

# Tragedy and Commons

- Guest Lecture
- Thomas Sterner
- EDF
- Economics, U of Gothenburg Sweden

# Carrying Capacity



# Garrett Hardin and the Tragedy





# Tragedy of the Commons

- As a rational being, each herdsman seeks to maximize his gain.
- Bentham's goal of "the greatest good for the greatest number"
- The optimum population is, then, less than maximum; Relinquish freedom to breed
- Every new enclosure of the commons involves the infringement of somebody's personal liberty.

# Elinor Ostrom





# Property / Law: Which first

- Private or Common L(Natural)/ Public law
- **10 Commandments**
- 1-3 No other Gods
- 4-5 Sabbath; parents
- 6-8 Don't kill, commit adult. Or **Steal**
- 9 No false evidence
- 10 No **envy of others** house, wife or other property



# Property Rights

“Bundles” of Rights = PROPERTY

- use it productively, enjoy profit
- rights of sale, lease and inheritance
- right of excluding others
- move, change or adapt
- even destroy or dispose of property

# Evolution of rights

- **REAL Estate (Rex)**
- Norman invasion of England 11th Century → Feudalism
- **Bargaining à stability, inheritance**

# Land titles



Skogskarta över  
**BONDARP 1:7**

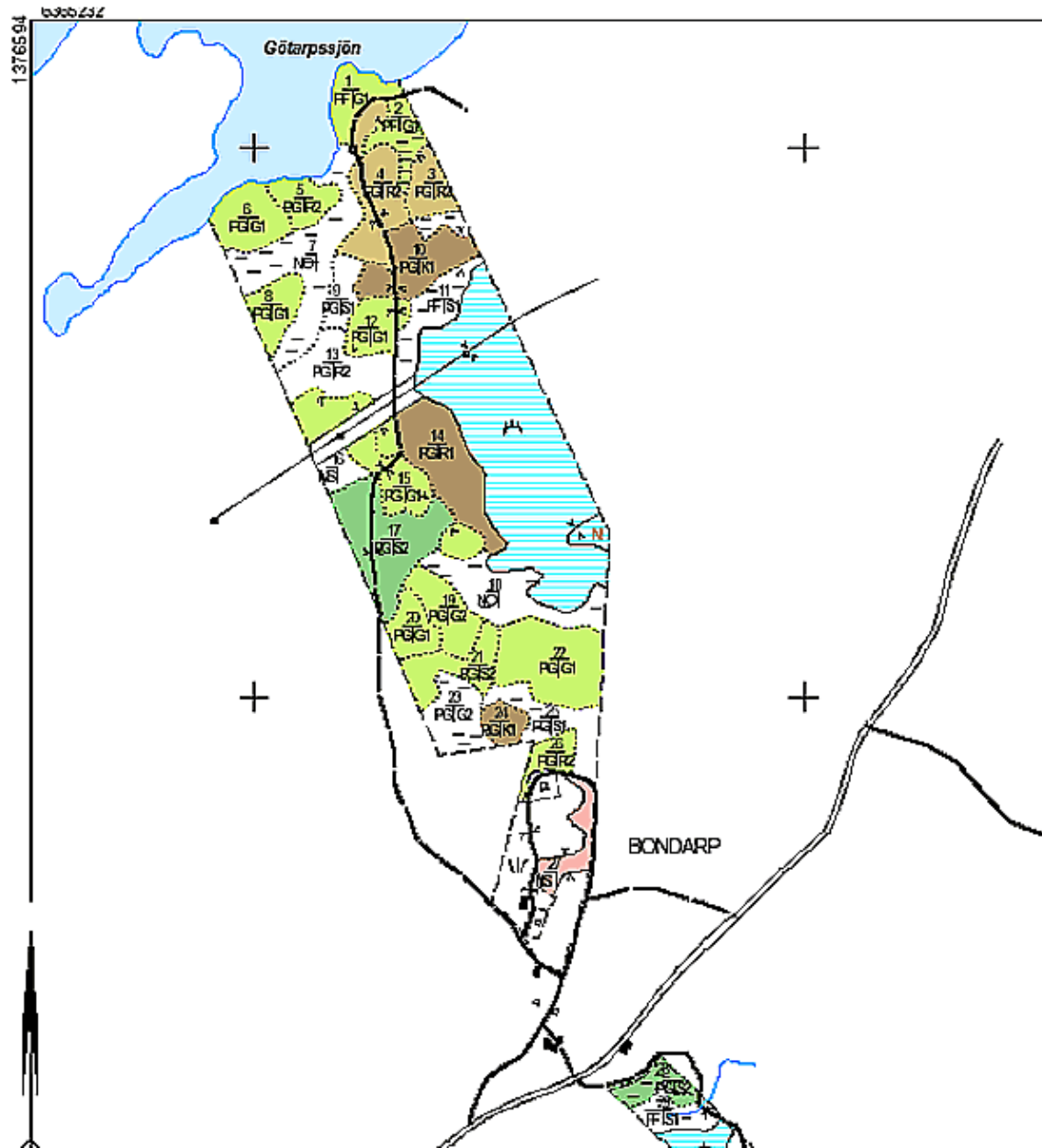
Åsenhöga församling  
Gnosjö kommun  
Jönköpings län  
Upprättad år 1997  
av Ragnar Sjöros

TEMA - Älgårder

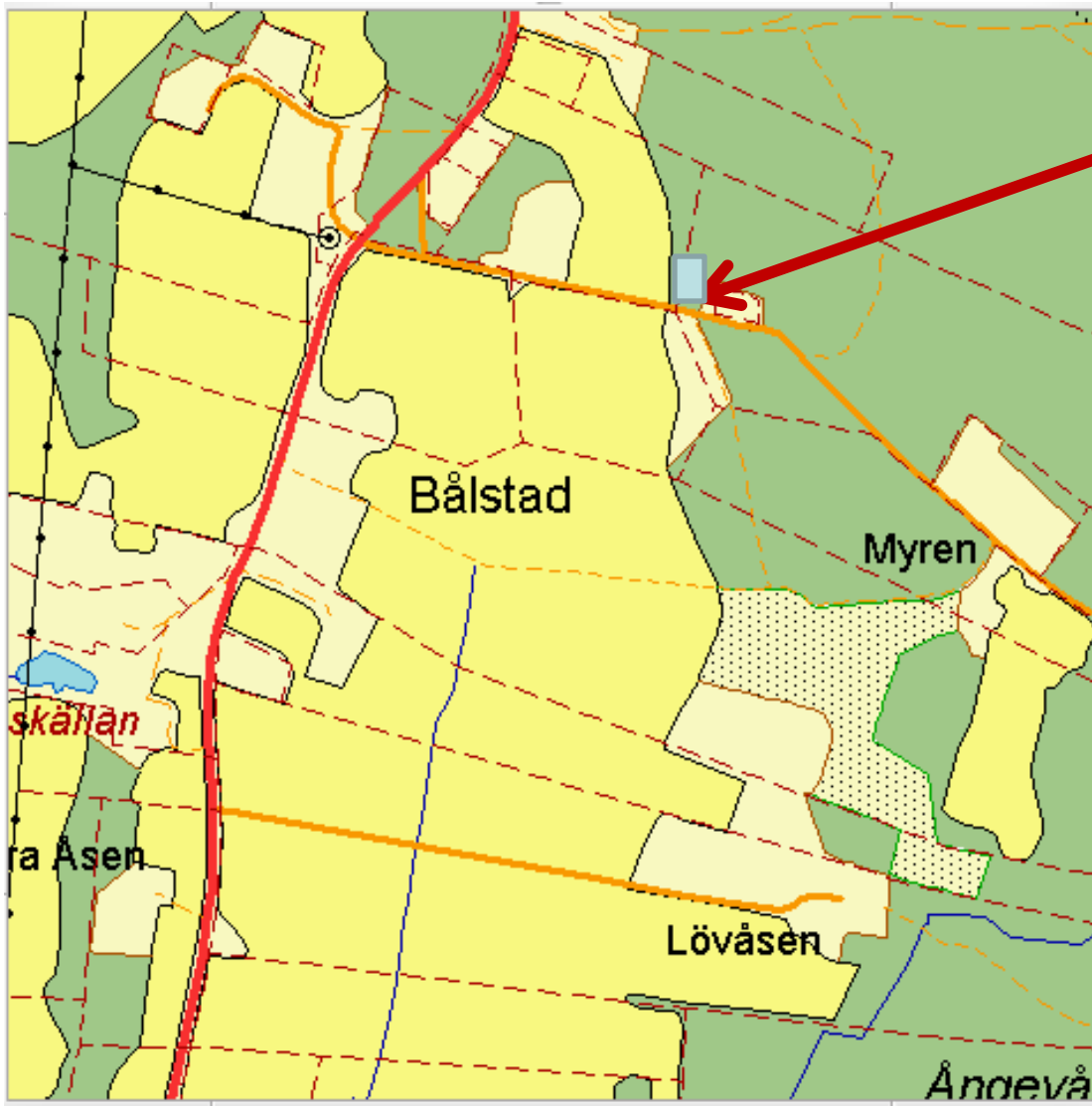
- Älvenärligårder
- Rövning
- Gallring
- Föryngingsavverkning
- Naturvårdande skötsel

TECKENFÖRKLARING

- Täck-Älgården
- Fossilgallnings
- Ardbeslagnings
- Äppelgallnings
- Allmänväg
- Enskiltväg
- Enskiltvägsträsk
- Täckvägsträsk
- Bäck/Dike/Vallen
- Myr (fukt, moss)
- Berg



# Property delineations



# Land → Minerals → Water → Eco

- Rights of landowner to water and oil or minerals. Compare US/Mexico
- US: landowner
- Mexico: State
- Land reallocations – Ethiopia.
- Feudalism – Jap-Ch



# Water law

- ***riparian doctrine***
- Justice Story, "*He whose property borders on a running water . . . may serve himself from it in its passage for the watering of his property. He whose estate such water crosses is at liberty to use it within the space which it crosses, but on condition of restoring it, at its departure from his land, to its ordinary course.*"
- 
- ***prior appropriation***
- Gold camps of the US west
- 
- ***Constitutional rights of state governments***

# Spanish Water Law

- *Fuero Juzgo Roman "[n]o one shall for his own private benefit, and against the interests of the community, obstruct any stream of importance; that is to say, one in which salmon and other sea-fish enter, or into which nets may be cast, or vessels may come for the purpose of commerce.*
- **Moorish:** Tribunal of Waters of Valencia
- 13th Century, Roman law again Castile region Alfonso X
- 
- Influence in Latin America and other colonies

# Lessons for environm. resources

- Prior Appropriation
- La tierra para quien trabaja
- Forests – Binswanger, Costa Rica
- Even houses – squatters
- Factory owner with smoke



# Squatters

- After sustaining three weeks of violent attacks and attempted illegal evictions - twice by the owner of the property, and once by the police - the Hackney Social Centre opened on February 14th. We've opened in spite of early challenges because we're tired of yuppie maisonettes forcing up to housing prices, while buildings are empty and affordable housing is eaten away. We've opened because we're set to resist and oppose the threats posed by gentrification, capitalism and the upcoming Olympic Games. We've opened because Hackney needs free spaces - spaces to escape the divisions of capitalism and the profit-hungry rat-race that alienates us from one another.

