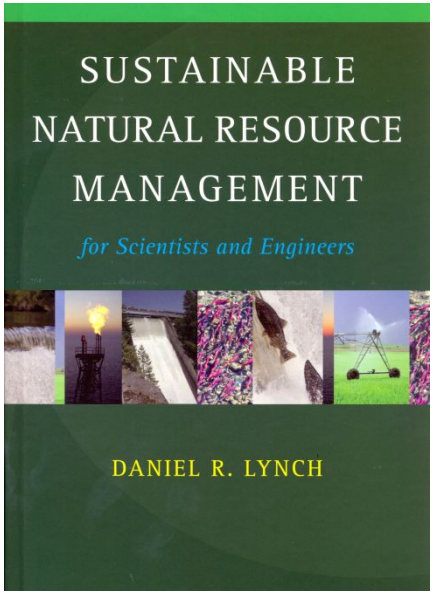
NATURAL RESOURCE MANAGEMENT -
PROBLEMS AND SOLUTIONS

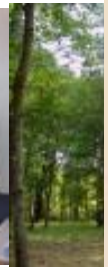
Lecture 2







Ecological Footprint



Ecological Footprint

- The Ecological Footprint measures the amount of nature's resources an individual, a community, or a country consumes in a given year, normalized to a unit of land area, most often hectares
- Coined in 1992 by William Rees a professor at the University of British Columbia in Vancouver, Canada





Every choice we make has an impact on the planet.

- An **ecological footprint** is a tool to measure our environmental impact.
  - It tracks how much individuals, organizations, cities, regions, or nations as a whole consume and compares this amount to the resources nature can provide.

