

Boosting the Ecology in the Ecosystem Approach

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Managing Ecosystem Processes and the Ecosystem Approach

4 Ecosystem Processes

Example - Lake Nakuru, Kenya

Tools for Managing Ecosystem Processes

Discussion Questions

The Ecosystem Approach and Ecology

Principle 3:

Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Principle 5:

Conservation of *ecosystem structure and functioning*, in order to maintain *ecosystem services*, should be a priority target of the ecosystem approach.

The Ecosystem Approach and Ecology

Principle 6:

Ecosystems must be managed within the limits of their functioning.

Principle 8:

Recognising the varying temporal scales and lag-effects that characterise *ecosystem processes*, objectives for ecosystem management should be set for the long term.



Ecosystem Services

The benefits people obtain from ecosystems

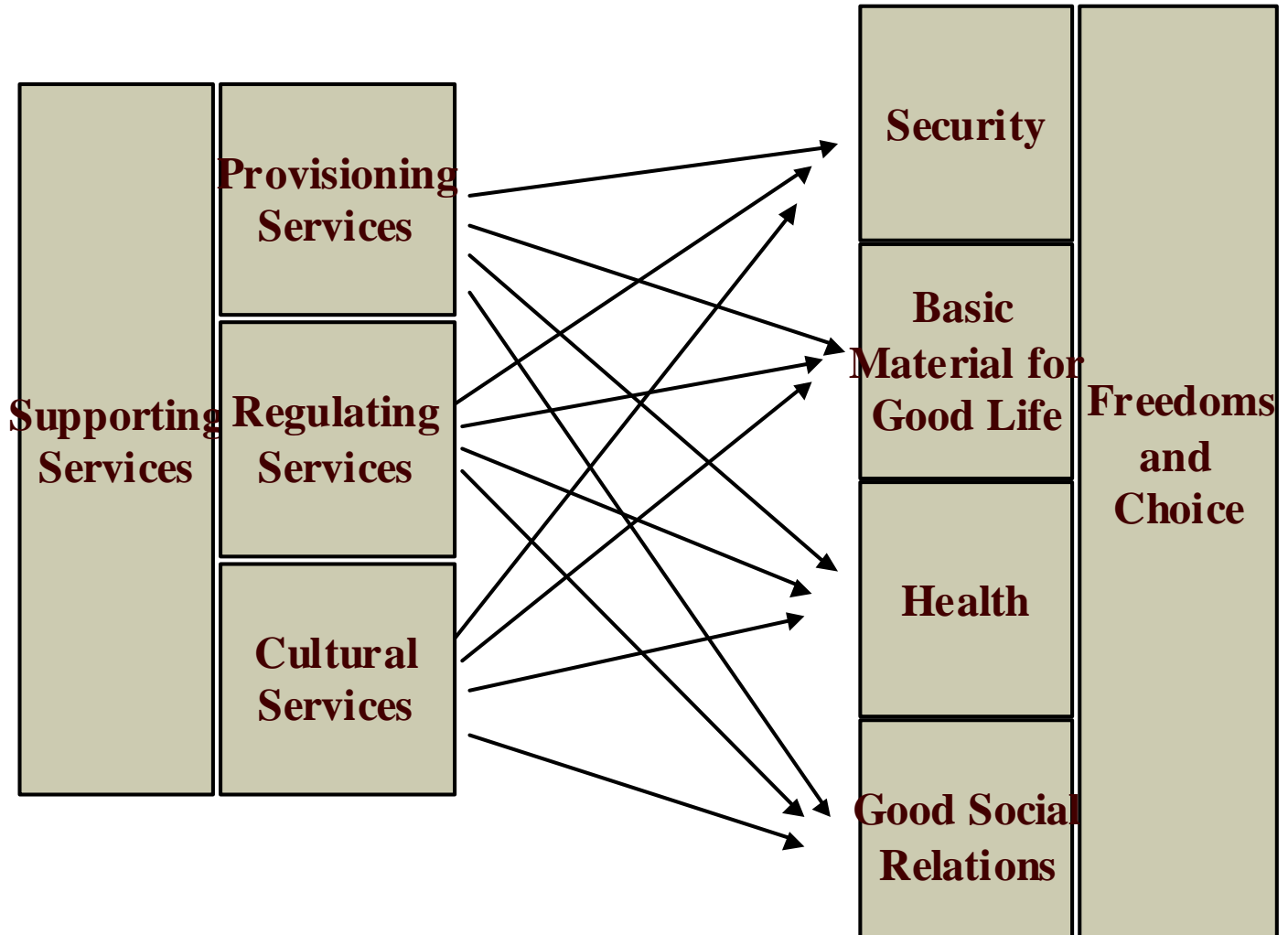
<p>Provisioning</p> <p>Goods produced or provided by ecosystems</p> <ul style="list-style-type: none">• food• fresh water• fuel wood• genetic resources	<p>Regulating</p> <p>Benefits obtained from regulation of ecosystem processes</p> <ul style="list-style-type: none">• climate regulation• disease regulation• flood regulation	<p>Cultural</p> <p>Non-material benefits from ecosystems</p> <ul style="list-style-type: none">• spiritual• recreational• aesthetic• inspirational• educational
<p>Supporting</p> <p>Services necessary for production of other ecosystem services</p> <ul style="list-style-type: none">• Soil formation• Nutrient cycling• Primary production		