CALL THE SHOTS Win a trip to Hollywood in our short film competition SEE FILM & TV

Squatter wins £2m London plot after 18-year stay

By Emily Dugan Thursday, 24 May 2007

For most people a property on Hampstead Heath would be many mortgages or lottery tickets away, but a squatter has been granted the rights to a plot of land worth £2m for nothing.

Harry Hallowes, who has lived in a shack on the corner of the heath in north London for more than 18 years, has been given deeds to the thicket he calls home. Mr Hallowes, who says he "never had any trade or profession", had been squatting in the grounds of Athlone House nursing home, but when the land was bought by developers he feared he would be evicted.

But now an agreement made under section 106 of the Town and Country Planning Act has ensured that he will be there for life. Mr Hallowes' lawyer, Morris Evans, said: "Mr Hallowes is now officially the owner of the plot. Until recently the law said that if you occupied land for 12 years or more without being thrown out, then you were entitled to own it."

The developer, Dwyer Asset Management, which bought the Victorian nursing home and its

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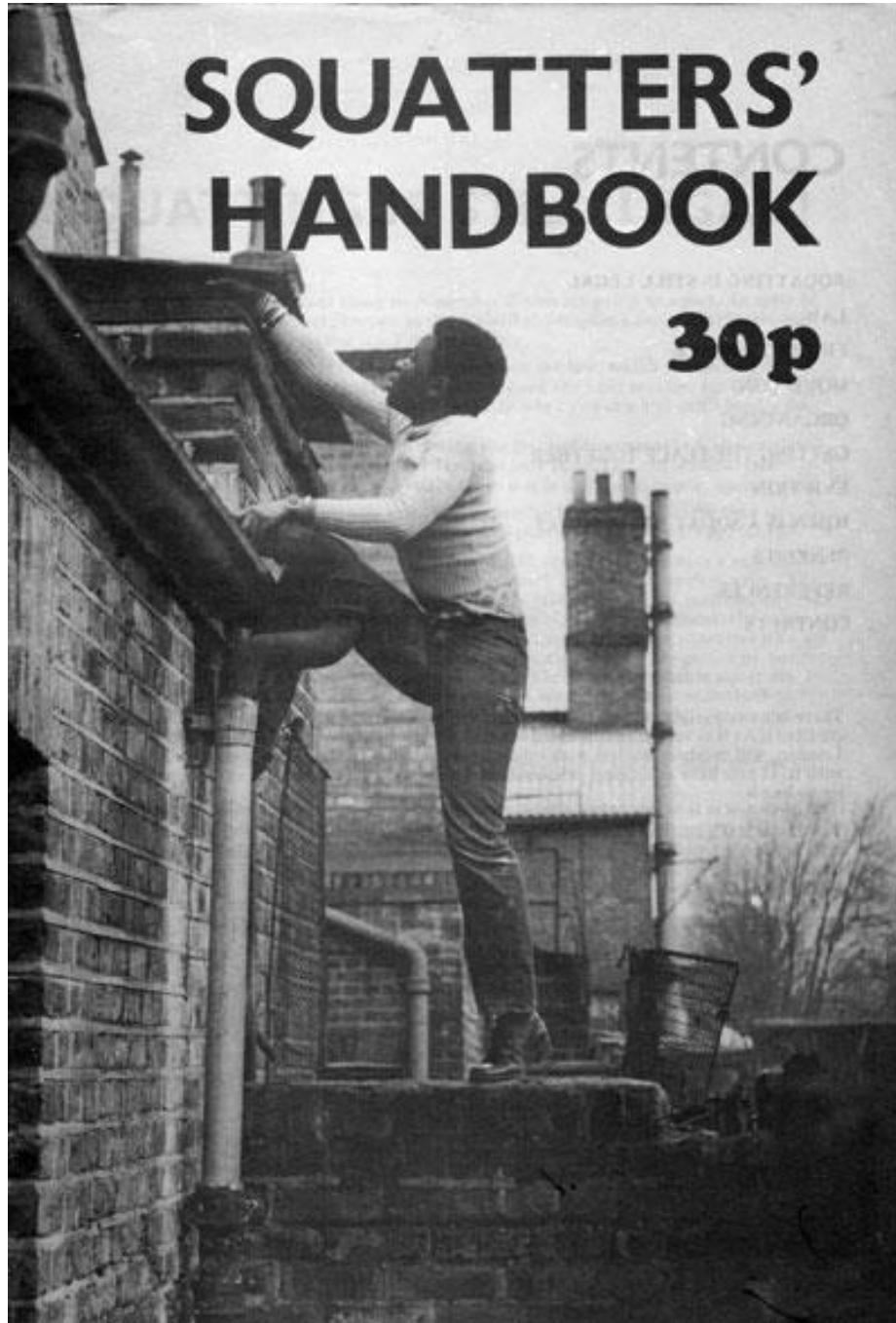
Self Select ISAs

From Td Waterhouse with £0 annual Admin Open an account Today....

EDITOR'S CHOICE

# SQUATTERS' HANDBOOK

30p



# Common property resources

- *res communes*
- Institutes of Justinian "[b]y natural law these things are common to all: air, running water, the sea and as a consequence, the shores of the sea."
-

# Enclosure of the Commons

- The Statute of Merton 1235, Henry III & barons. 20 years after Magna Carta, another limitation of the rights of the King. It allowed Lords to enclose common land providing sufficient pasture remained for his tenants - setting out in what cases, and in what manner, Lords may approve part of the wastes, woods, and pastures, belonging to their Manors, against the tenants. Ireland in 1236 then quickly became a basis for English common law, developing and clarifying legal concepts of ownership. In January 1550, it was revived under John Dudley, the Duke of Northumberland, to enable lords to enclose their land at their own discretion. It was, in fact, only finally repealed in 1948

**ENCLOSURE**



# Enclosure 2

## Sir Thomas More 1516 Utopia enclosure → theft

But I do not think that this necessity of stealing arises only from hence; there is another cause of it, more peculiar to England.' 'What is that?' said the Cardinal: 'The increase of pasture,' said I, 'by which your sheep, which are naturally mild, and easily kept in order, may be said now to devour men and unpeople, not only villages, but towns; for wherever it is found that the sheep of any soil yield a softer and richer wool than ordinary, there the nobility and gentry, and even those holy men, the abbots not contented with the old rents which their farms yielded, nor thinking it enough that they, living at their ease, do no good to the public, resolve to do it hurt instead of good. They stop the course of agriculture, destroying houses and towns, reserving only the churches, and enclose grounds that they may lodge their sheep in them

The enclosure of common land for sheep farming and the consequent eviction of villagers from their homes became an important political issue for the Tudors. Reflecting royal opposition, the anti-enclosure acts of 1489 and 1516 were aimed at stopping enclosure which would lead to lower tax revenues, fewer potential military conscripts for the crown, and more potential underclass rebels. The Tudor authorities were extremely nervous about how the villagers who had lost their homes would react. In the sixteenth century, lack of income made you a pauper. If you lost your home as well, you became a vagrant and vagrants were regarded (and treated) as criminals. The authorities saw a multitude of what they looked upon as vagabonds and thieves coming into existence as a result of enclosure and depopulation of villages. There were numerous acts of parliament to prevent it (or extract money from those responsible). From the time of Henry VII onwards, parliament began passing acts to stop enclosure, to limit its effects or at least to fine those who did it. The first such legislation was in 1489. Over the next 150 years, there would be a further eleven Acts of Parliament and eight Commissions of enquiry on the subject



# Enclosure 4

- The whole of British History permeated by the riots and the struggles concerning enclosure...
- biodiversity, radio frequencies, seas, Antarctic, space, genetics.
- “Monsanto + Rights” > 2 Million hits

# Erosion of principle of "nuisance" or "trespass"

William Alfred UK 1611 offending Hog sty: The defendant argued social value of his activity "necessary for the sustenance of man .. one ought not to have so delicate a nose". Court formulated Sic utere tuo ut alenum non laedas

- Hay v. Cohoes Co Hay cannot, erect a nuisance or annoyance of the adjoining proprietor, *even for the purpose of a lawful trade*".
- *Booth v Rome, Watertown & Ogdensburg Terminal Railroad*, blaster given the right if 'reasonable care'.
- *Boomer v Atlantic Cement*      Nuisance but not injunction.

# Is the concept of externality clear?

- $U_i = (x_{1i}, \dots, x_{ni}, x_{aj})$ .
- $F_k = (x_{1k}, \dots, x_{nk}, x_{aj})$ .
- **J makes a noise and “i” suffers a loss of utility or k suffers a loss in production.**

# COASE:

- **Reciprocity:**
- *Sturges vs Bridgman*. Medical Doctor disturbed by confectioner.
- *Defendant*: **Local, owner, Rights, (poorer?), productive, first (mortar).**
- *Plaintiff*: **Newcomer, property rights, productive.**
- Does the confectioner impose an externality on Dr? Or vice versa?

# Is the concept of externality clear?

- $F_k = (x_{1k}, \dots, x_{nk}, x_{aj})$ . Where  $x_{aj} = Db$  or
- $F_k = (x_{1k}, \dots, x_{nk}, \text{Silence})$ .
- J makes noise and k suffers a loss in production  $F'_{k,aj} < 0$  or  $F'_{k,silence} > 0$
- $F_j = (x_{1j}, x_{aj}, \dots, x_{nj})$ . The noise that is an externality  $x_{aj}$  for k is a factor of production for 'j'. Silence however, a prod factor for k would be an externality for j.  $F_j = (x_{1j}, x_{aj}, \dots, x_{nj}, \text{Silen.})$
- $F'_{j,silence} < 0$

# Coase

- Marginal analysis incomplete. We must look at total analysis of all possibilities and choose highest aggregate welfare. This would be outcome of negotiation whoever had right – as long as one party has it!

# Common property resources

- *What are res communes ?*
- What is ENCLOSURE?
- Who has the right to 88 MHz
- Who has the right to seabed in midatlantic
- Who has right to the human genome?
- Who has the right to ambient concentration of ozone, CO<sub>2</sub> or VOC?
- Can CPR work?
- What rules are needed?