http://www.footprintnetwork.org





Concept of Ecological Footprint

The quantity of bioproductive land

that is required to

support current

consumption food, housing, transport, consumer goods, services

Includes land needed for absorption of waste

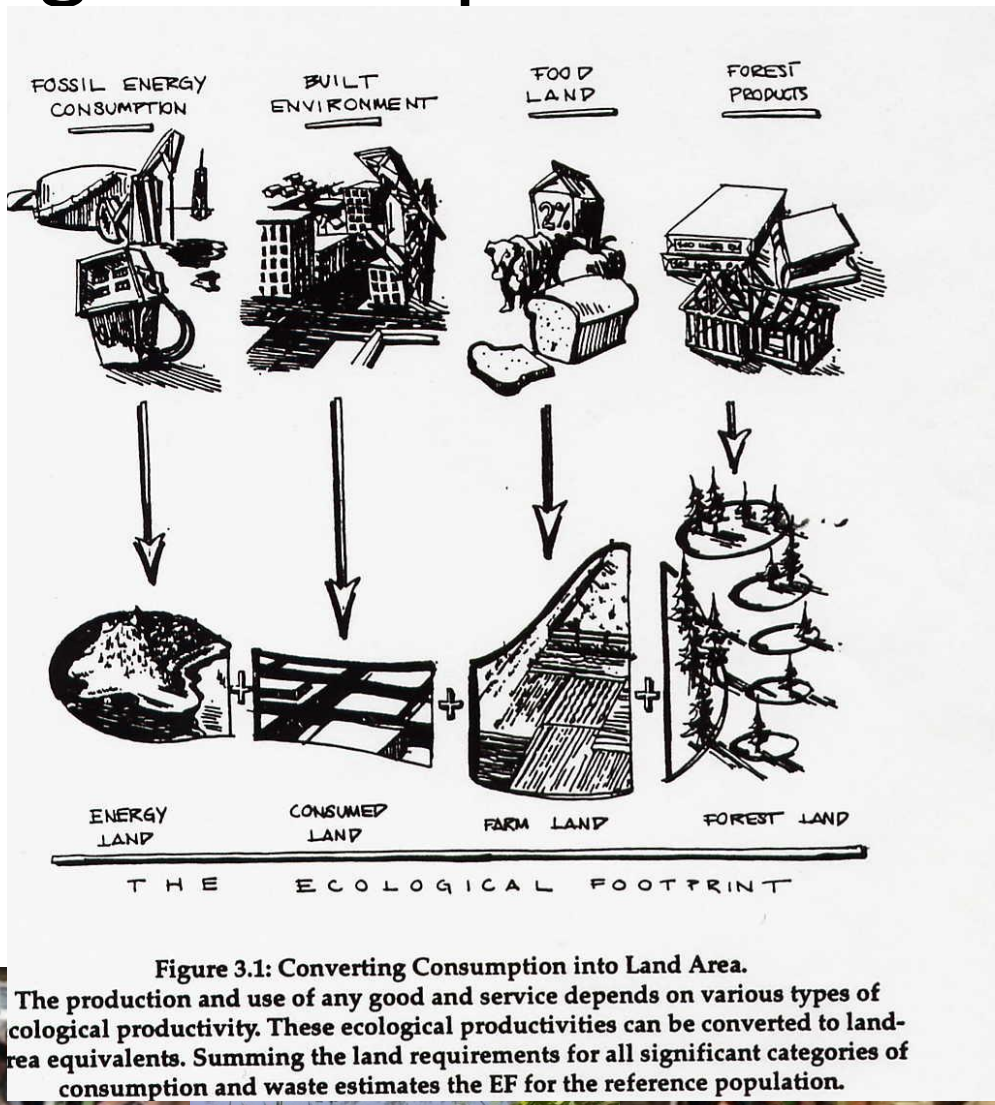


Figure 3.1: Converting Consumption into Land Area.
The production and use of any good and service depends on various types of cological productivity. These ecological productivities can be converted to land-rea equivalents. Summing the land requirements for all significant categories of consumption and waste estimates the EF for the reference population.

Wackernagel and Reese, *Our Ecological Footprint*

How big is your footprint?

- There are currently about 7 **billion** people on the Earth.
- Do you believe that the planet has the capability to support your lifestyle for everyone?





Ecological Rucksack

Ecological Rucksack is the total quantity (in kg) of the natural material that is disturbed in its natural setting and thus considered the total input in order to generate a product - counted from the cradle to the point when the product is ready for use - minus the weight (in kg) of the product itself.





Quantfied Ecological Rucksack

- Steel: 21 (One kilogram of steel carries an ecological rucksack of 21 kilograms.)
- Aluminum: 85
- Recycled Aluminum: 3.5
- Gold: 540,000
- Diamond: 53,000,000
- Rubber: 5.





Some other ecological rucksacks

- Coffee maker - 298 kg
- toothbrush about - 1.5 kg
- plastic bucket - 26 kg
- silver chain - 20 kg
- 12 wine glasses - 6 kg
- 5-gram gold ring - 2000 kg
- wooden beads - 0.5 kg

(Simonen 1999)

