. Imposes a negative externality to both current & future generations by generating a public bad (air pollution, climate change).

Public good (bad): anything that generates a benefit (cost) to everyone and there is no way to exclude others from enjoying (suffering). E.g Afforestation = public good.

Imagine there are 2 individuals A & B. To obtain the market demand for afforestation, we sum the demand curves - A and B – vertically to capture consumer surplus for A & B. Both can enjoy the forest when one person pays for the forest.  $P^M = P^A + P^B$  &  $Q^*$  is the socially optimal level of afforestation but we will not achieve. Why?

Free rider problem: e.g A can free ride on B's demand for afforestation and will not pay for restoring forest.  $Q^B$  amount of afforestation.

# Public goods/bad framework: limitations

- Can charge different fees for each individual but hard to achieve administratively.

$P^A * Q^*$  for person A ,  $P^B * Q^*$  for person B

- Received fees could be used to restore forest – planting of new trees, hiring staff to monitor illegal timbering.
- No incentive to divulge their willingness to pay (demand curve) for each individual – prefer to free-ride on others.
- Difficult to collect fees from impoverished subsistence individuals with little or no income (e.g illegal timber seller)
- Monitoring is challenging given how big the forest is!



# Urbanisation and Environment



# Environmental Issues in Cities

## Environmental problems of urban slums

Health threatening pollutants  
(Example: Particulates from cooking)

Unsanitary environmental conditions  
(Example: Lack of functional sewage system)

Serious impact on poor  
(i.e. Low income people tend to bear more environmental consequences)

The urban poor are much less able than the wealthy to insulate themselves from the negative effects of a tainted environment. They are more likely to suffer serious consequences resulting from environmental degradation.

**An example: Lagos** <https://www.worldbank.org/en/news/video/2015/06/15/pollution-chokes-african-lives-livelihoods>

# Environmental Issues in Cities

Relationship between industrialization and urban air pollution

- Environmental Kuznets curve
- Pollution tax usage
- Absorptive capacity of the environment
- Severity of industrial pollution