# What about collective property

- Common property resource management
- Communal or cooperative management
- NOT = open access
- See OSTROM





© Mofino

# HUERTA IRRIGATION SYSTEMS

- Rivers in Valencia, Murcia, Alicante in Spain.
- Documented irrigation cooperation >1435
- Small & very erratic rainfall.
- Farmers elect syndic and other officials who preside weekly TRIBUNAL DE LAS AGUAS outside church in Valencia etc.
- low water → farmers take turns at water:
- Fixed order for turns; each farmer decides q.
- Physical waiting for turn is automatic (low-cost) mechanism for monitoring
- Fine books 1443/1486 preserved. Few fines.
- Small, graduated fines in general: 2/3 for the Syndic and 1/3 for accuser



# ALANJA, TURKEY

- ~100 Fishermen
- 1970's Unrestrained fishing => stock decline
- Took > 10 yrs to design the following system:
- 1.- Sept. list of all eligible fishermen
- 2.- Each fishing site named (with spacing)
- 3.- Fishermen draw lots for first day
- 4.- Each day everyone moves one East
- => *Sufficient spacing for efficiency*
- => *Limit on fishing for reprod.*
- => *Equity*
- => *Monitoring*



# Törbel; Switzerland

- AlpTop Meadows/woods; steep slopes; Little rain
- Since 1224: Comunal land includes Alpine grazing; forests; irrigations, paths
- "Fremde" excluded even if landowners
- "Cowrights" allotted according to criteria:
- Pasture, share in cheese; Number of cows fed in winter; Hay; Land (Acres or Value); Coop Shares
- Annual meetings make rules & select officials, hire staff & decide:
- Fines for Misuse
- Allocation of manure on summer pastures
- Roads & other maintenance work
- The allocation of wood by various criteria.
- Trees marked by officials, Only felled in season by work teams, hauled into stacks allocated by lottery

# More on CPR and OSTROM

PAYOFFS (A , B)	A plays Strategy 1	A plays Strategy 2
	B Strategy 1	(2 , 2)
B Strategy 2	(11 , 0)	(10 , 10)

Prisoners dilemma solved by tax of 2 on cheating

PAYOFFS (A , B)	A plays cheat	A plays cooperate
	B cheats	(0 , 0)
B cooperates	(9 , 0)	(10 , 10)

# But does this work?

- Fines have to be assessed, levied and collected. Suppose the state sends outsiders who are incompetent and fine the wrong people?
- Ostrom's conclusion is that the only people who have knowledge and incentive to make the system (of fines) work are the locals themselves! → CPR solution



# Ostroms 7 principles for CPRs

1. Clear Boundaries. Exclusion possible
2. Local rules of provision & appropriation
3. Decisionmaking is participatory
4. Locally designated agents monitor
5. Availability of local "courts"
6. Graduated sanctions
7. Outside governments respect CPR rules

# Second-Tier Variables of a SES

## Social, Economic, and Political Settings (S)

S1- Economic development. S2- Demographic trends. S3- Political stability.  
S4- Government resource policies. S5- Market incentives. S6- Media organization.

## Resource Systems (RS)

RS1- Sector (e.g., water, forests, pasture, fish)  
RS2- Clarity of system boundaries  
RS3- Size of resource system\*  
RS4- Human-constructed facilities  
RS5- Productivity of system\*  
RS6- Equilibrium properties  
RS7- Predictability of system dynamics\*  
RS8- Storage characteristics  
RS9- Location

## Resource Units (RU)

RU1- Resource unit mobility\*  
RU2- Growth or replacement rate  
RU3- Interaction among resource units  
RU4- Economic value  
RU5- Number of units  
RU6- Distinctive markings  
RU7- Spatial and temporal distribution

## Governance Systems (GS)

GS1- Government organizations  
GS2- Nongovernment organizations  
GS3- Network structure  
GS4- Property-rights systems  
GS5- Operational rules  
GS6- Collective-choice rules\*  
GS7- Constitutional rules  
GS8- Monitoring and sanctioning processes

## Users (U)

U1- Number of users\*  
U2- Socioeconomic attributes of users  
U3- History of use  
U4- Location  
U5- Leadership/entrepreneurship\*  
U6- Norms/social capital\*  
U7- Knowledge of SES/mental models\*  
U8- Importance of resource\*  
U9- Technology used

## ACTION SITUATIONS [Interactions (I) → Outcomes (O)]

I1- Harvesting levels of diverse users  
I2- Information sharing among users  
I3- Deliberation processes  
I4- Conflicts among users  
I5- Investment activities  
I6- Lobbying activities  
I7- Self-organizing activities  
I8- Networking activities

O1- Social performance measures  
(e.g., efficiency, equity, accountability, sustainability)  
O2- Ecological performance measures  
(e.g., overharvested, resilience, biodiversity, sustainability)  
O3- Externalities to other SESs

## Related Ecosystems (ECO)

ECO1- Climate patterns. ECO2- Pollution patterns. ECO3- Flows into and out of focal SES.

\*Subset of variables found to be associated with self-organization.