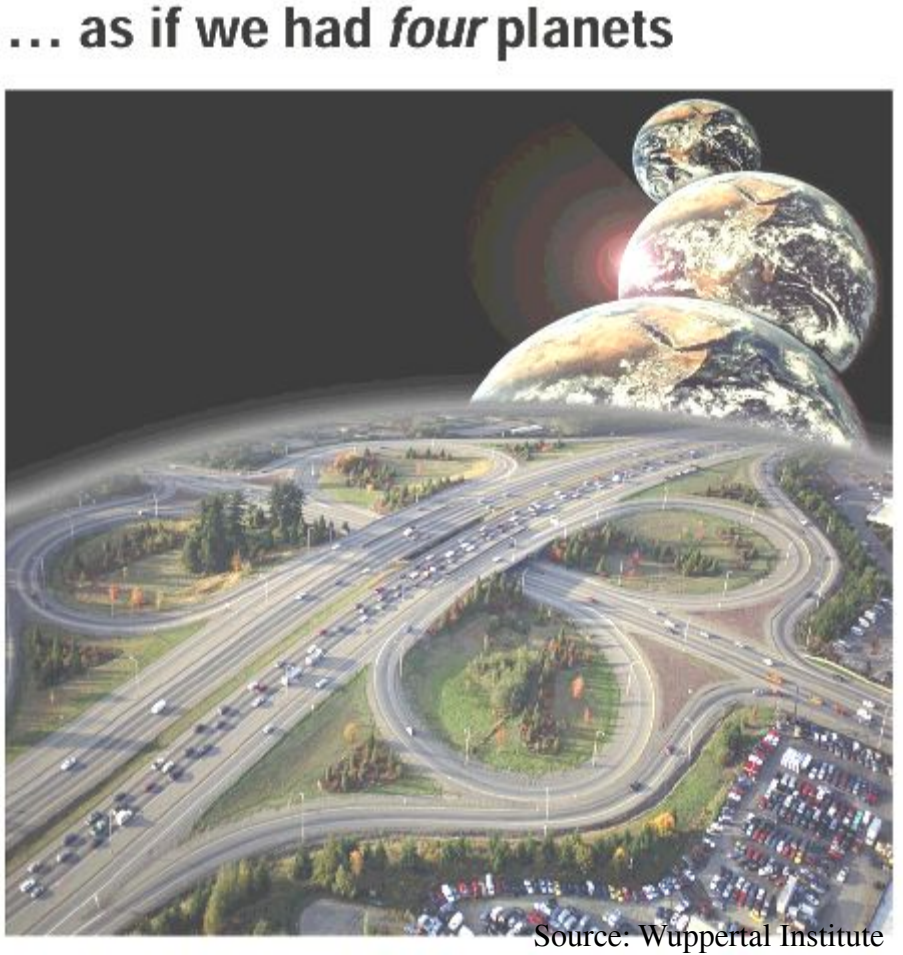




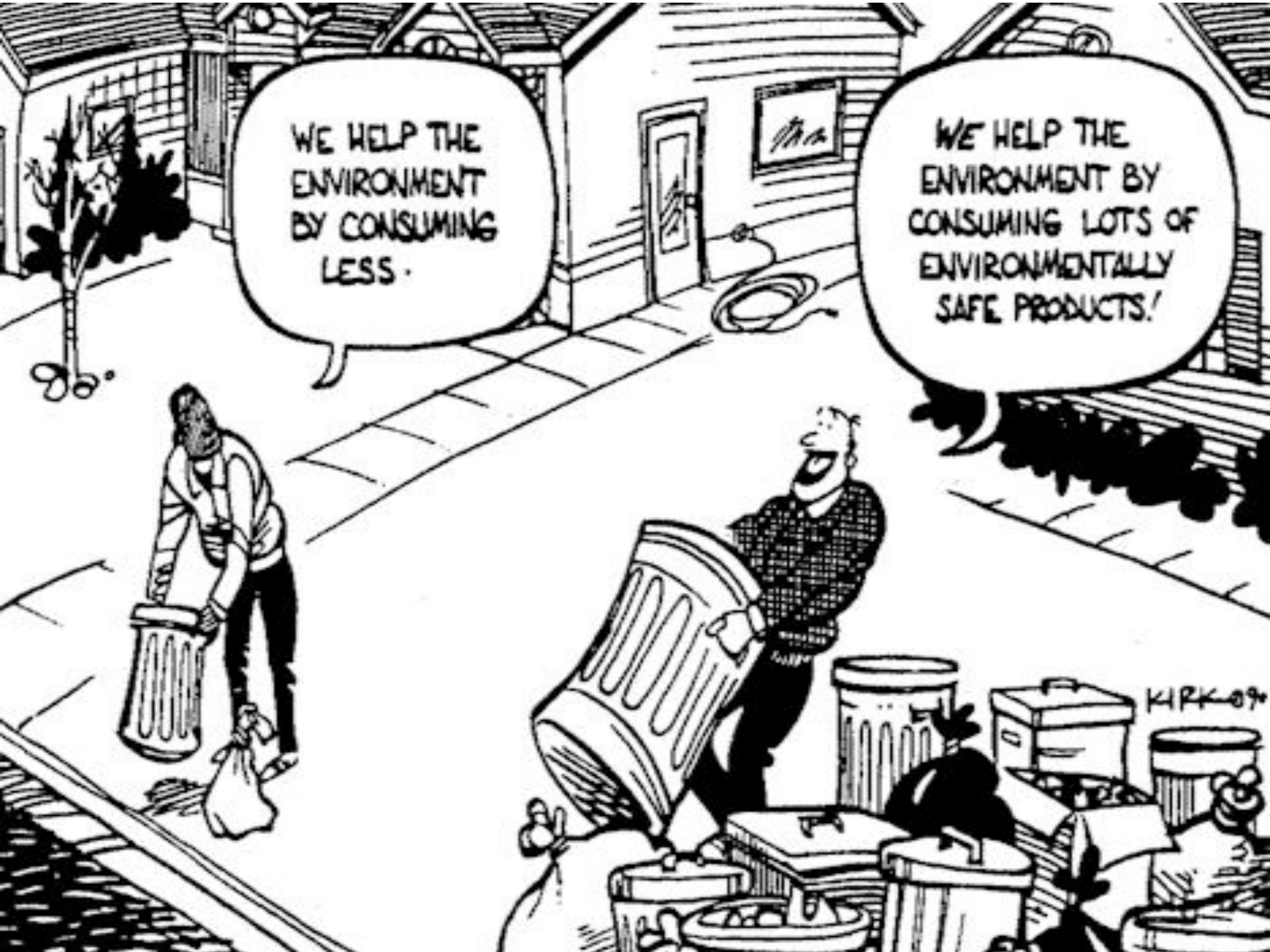
Ecological Rucksack

Resource productivity: more from less

- More benefit out of less material and energy
- More welfare with less environmental damage
- Unsustainable level of natural resource consumption
- Carrying capacity of nature
- Total material consumption
- Consumption distributed unequall
  - increasing poverty problems
  - increasing social problems



Source: Wuppertal Institute


WE HELP THE ENVIRONMENT BY CONSUMING LESS.
WE HELP THE ENVIRONMENT BY CONSUMING LOTS OF ENVIRONMENTALLY SAFE PRODUCTS!
KIRK-94

Natural Resource Management (NRM) is complex and multi-faceted –having policy, institutional, social, economic and technical dimensions.