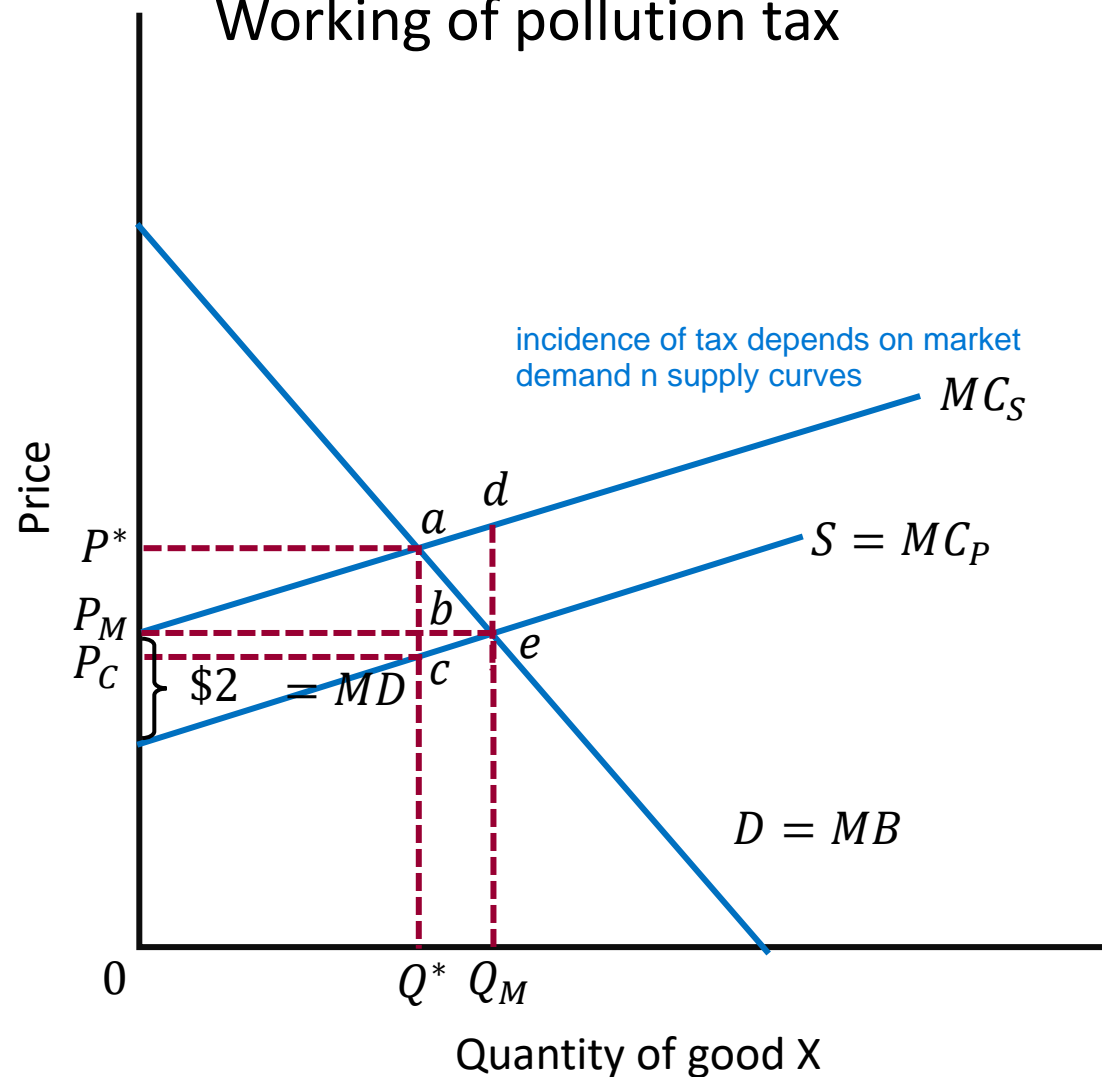


Until technologies and infrastructures capable to cope with environmental consequences are introduced, modernisation is likely to lead to high urban environmental costs.



# Pollution Tax: Tackling Externalities

Working of pollution tax



How negative externalities associated with the production of good X (e.g steel) makes the society worse off?

Marginal Private Cost ( $MC_P$ ) of producing good X = the cost incurred by producer. Marginal Social Cost ( $MC_S$ ) is  $> MC_P$  because of the damage to third parties (e.g air, noise pollution) = MD. Too much good X produced at  $Q_M$ . Deadweight loss =  $ade$

Pollution Taxes:  $\$2/\text{unit}$  = marginal damage (MD) for producing a unit of good X. Taxes force producers to internalize the marginal damage to third parties.