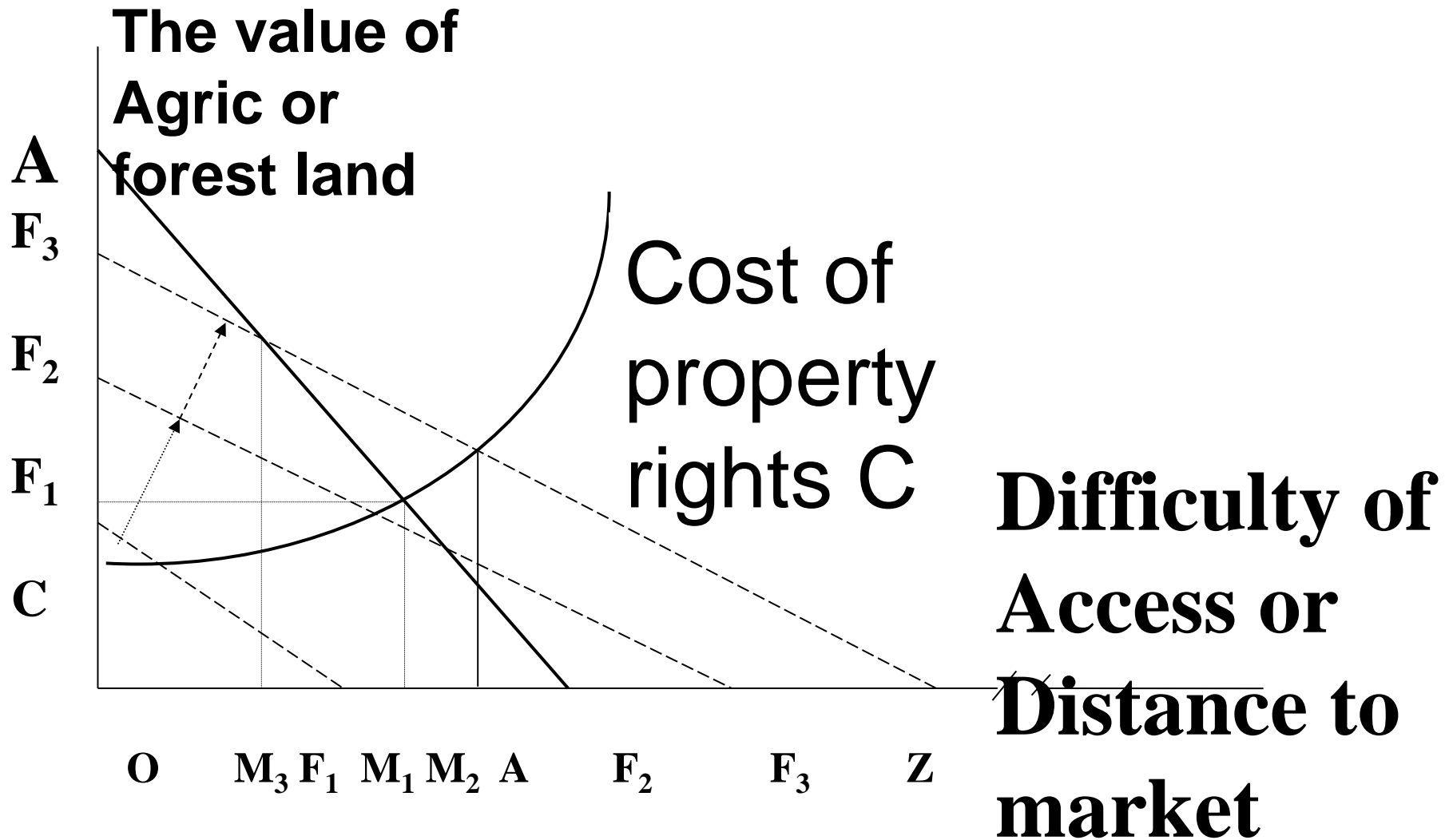




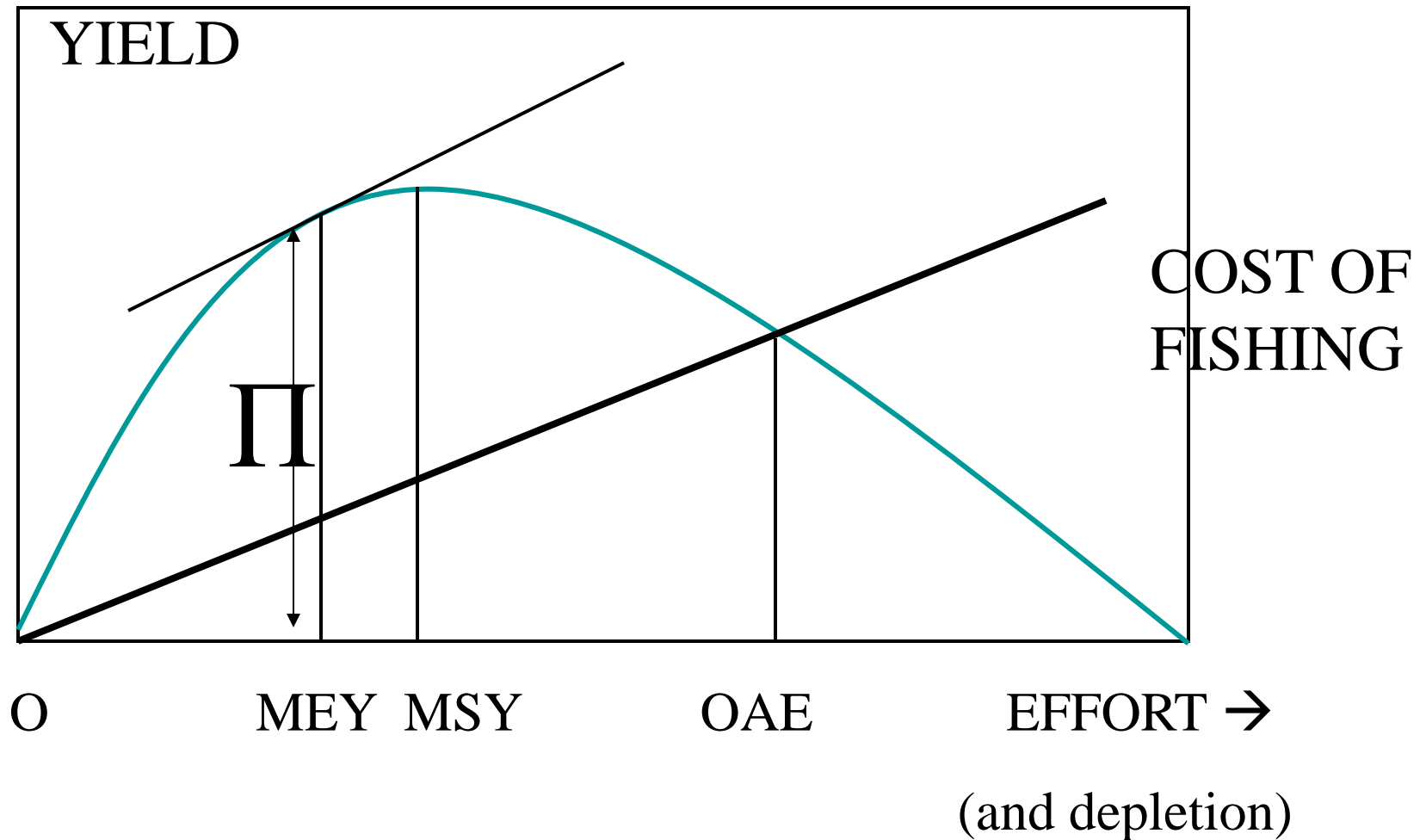


End

# The important spatial dimension



# A Bio-economic model of fishing

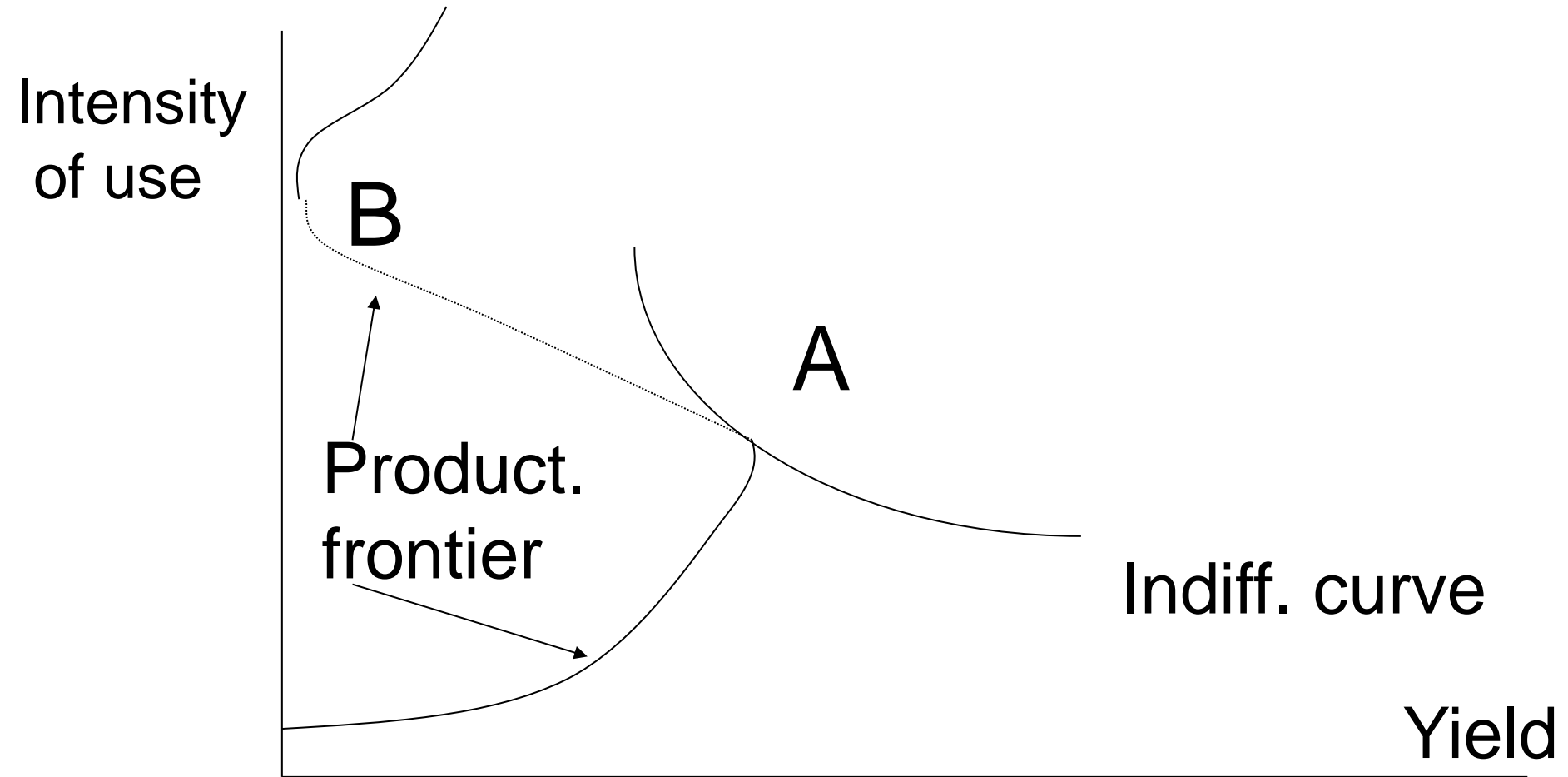


# Ecosystem Complexity

## Services from a mangrove forest

- **Shrimps, crustaceans and molluscs**
- **Spawning and breeding of fish**
- **Fuel wood, construction wood**
- **Source of plants, herbs, small game**
- **Production of salt and shrimps**
- **Control of storms, floods & erosion.**
- **Sequestration of C, N, P; and of toxins**
- **Protection of coastal ecosystems**
- **Habitat for birds – (& watchers)**
- **Option & Existence values**

# Managing an ecosystem with threshold effects



# END

- Pick up a few items from lecture 1.

# Industrial Pollution: Permits vs Taxes

- Just like ITQs – permits have been very successful in abatement of Sulfur in the US
- Reduction by 50% in CAAA. 19-10 Gtons
- Estimated costs 600-1000 \$/t.
- Actual prices per permit around 100-150!
- Marvels of the market...
- In Sweden tax works well too. T=2500 \$/t



# Different types of Permit

- The original add-on to regulation: Make regulations into rights and then let people trade in over-fulfilment (Emission Reduction Credits).
- Cap and Trade. Decide a maximum (CAP) for pollution and then let the market work on its own. Less transaction costs.
- Ambient permits, certificate schemes etc

# Allocation of permits

- Permits can be allocated in proportion to:
- Historical pollution: Grandfathering
- (Historical/current) production: Output allocation or benchmarking.
- Equally
- By WTP ie through an auction
- NB Duration, bankability, updating...

# Properties of Permits

- $L = pq_i - c_i(q_i, a_i) + P_e(\hat{e}_{i0} - e_i(q_i, a_i))$
- Kuhn-Tucker conditions are:
- $c'_a = -P_e e'_a$  MC Abatement is optimal
- $P = c'_q + P_e e'_q$  Output price is optimal
- If number of permits is related to output then second condition does not hold

# Weitzman P vs Q

If **uncertainty** re MC abatement and

- M Damage of pollution is steep (thresholds) → **QUANTITY-type Instr**
- M costs are steeper (risk of bankruptcy) but damage is flat (eg stock pollutants) then **USE PRICE-type** instruments.

# Moral Hazard/Adverse Selection

- The very poor are very risk averse
- They would need savings or insurance
- Banks not available due to transaction costs and lack of collateral (→tenure issues)
- Insurance not available: Moral Hazard + Adverse Selection
- → Inequitable contracts and
- →Unsustainable use of resources

# Taxing cows

- Overgrazing is a major problem with a stock externality:
- More cows → lower survival  
Farmers put more cattle on common grazing to be sure some survive.
- Should we tax cows?

# Taxing cows ?

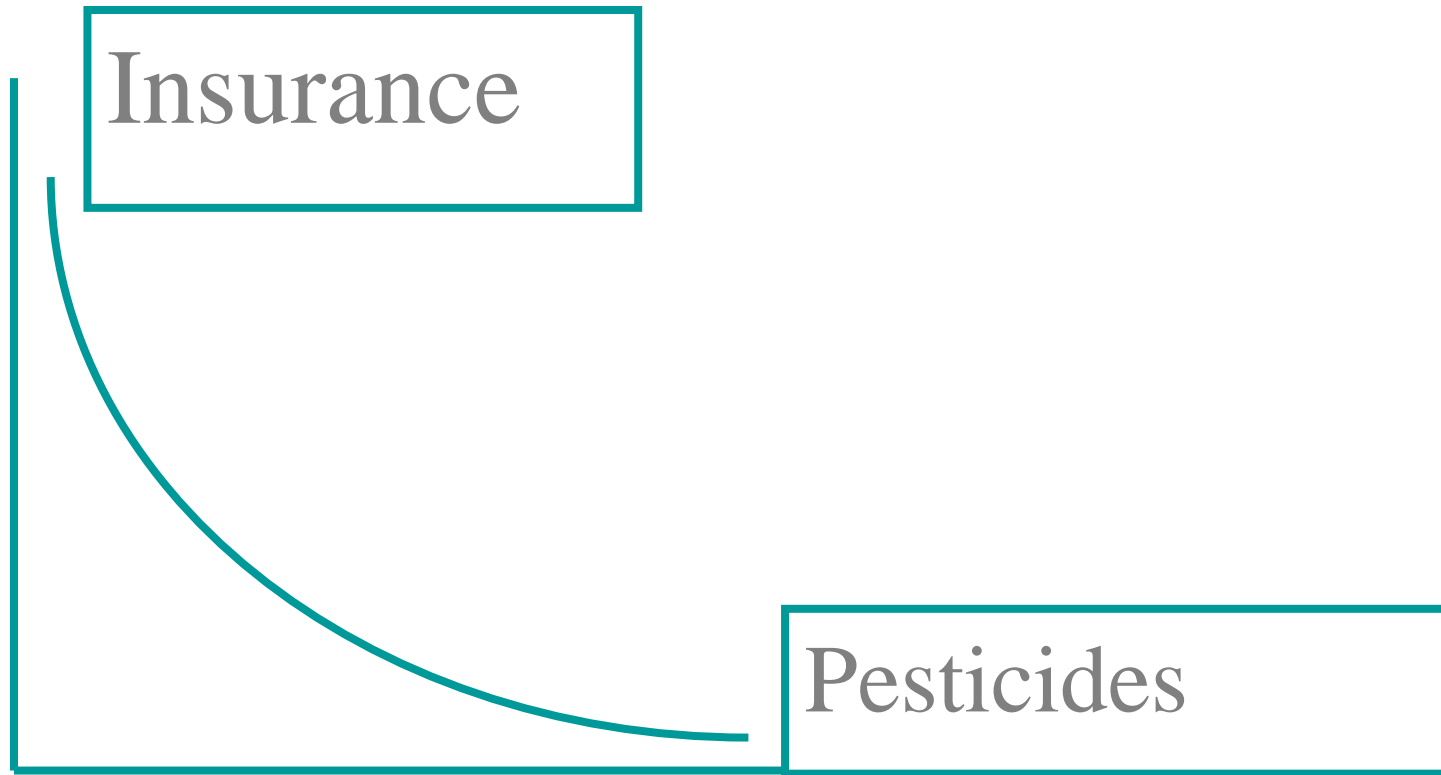
- NO! Lack of markets for saving (banks) is real cause. It leads to other saving forms such as cattle Don't tax cows.
- **Provide banks!**
- Such as Grameen

# Risk and environmental management

- Lack of insurance makes poor farmers very risk averse.
- Risk of pests (locust) unacceptable even if average damage small.
- Don't provide pesticide spray.  
**Provide insurance!**



# The important role of financial institutions



# Some other rules of Instrument selection and design 1

- If abatement possibilities limited then a higher product price caused by a tax will lower consumption to socially optimal level. This **OUTPUT** effect is desirable. Except for small open economies where the products will just be imported
- Monopolies: taxes perverse because prices already too high and output too low.

# Some other rules of Instrument selection and design 2

- For some pollutants (related to energy/transport) tax revenues are substantial. In this case the revenue-recycling effect of tax implies other taxes can be lowered which decreases the cost of the instrument. This effect is lost if regulation or (free) permits are used.