Different reactions to dynamic change within NRM :

- existing management practices and technologies, policies and institutional arrangements may no longer be sufficient;
- power relations, benefit distribution, and interests may no longer be in balance
- ecological functions may be disrupted
- risks may exceed management capacity
- economic forces may outstrip conservation forces;
- cultural heritage associated with management practices as well as ownership patterns, may no longer be operating.





Shifts in Development Paradigms

1920's – 1940's	Economic cum Cultural Progress Exploitation of natural resources
1940's – 1960's	Economic Progress Industrialization as vehicle of econ devt
1950's – 1970's	Economic Progress cum Rural Development Recognition of disparity in income
1970's	Integrated Area Development Agri-production and geographic equity
1980's	Participatory Development Reversal of TOP–DOWN approach
1990's-2000's	Sustainable Development





Paradigm Shift

- A paradigm shift is call for a shift from ***business as usual***, and from *lineal approach* to *interdisciplinary approach.*

- The paradigm shift needs to start with *institutions of higher education.*These institutions are well placed to make the necessary curriculum changes that will turn out future professionals that have the skills and knowledge to work in interdisciplinary teams.

- Interdisciplinary approach to problem solving means that *professionals of different backgrounds work together to solve a complex problem*.





Ceres Principles
1989

a 10-point code of corporate environmental ideals to be publicly endorsed by companies as an environmental mission statement or ethic

- Protection of the biosphere
- Sustainable use of natural resources
- Reduction and disposal of wastes
- Energy conservation
- Risk reduction
- Safe products and services
- Environmental restoration
- Informing the public
- Management commitment
- Audits and reports





Hannover Principles

(William McDonough and Michael Braungart, 1992)

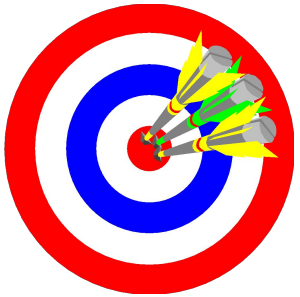
http://www.mindfully.org/Sustainability/Hannover-Principles.htm

- Rights of humanity and nature to co-exist
- Interdependence between humans and nature
- Respect relationships between spirit and matter
- Responsibility for consequences of design
- Safe objects of long-term value
- Eliminate the concept of waste
- Rely on natural energy flows
- Understand the limitations of design
- Share knowledge for constant improvement





Objective of Natural Resource Management



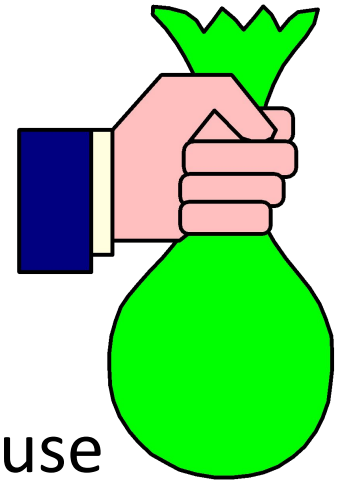
Sustainable Use:

Use of natural resources in ways that ensure a non-declining stream of benefits for all, without weakening ecological functions of the resources.





Economic Principles



Full-cost pricing is the essence of economic principles

- **Undistorted price**
  - remove government subsidies for resource use
- **Cost internalization**
  - resource users pay for external effects
- **Constant income**
  - estimate & invest user costs to maintain income-generating capacity of the resource





Harvard Business Review*

"An activity is sustainable when all costs are internalized."

"Holding on to an economics-based definition of sustainability helps reconcile broader social interests with the measurement of shareholder value."