Consequences of Ecosystem Change for Human Well-being

**Ecosystem
Services**

**Constituents of Well-
being**



Energy Flow

Water Cycle

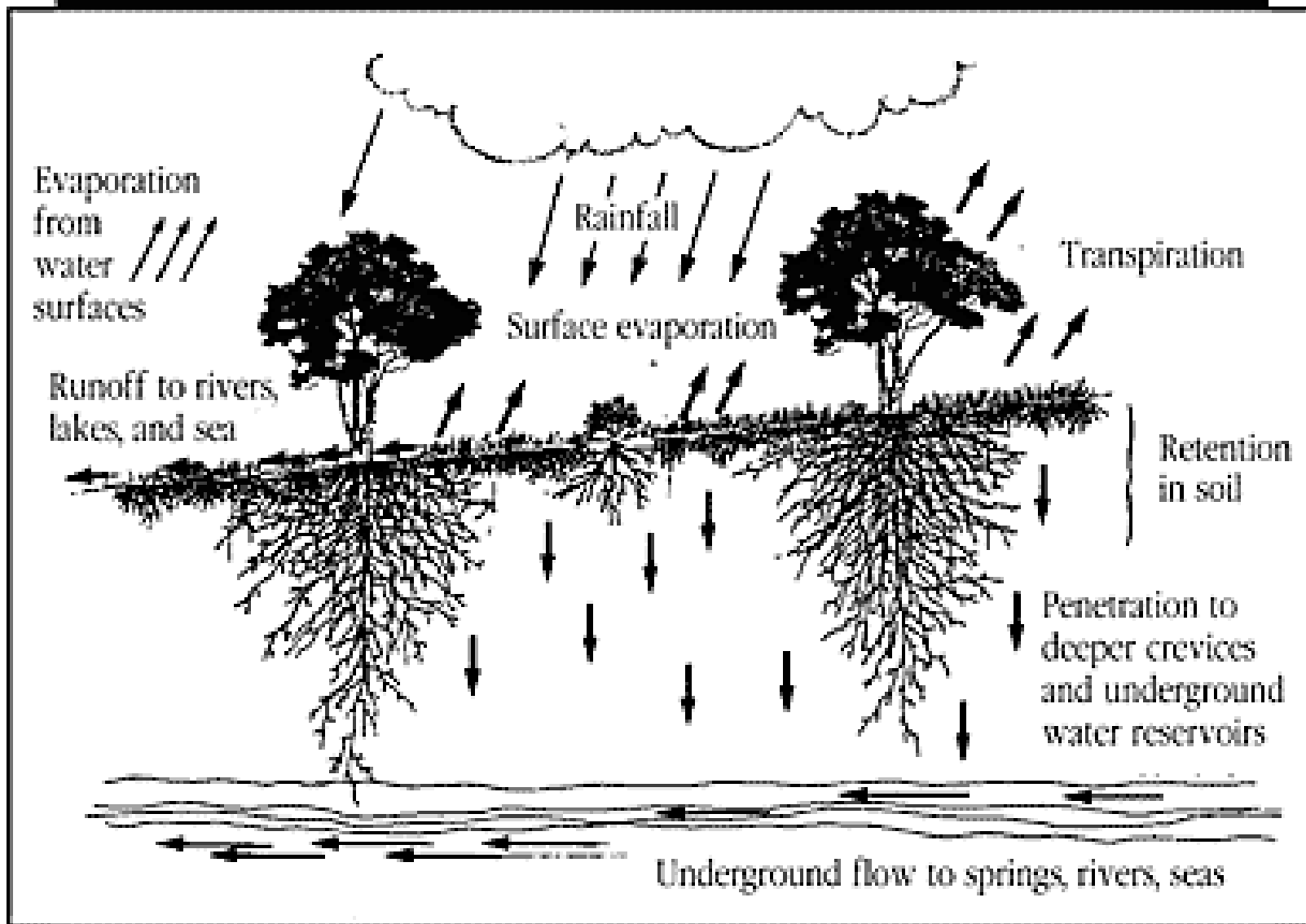


**Natural
Community