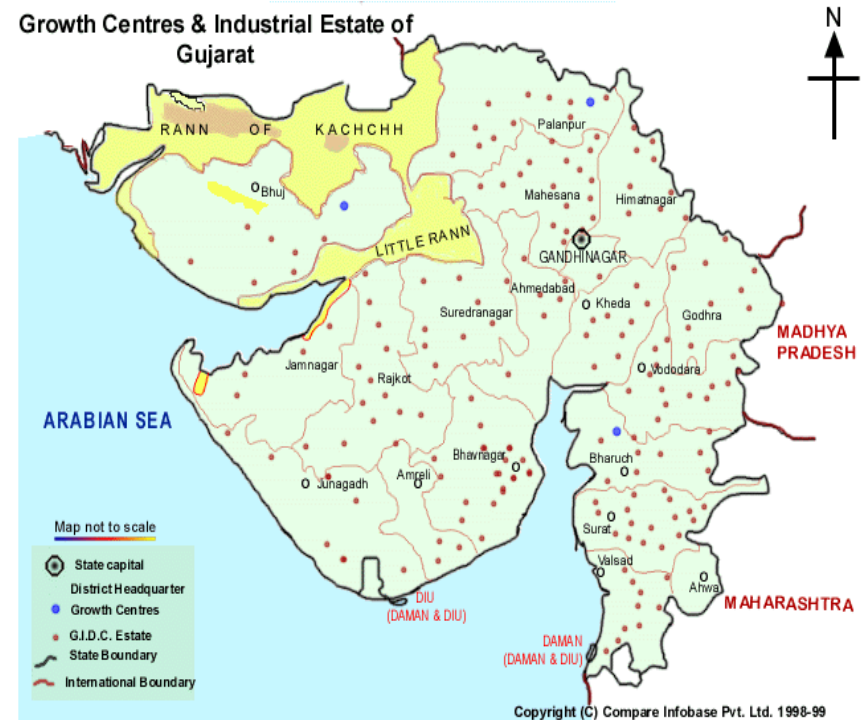
# Some other rules of Instrument selection and design 3

- Subsidies work *roughly* like taxes
- But have perverse output effect → encourage entry (delay exit from) industry
- Reduction of Perverse subsidies important
- Deposit Refund schemes superior to taxes when monitoring of pollution is expensive
- Fines or liability also important complement

# Ankleshwar Indust Estate

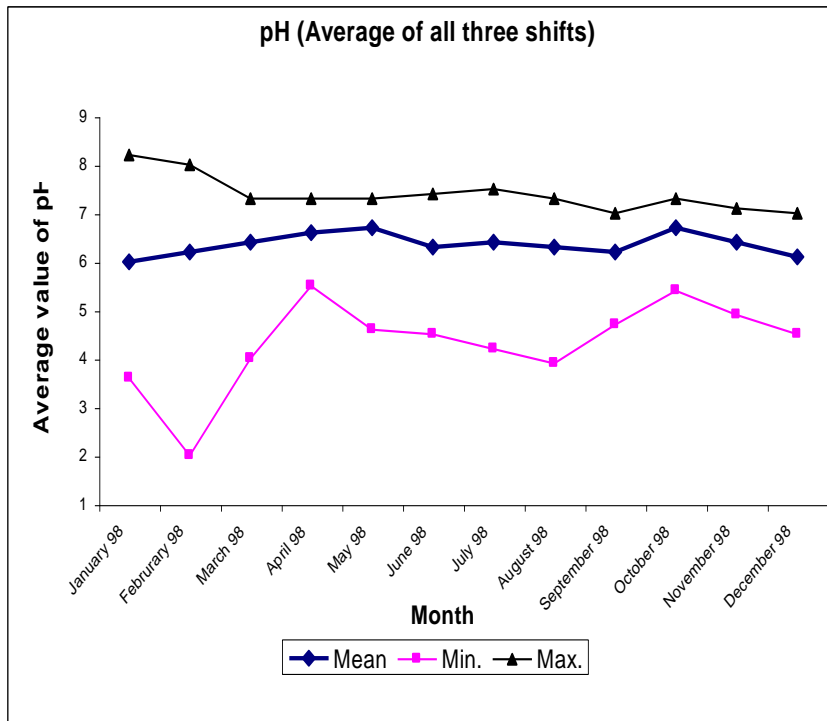
## Gujarat

- One of largest in India
- 400 plants in 1605 Ha
- 5% India's chem. output
- 250 M litres effluent/day
- Common Effluent Treatm.
- Common Waste Mgt.
- Two-tier Management
- Peer monitoring
- Graduated Sanctions



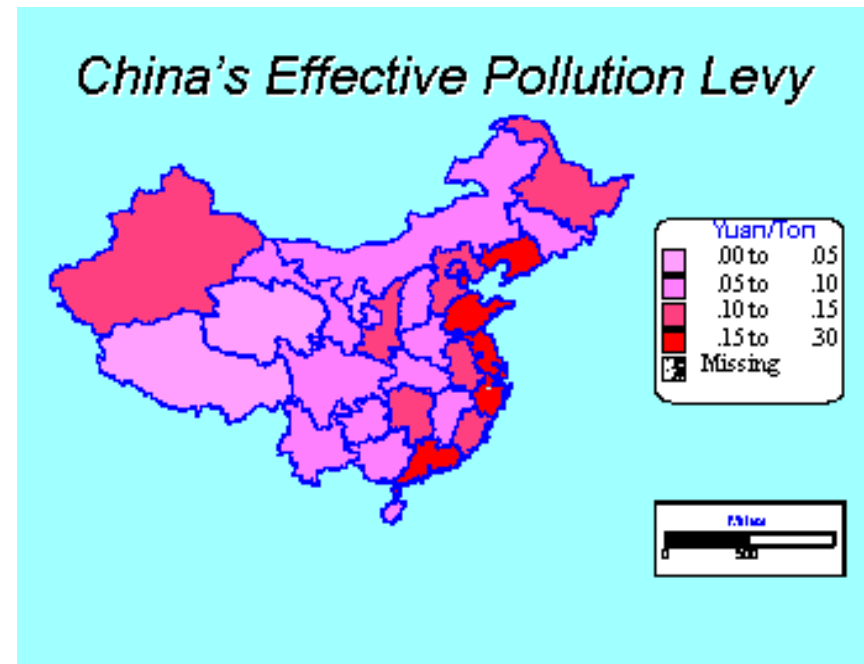
# Peer monitoring & graduated fines

- Rain -
- Penalty -
- First Shift +
- Holliday 0
- Time (neg)



# Chinese industries pay fees

- 1979 Environm. Law
- Hundreds of thousands of factories eligible for fee.
- 70-80% of fees → finance abatement
- Enforcement varies regionally



# Columbian firms pay charges

- 1993 creation of MINAMBIENTE + local EPAs
  - Pollution Charges
  - Example: CORNARE
  - Rio Negro Watershed (near Medellin)
- Allocation of Funds
    1. Waste treatm pl 50%
    2. Clean Tech Inv 30%
    3. Research 10%
    4. Administration 5%
    5. Education 5%



28% reduced BOD first year



# PROPER Labelling in Indonesia

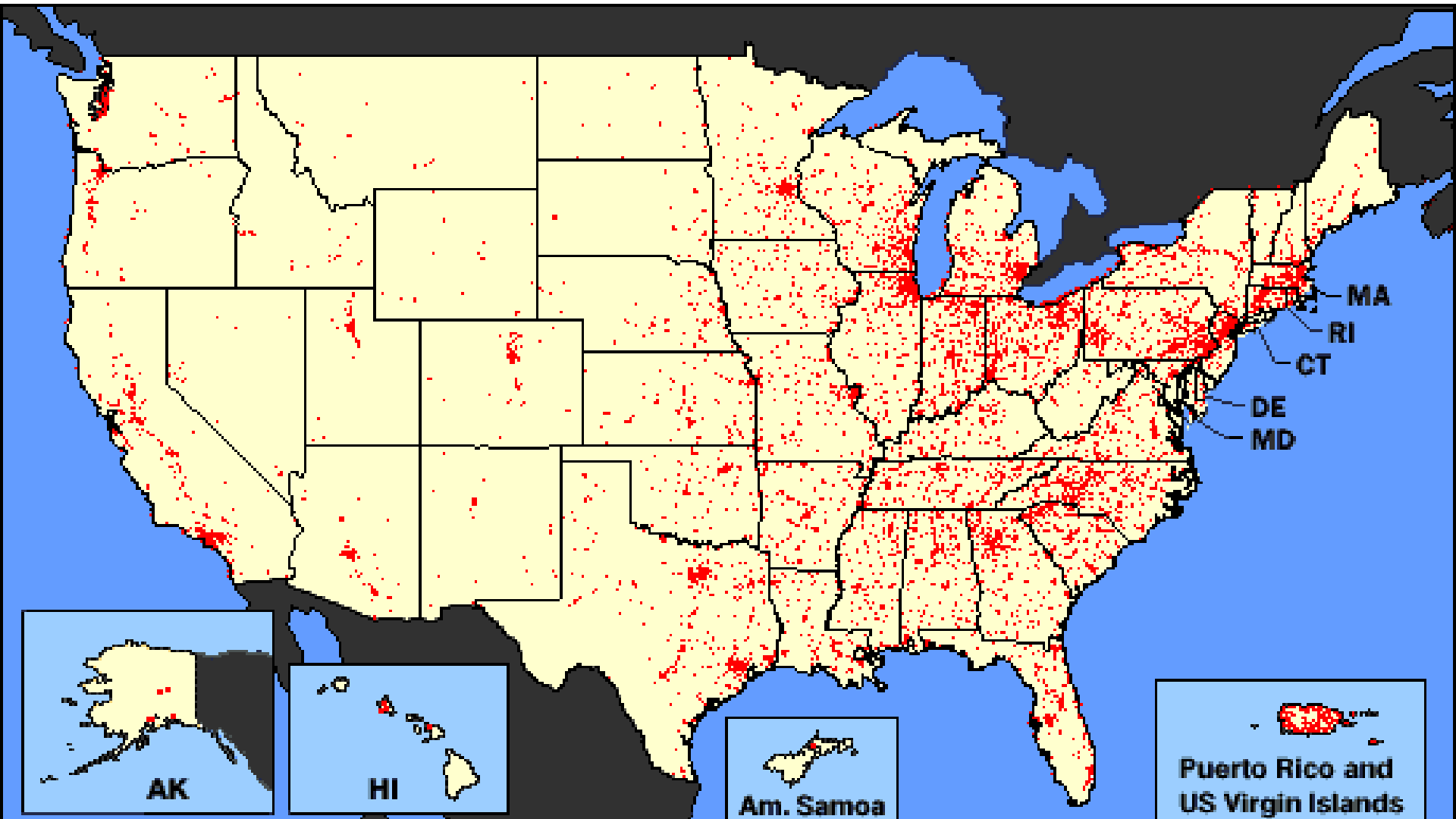
	<b>June 1995</b>	<b>Dec 1996</b>	<b>Change</b>
<b>Gold</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Green</b>	<b>5</b>	<b>5</b>	<b>0</b>
<b>Blue</b>	<b>61</b>	<b>94</b>	<b>33</b>
<b>Red</b>	<b>115</b>	<b>87</b>	<b>-28</b>
<b>Black</b>	<b>6</b>	<b>1</b>	<b>-5</b>