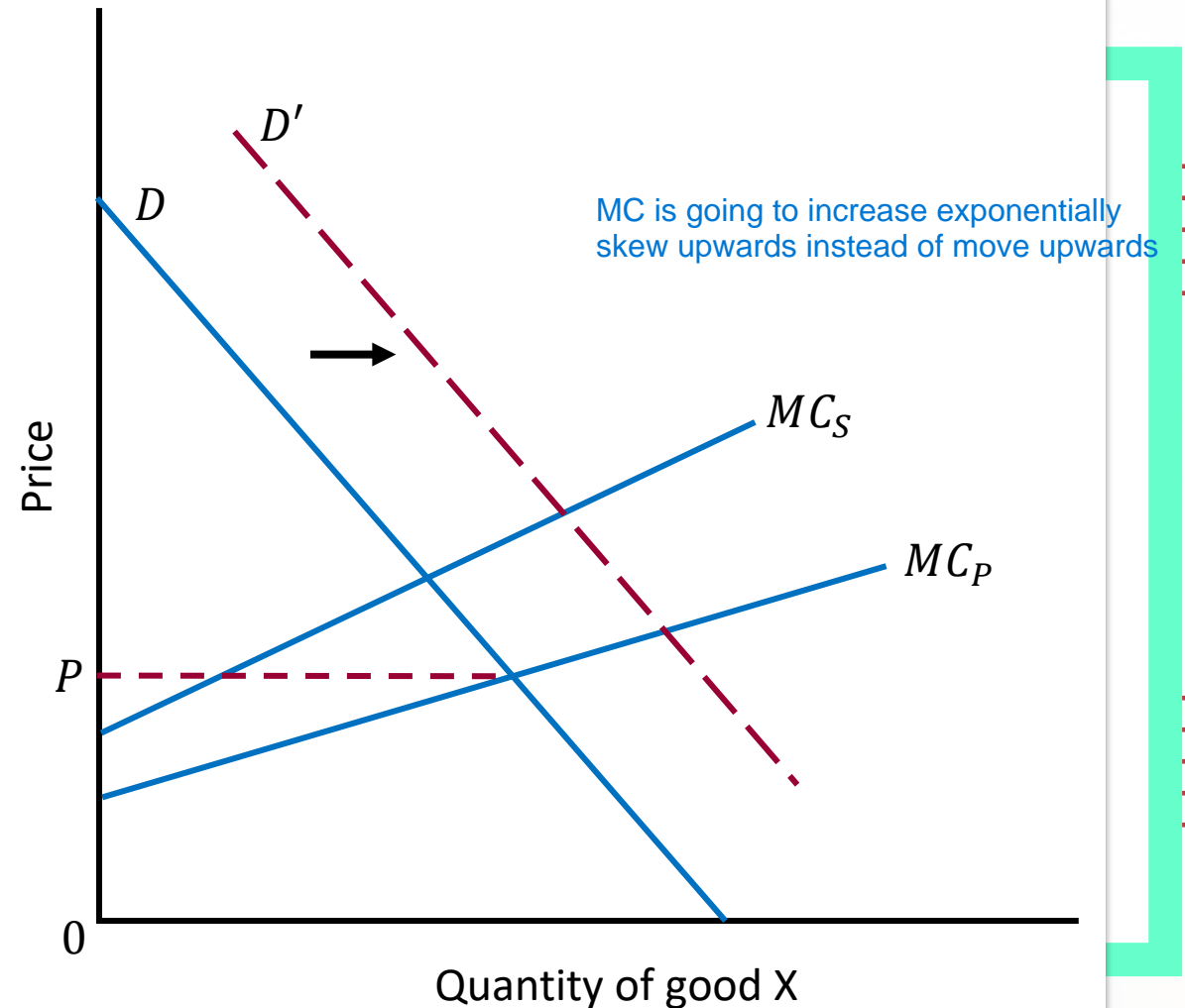
Social optimal level of good X produced at  $Q^*$  with price at  $P^*$ . Price received to producer falls to  $P_C$ . Tax revenue =  $ac P_C P_*$

Tax incidence depends on the relative elasticities of demand and supply curves. Here, producer pay  $bc$  and consumer pay  $ab$ .  $ab > bc$  when  $dd$  curve is more inelastic than  $ss$  curve

# A more realistic marginal social cost curve

At high levels of emission, toxicity is likely to be greater as humans have some tolerance towards pollutants. Hence, Marginal Social Cost ( $MC_S$ ) is likely to increase at increasing rate!

As the demand curve shifts outward because of rapid urbanisation and rising incomes, the importance of externalities rises at an increasing rate.



# Summary

Here are the key takeaways from this lesson.

- overexploiting resources
- how come up with env solutions to help producers internalise the damage
- > ultimately how they can produce sustainably

The world is faced with challenges in **all three dimensions of sustainable development—economic, social and environmental**. On one hand, countries face problems related to poverty and lack of basic services and large-scale, rapid industrialisation, urbanisation and technological development on the other. Problems are often simultaneously local and global.

More than 1 billion people are still living in extreme poverty; income inequality within and among many countries has been rising. At the same time, unsustainable consumption and production patterns have resulted in huge economic and social costs and may endanger life on the planet.

Over the last five decades, environment quality has been increasingly degraded by rapid urbanisation and various human activities. Environmental factors are a major contributor to sickness and death throughout the world, especially in the poorest regions.



# Summary

Here are the key takeaways from this lesson.

It is becoming readily apparent that the capacity of the environment to meet growing human needs is limited. This makes it crucial to improve the understanding of the complex relationships between the development process, environmental capacity and human health.

The number of people living in absolute poverty is growing steadily with them bearing a disproportionate share of the global burden of ill-health. They live in unsafe and overcrowded housing being more likely to be excessively exposed to pollution, traffic and industrial and other risks at home, at work or in their communities. Even in rich countries, the poor suffer worse health as compared to the rich.

Deforestation is a good example that shows the solution to environmental issues that require global cooperation.