* "We Need a Definition of Sustainability", Chris Meyer - 2008





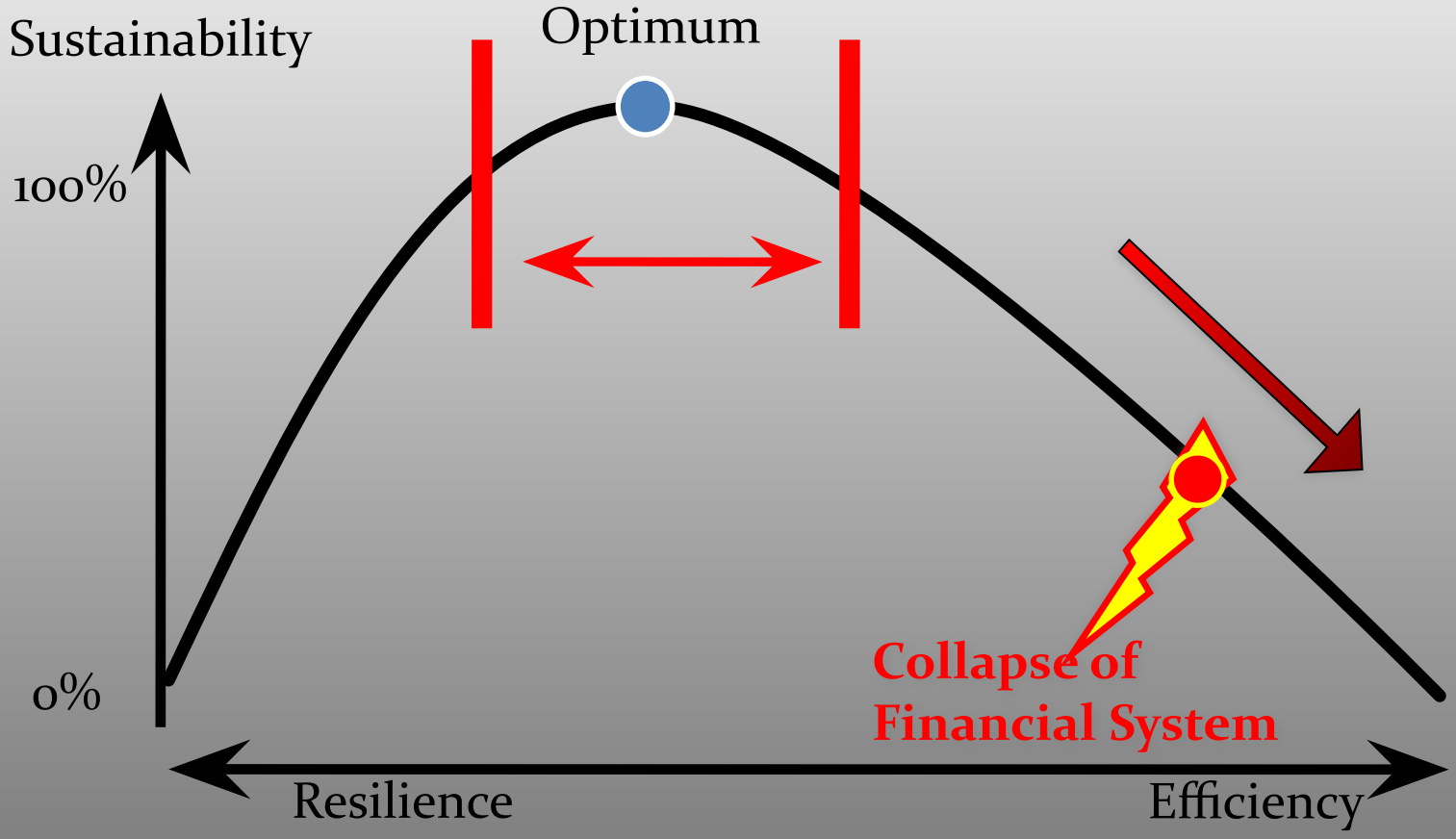
A system is sustainable when it does not generate the symptoms of unsustainability.