# Total Releases in TRI

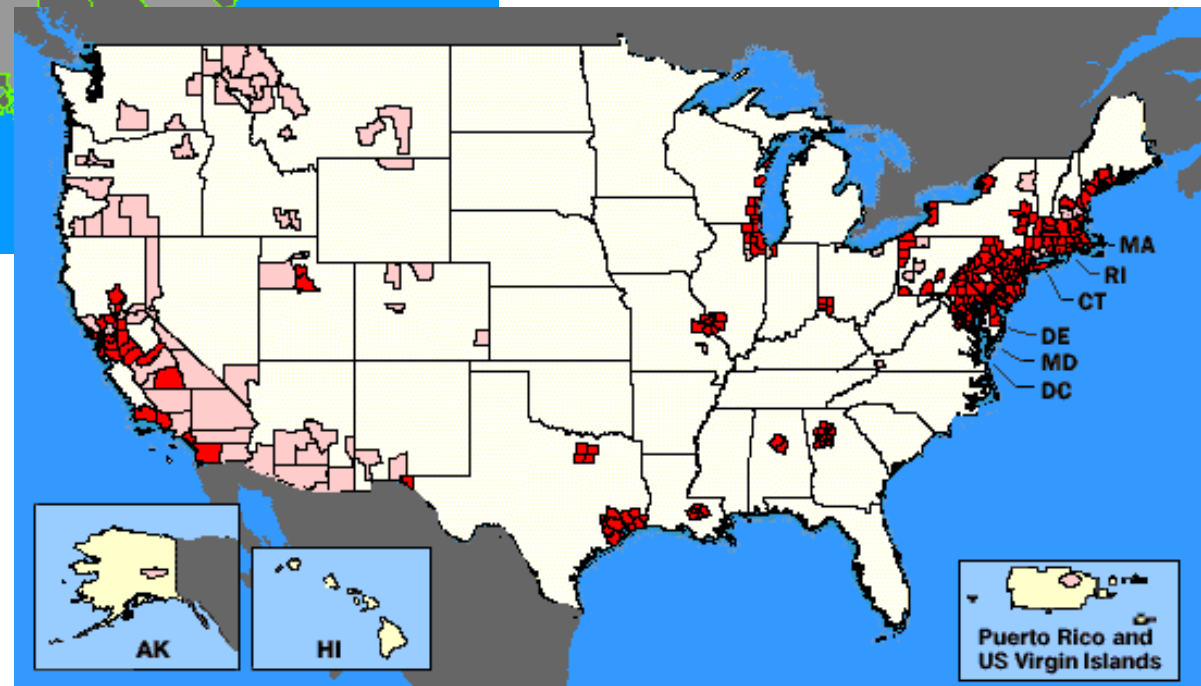
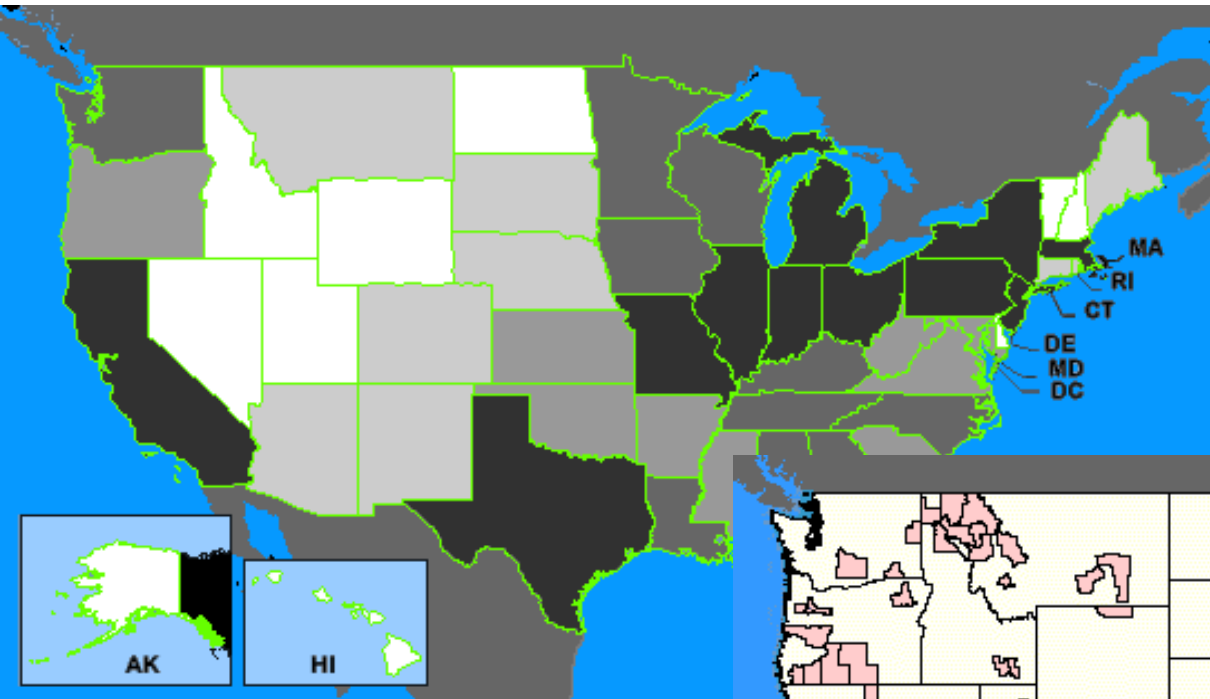
	<i>Total releases (millions of pounds)</i>			<i>Reduction (%)</i>
	<i>1988</i>	<i>1995</i>	<i>1998</i>	<i>1988-98</i>
N of facilities	20,470	20,783	19,610	4.2
Air emissions	2,183	1,201	921	57.8
Surface water	165	37	45	72.9
Underground injection	162	143	115	29.3
Total on-site releases	2,968	1,688	1,427	51.9
Total releases	3,396	1,977	1,857	45.3

Thomas Sterner Policy Instruments

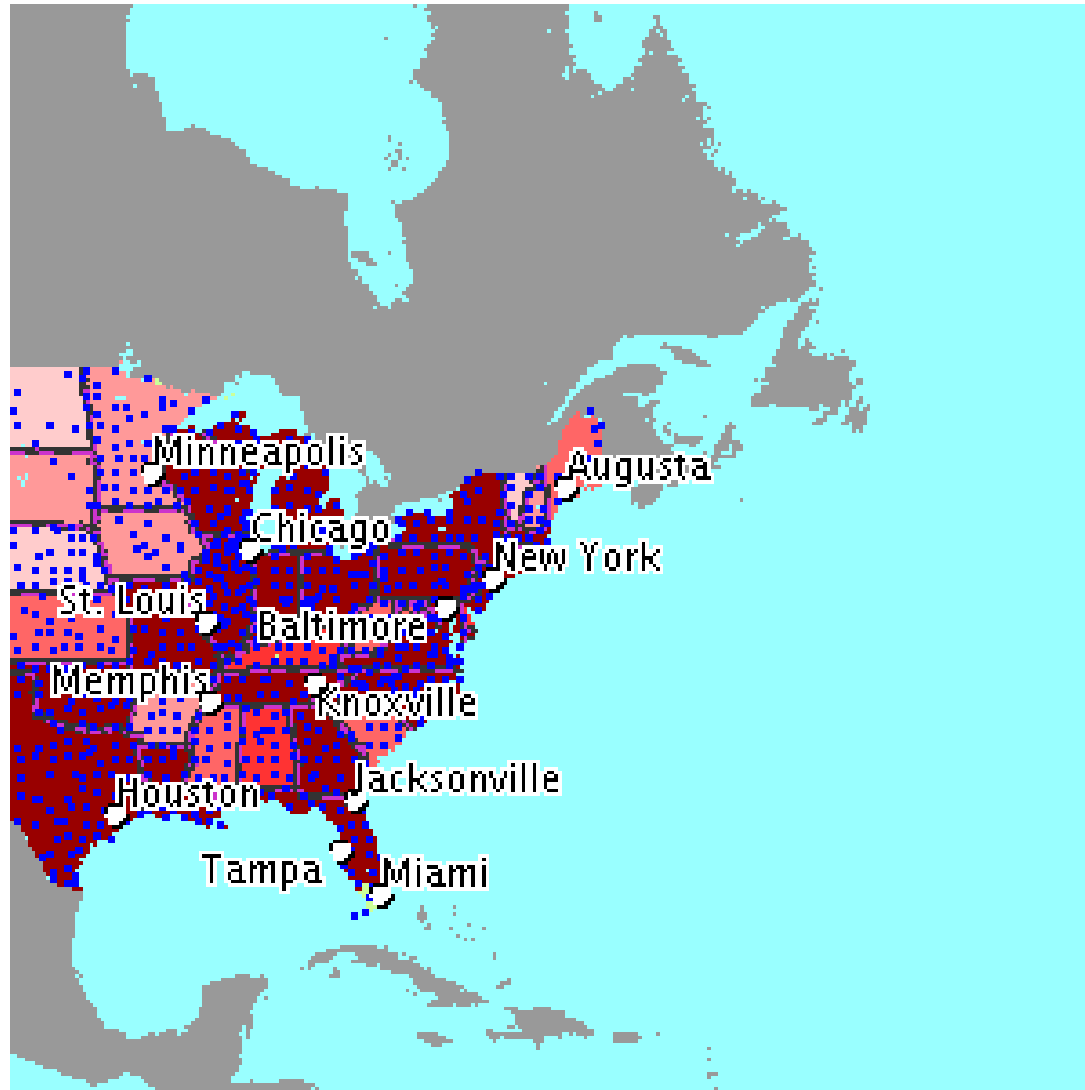
# Scorecard.org organises data



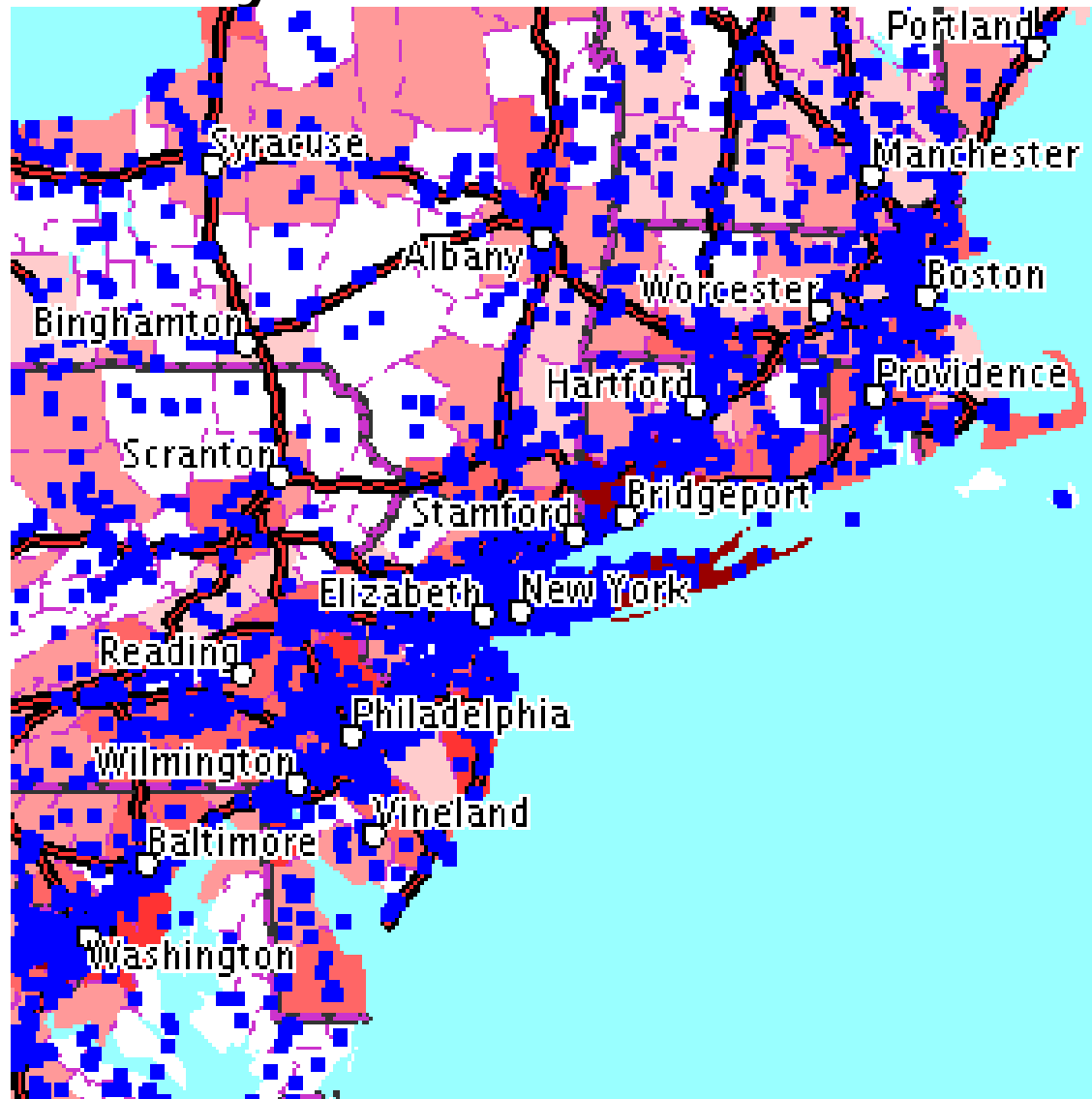
# Total, Lead or water exposure



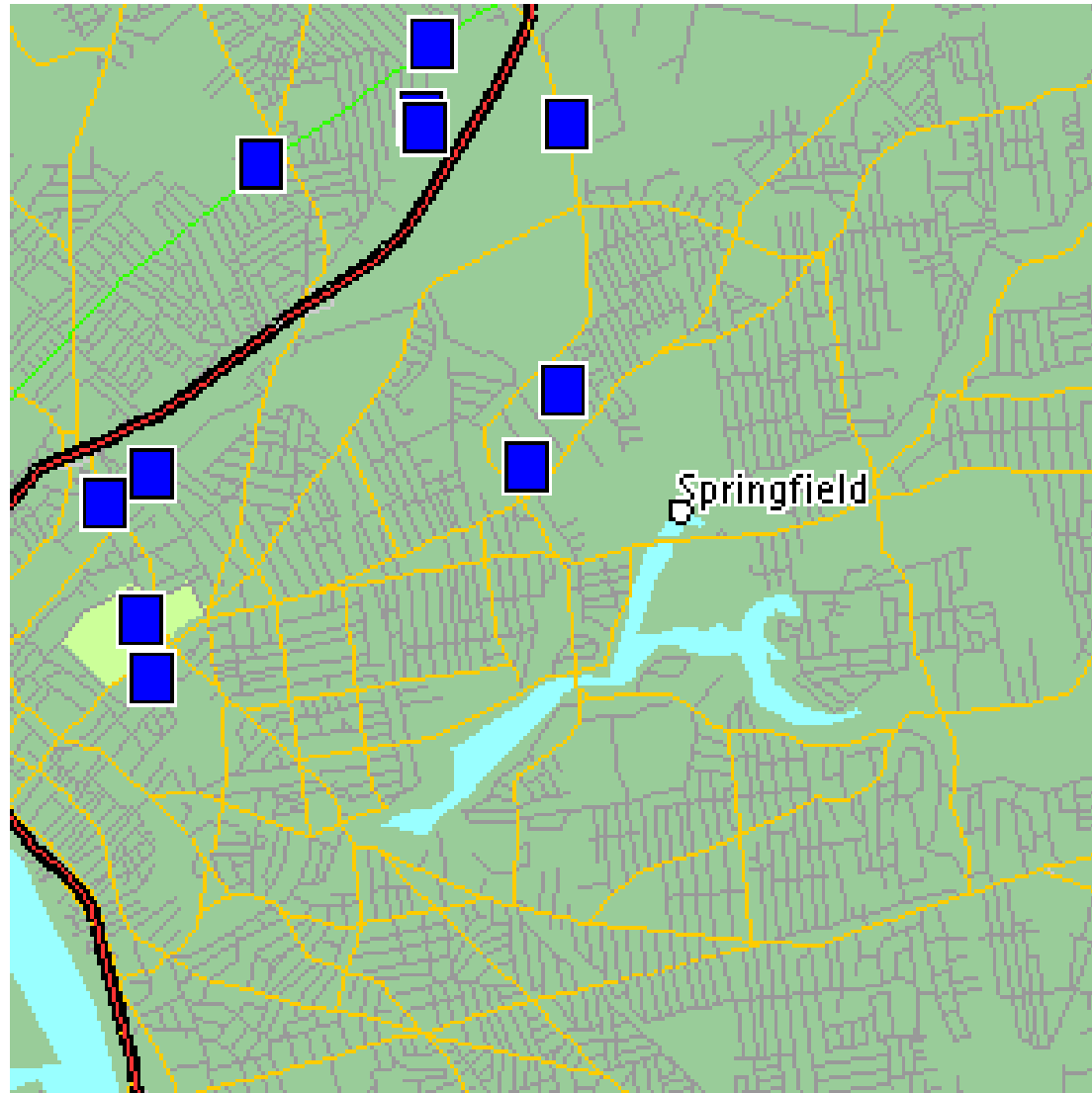
You can check out a region before  
you move...



You can check out a state before  
you move...

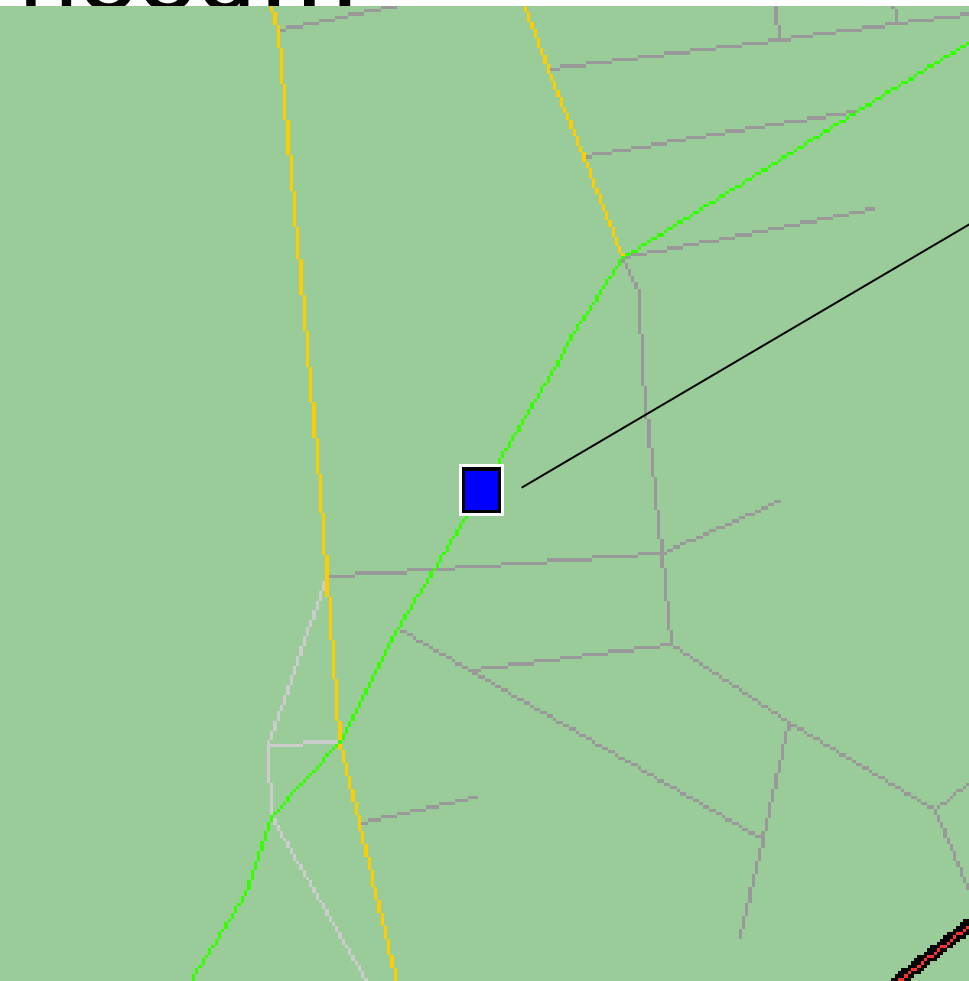


You can search the town for specific pollutants or plants...





check out the local plant on the street  
before you buy a house. There is all  
the information you would ever  
need....