The most important chart in the world…



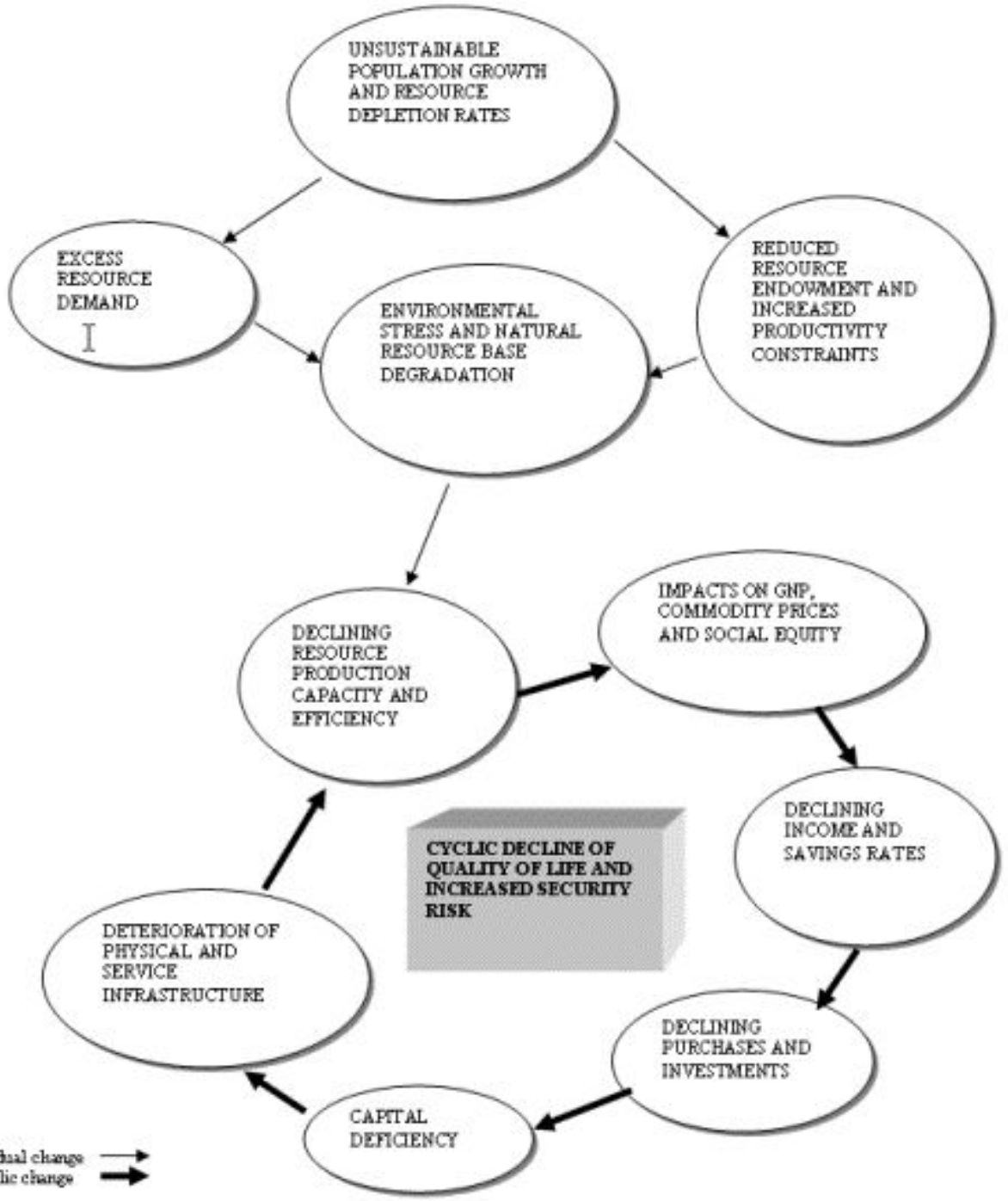

Natural Systems Definition: Balance of Efficiency and Resiliency

Source: Lietaer, Ulanowicz, Goerner 2008








UNSUSTAINABLE POPULATION GROWTH AND RESOURCE DEPLETION RATES
EXCESS RESOURCE DEMAND
ENVIRONMENTAL STRESS AND NATURAL RESOURCE BASE DEGRADATION
REDUCED RESOURCE ENDOWMENT AND INCREASED PRODUCTIVITY CONSTRAINTS
DECLINING RESOURCE PRODUCTION CAPACITY AND EFFICIENCY
IMPACTS ON GNP, COMMODITY PRICES AND SOCIAL EQUITY
DECLINING INCOME AND SAVINGS RATES
CYCLIC DECLINE OF QUALITY OF LIFE AND INCREASED SECURITY RISK
DECLINING PURCHASES AND INVESTMENTS
CAPITAL DEFICIENCY
DETERIORATION OF PHYSICAL AND SERVICE INFRASTRUCTURE
Gradual change
Cyclic change

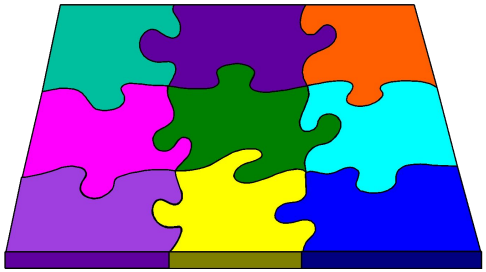
Environmental Principles

- **Sustainable harvest**
  - do not mine renewable resources
- **Constant stock**
  - increase renewable resources to make up for loss of non-renewable resources
- **Precautionary principle**
  - safeguard ecological functions in the face of uncertainty





Social Principles



- **Fair distribution**
  - distribute secure property rights or use rights to the poor
- **Community management**
  - rely on community institutions for managing their common resources
- **Critical support**
  - provide info, technology, training, & credits to enable sound resource management