**Criteria Air Pollutant Emissions  
Report: L.E. BELCHER, INC**

**Map(s) Locating this Facility**

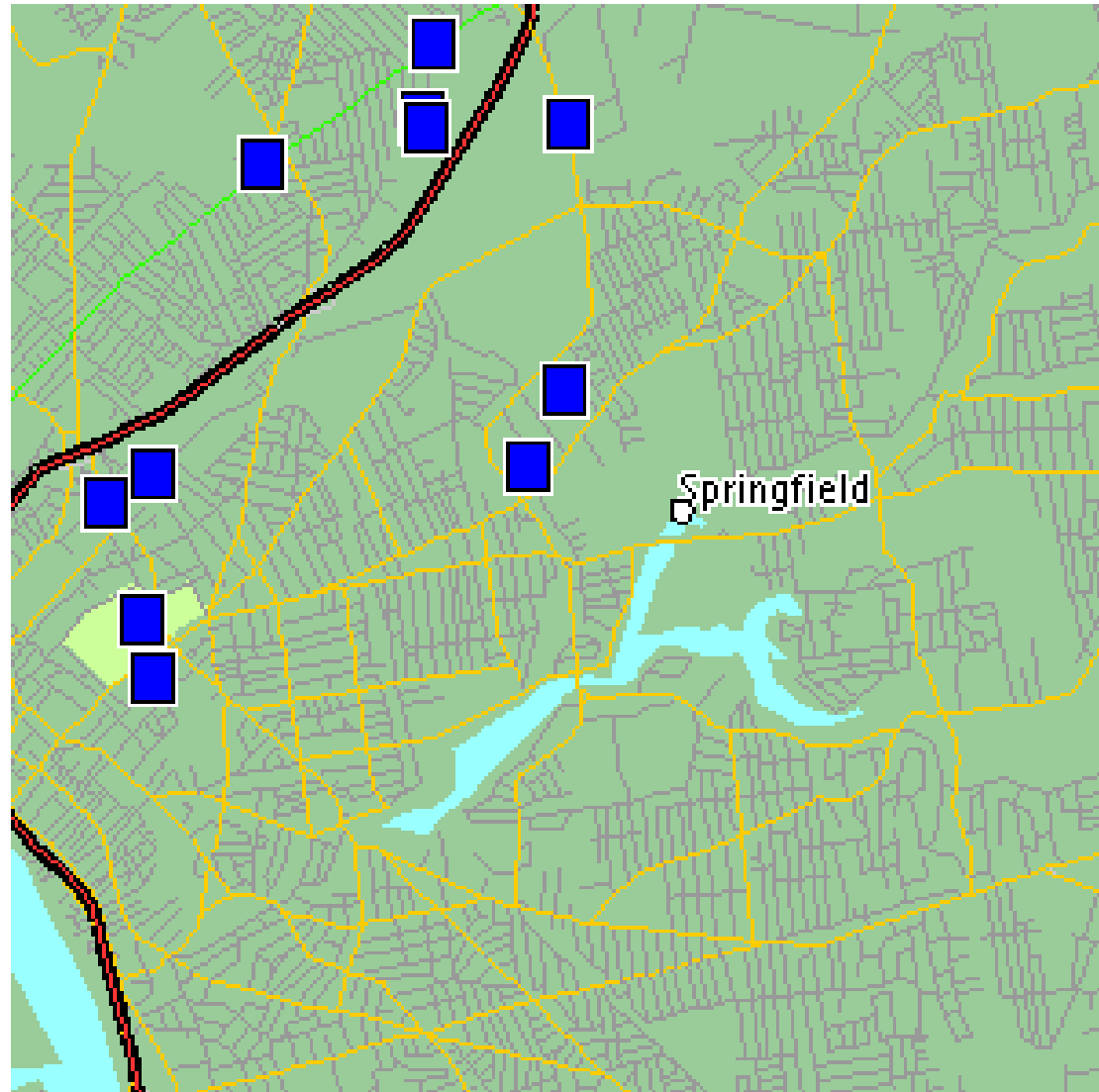
**Rankings for this Facility**

**1999 Emissions Summary**

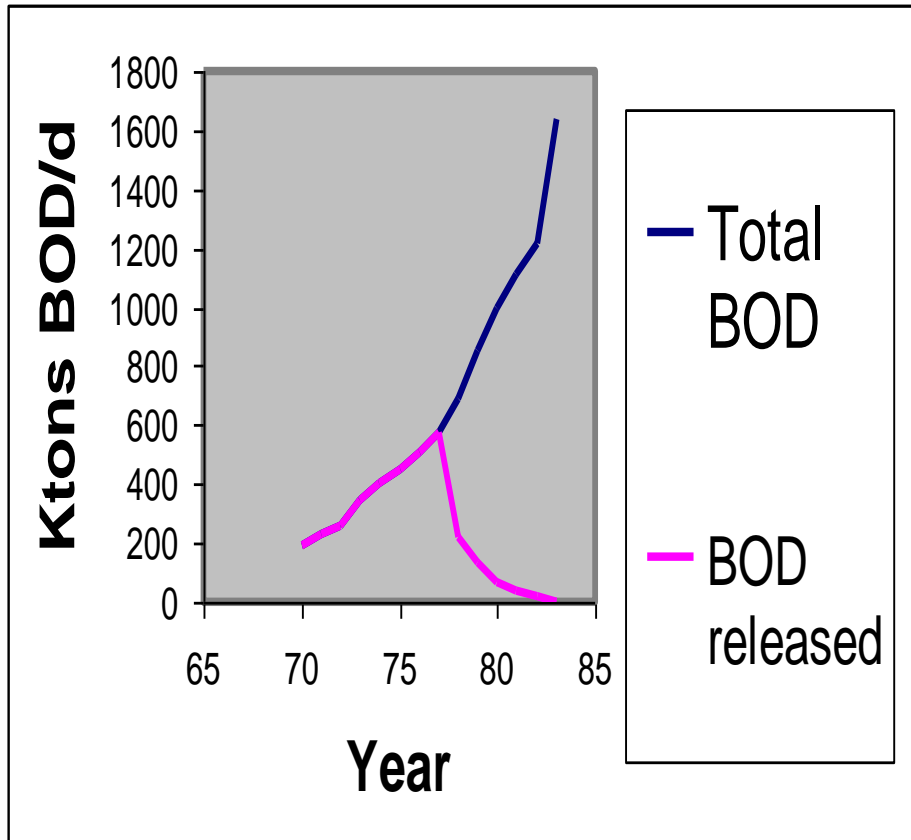
**Facility Information**

erner Policy  
ments

You can search the town for specific pollutants or plants...



# Taxes and Regulation of Palm Oil industries in Malaysia



<1977 25000 ppm BOD

1978 5000

1979 2000

1980 1000

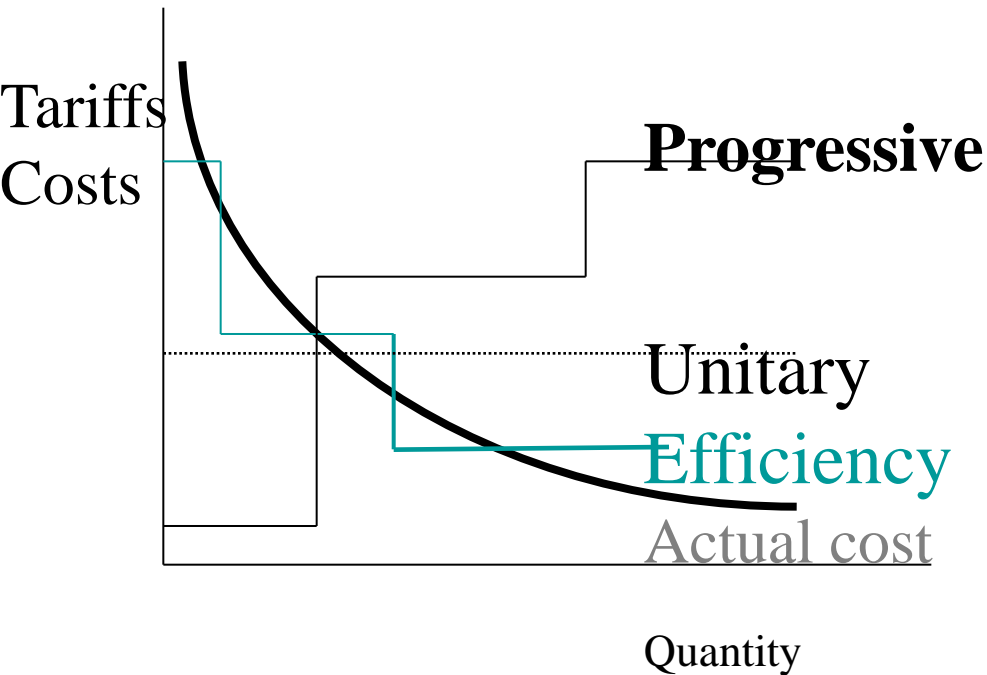
1981 500

1982 250, 1984: 100 etc

$$T = T_0 + T_1 \hat{e} + T_2(e^{-\hat{e}})$$

$$T_1 = 10 T_2$$

# Tariff structure is a policy instrument



- Some tariffs in Mexico 1993 \$/kWh
- Small Resid 0.06
- Big Resid 0.47
- Irrigation 0.10
- Big Indust 0.22
- The poor who are supposed to benefit get nothing

# Water management in S Afr

Kader Asmal, ex-minister of water & forestry in S Africa and chairman of World Commission on Dams, awarded 2000 Stockholm Water Prize for water management in S A.

- • 1994 >16 million S Africans lacked water.
- • Water Policies include:
- • Removal of invasive, species, rob 7% of water.
- • Control planting of trees. License required for “stream flow reduction activity.”
- • Consider how “easy” is LDC carbon sequestration
- >7 million people served

# Personal Responsibility

BEECHER'S HANDMADE CHEESE

**YOU'VE JUST RECYCLED!**

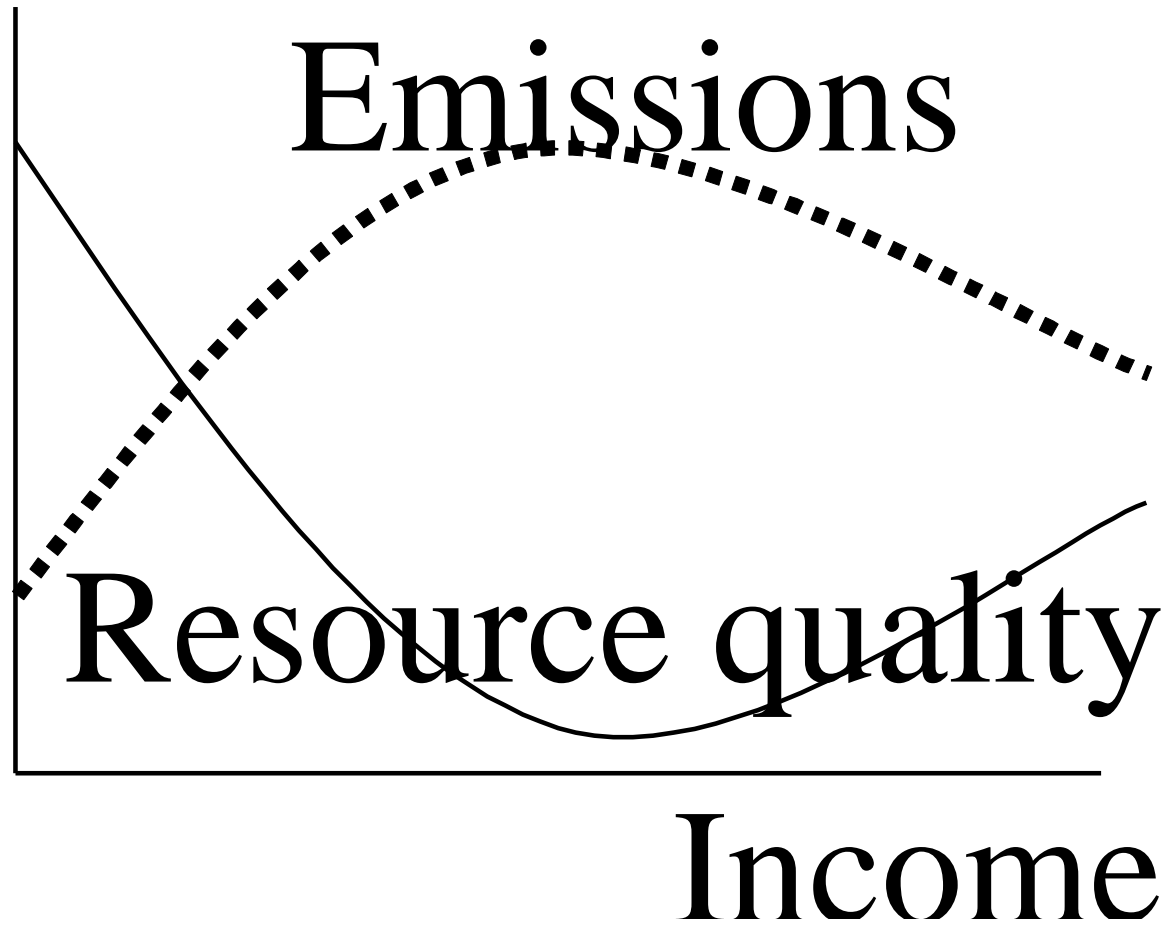
(We pay a premium to sort and recycle all garbage)

# Some Conclusions

- For the poor: Risks, Ecosystem resources and thus Distribution of costs important
- Institutions needed. Capacity building
- Lack of capacity may favor some instruments but does not exclude taxes
- Environmental funds & building partnerships
- Global funds (eg GEF) may be beneficial.

# Growth & Environment

Rome Club  
EKC





# The Grand View of The Future

- The Rome Club
- Herman Kahn
- Measuring Welfare – Net Econ Welfare

# “Let them eat Pollution!”

- Internal memo from Larry Summers:
- *Just between you and me, shouldn't the Bank be encouraging more migration of dirty industries to the LDCs?”*
  1. *Cost of health damage = f(wages)*
  2. *Costs of pollution low in clean environm.*
  3. *Demand for clean env. has high income elasticity*