Principles: Illustration

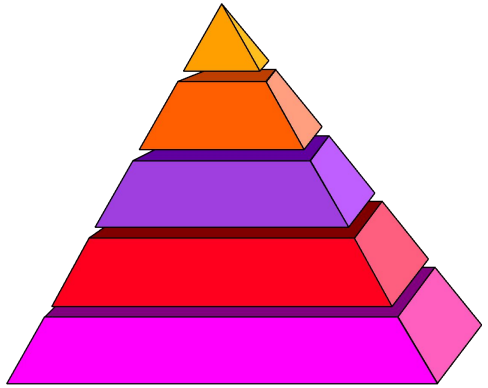
Economic	Env'tal	Social
Undistorted price	Sustainable harvest	Fair distribution
Cost internalization	Constant stock	Community management
Constant income	Precautionary principle	Critical support





Institutional Implications

- What institutional arrangements are required to:
  - implement full-cost pricing?
  - ensure sustainable harvest?
  - prevent irreversibility?
  - redistribute rights over use of resources
  - make community resource mgt effective?
- What are the difficulties?







Approaches applied to natural resource management

- Top-down or Command and control
- Bottom-Up (regional or community based NRM)
- Adaptive management
- Precautionary approach
- Integrated approach (INRM)





Adaptive management

- Determination of scale
- Collection and use of knowledge
- Information management
- Monitoring and evaluation
- Risk management
- Community engagement
- Opportunities for collaboration





Definitions of Integrated Natural Resource Management

- INRM is defined as *an approach that integrates research on different types of natural resources into stakeholder-driven processes of adaptive management and innovation to improve livelihoods, agro-ecosystem resilience, agricultural productivity and environmental services at community, eco-regional and global scales of intervention and impact*' (Hawkins et al 2009) .
- Sayer and Campbell (2004) defines INMR as a *systems approach and a process-orientated approach that leads to measurable impacts and outcomes; work at multiple scales with multiple stakeholders; address issues of tradeoffs; employ new tools and methods; be amenable to scaling up and out ....*"





INRM Efficiency

The efficiency of INRM in dealing with these problems comes from its ability to:

i. empower relevant stakeholders
ii. resolve conflicting interests of stakeholders
iii. foster adaptive management capacity
iv. focus on key causal elements (and thereby deal with complexity)
v. integrate levels of analysis
vi. merge disciplinary perspectives
vii. make use of a wide range of available technologies
viii. guide research on component technologies
ix. generate policy, technological and institutional alternatives





Principles of INRM

- INRM integrates the perspectives, knowledge and actions of different stakeholders around a common theme. The theme or 'entry point' represents a research and development 'challenge', identified by one or more stakeholders who recognize that a broader working alliance is needed to achieve the desired development impact.

- INRM integrates the learning that stakeholders achieve through working together. Beyond simply a concerted *action* process, INRM is a social *learning* process, with stakeholders learning from the experience of working together.

- INRM integrates analysis, action and change across the different (environmental, social and economic) 'dimensions' of development.





Approach to INRM institutionalisation

Institutional Arrangement for projects implementation

Capacity development

Stakeholder Engagement

Team work





Implementing INRM principles

Education •External stakeholders engaged in curricula development / design and teaching •Room for experiential learning by doing (rather than being taught) •Focusing on problem solving capacities (rather than on just acquiring knowledge) •Room to apply real world issues in a professional context (rather than on classroom case studies or artificial/ academic field work situations) •Room for inter-disciplinary curriculum development and teaching within and between faculties •Collective learning (rather than individual)	**Research** •Joint research with stakeholders •Room for inter-disciplinary research within and between faculties •Problem-oriented research co-identified/co-researched and (partly) paid for by external stakeholders •Research more linked to policy processes with long-term strategic engagement •Link research to teaching around real life cases •More consistency and complementarities in research programmes •Experimentation with other research models such as action research	**Service to the community** •Clear strategic orientation on intended impact and service delivery (whose problem will be solved?) •Consistency in programme to translate new knowledge (research result) in societal impact •Long-term R&D assignments in support of change processes in society •Quality checks in place by engagement of independent bodies





Strengthening INRM capacities

At individual staff level (competencies)	At organizational level (norms & culture)	At institutional level (conditions & mechanisms for inter-institutional linkages)
At individual staff level (competencies) •*Apart from knowledge in the individual academic discipline also in* ***meta-disciplines:*** *systems thinking, knowledge management, strategic planning, knowing how to learn, effective writing, use of ICT, etc.;* •*In* ***social skills****: communication, teamwork, networking, facilitation, etc.,* •*In* ***mindsets*** *and attitudes: empathy, self-awareness, self-regulation, self-motivation, social awareness*	***At CANR/KNUST organizational level (norms & culture)*** •*In structures and processes needed to provide performance and incentives that encourage interdisciplinary teamwork* •*In partnerships with other stakeholders* •*With emphasis on mutual learning* •*Improved communication* •*With effective knowledge management that promotes learning and change*	***At institutional level (conditions & mechanisms for inter-institutional linkages)*** •*That allow different stakeholders - individuals and organisations, from public and private sectors – to come together on a "level playing field"* •*Finding appropriates ways to manage & finance inter-institutional space* •*Linking education and research to policy development, remaining relevant and problem-oriented.*





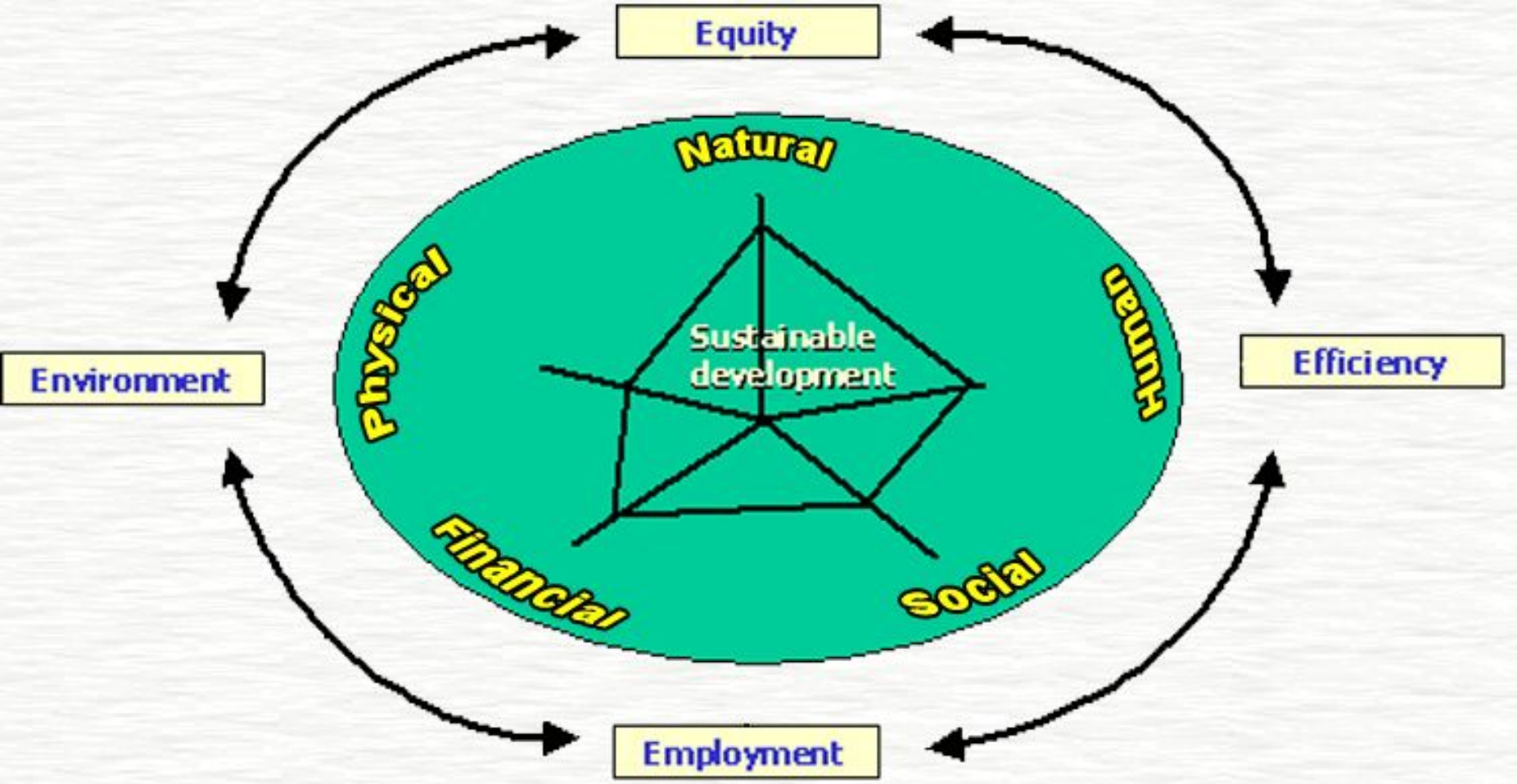


Figure 3. Sustainable management of natural resources through development of five capitals