Dynamics**

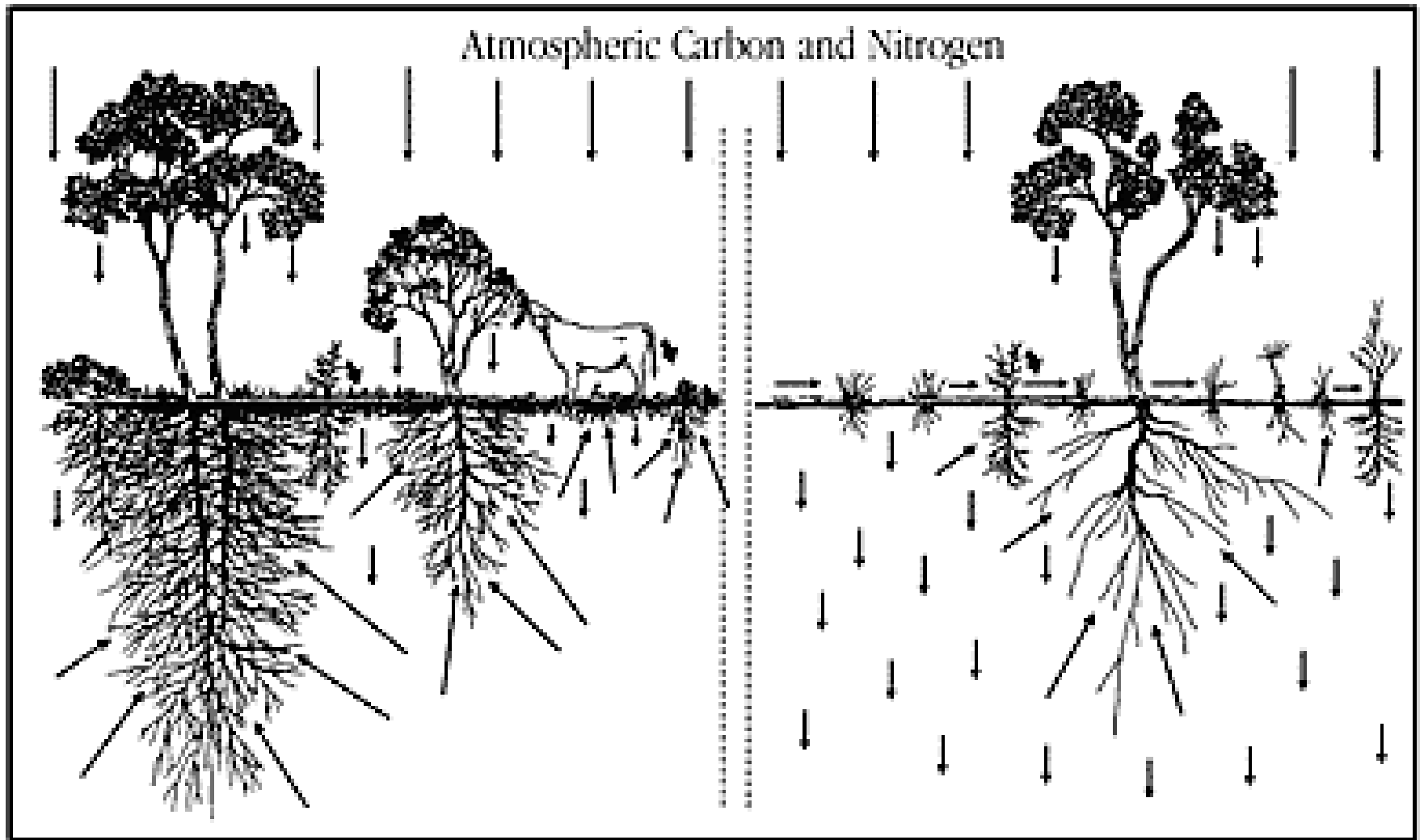
Mineral Cycle

www.holisticmanagement.org

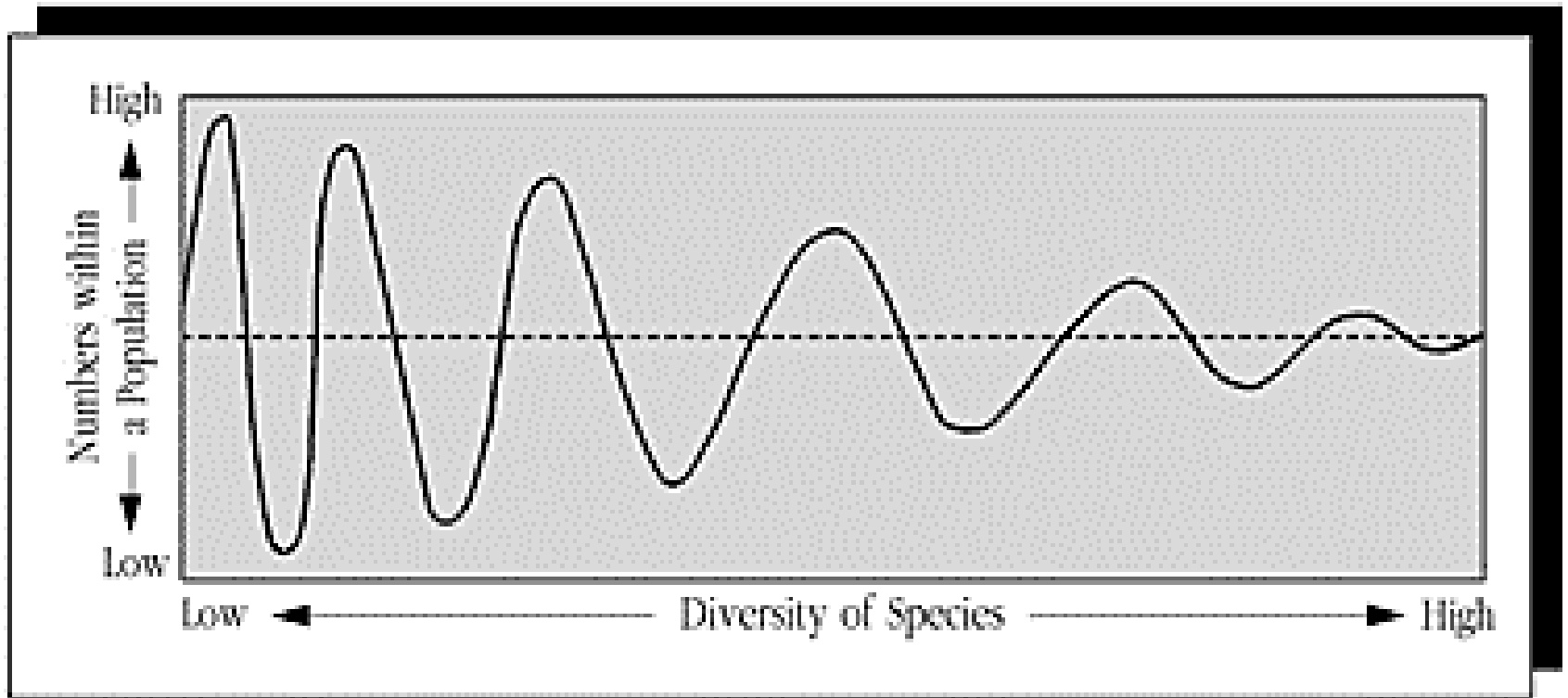
The Water Cycle



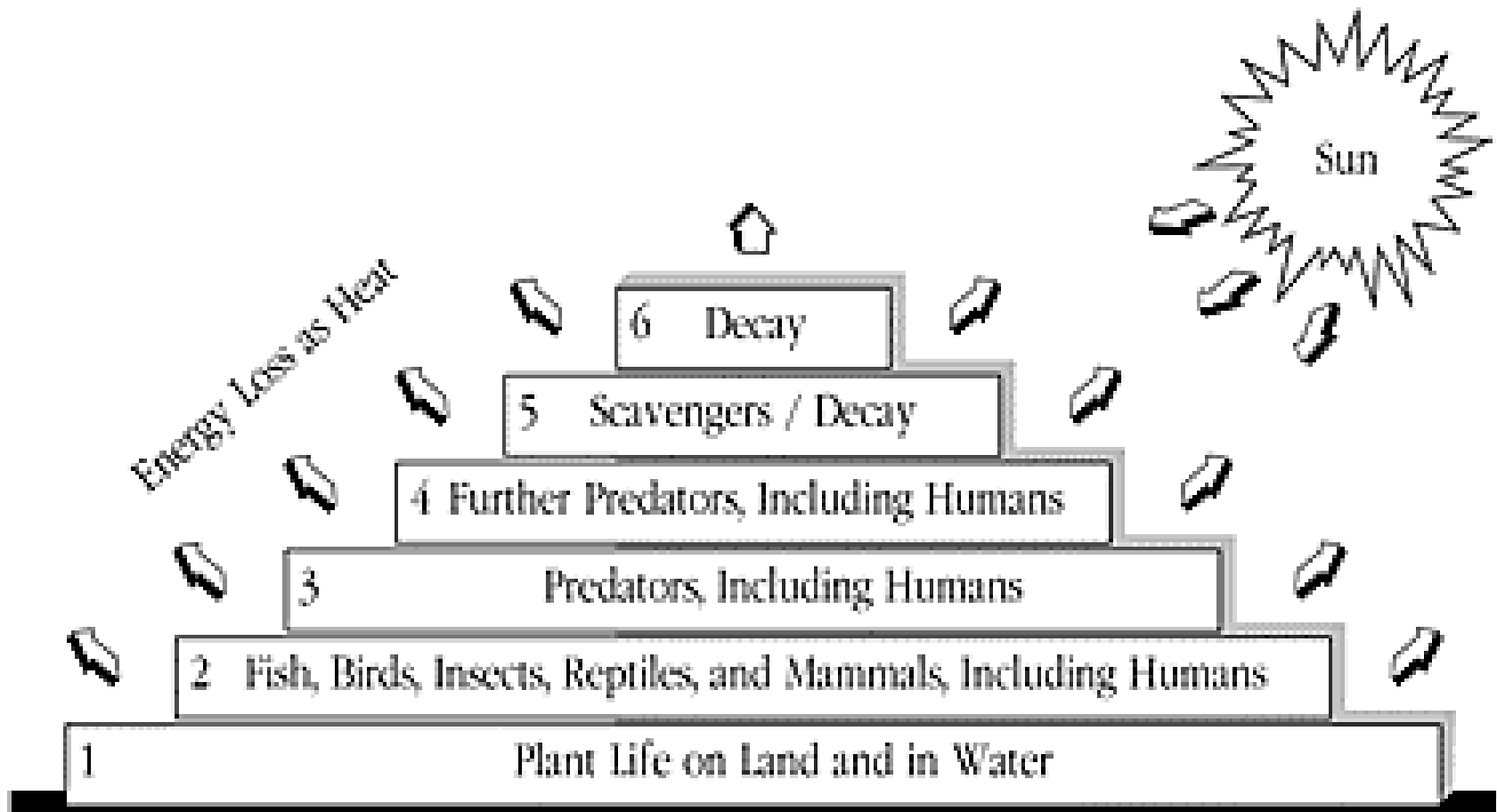
The Mineral Cycle



Community Dynamics



Energy Flow





Water Cycle	Complex, high soil infiltration & moisture content	Quick, high evaporation and run-off; low soil moisture
Mineral Cycle	Complex, slow	Simple, reduced decomposition
Community Dynamics	High species richness and diversity	Few species, high population fluctuations
Energy Flow	High	Low

LOCATION OF LAKE NAKURU CATCHMENT

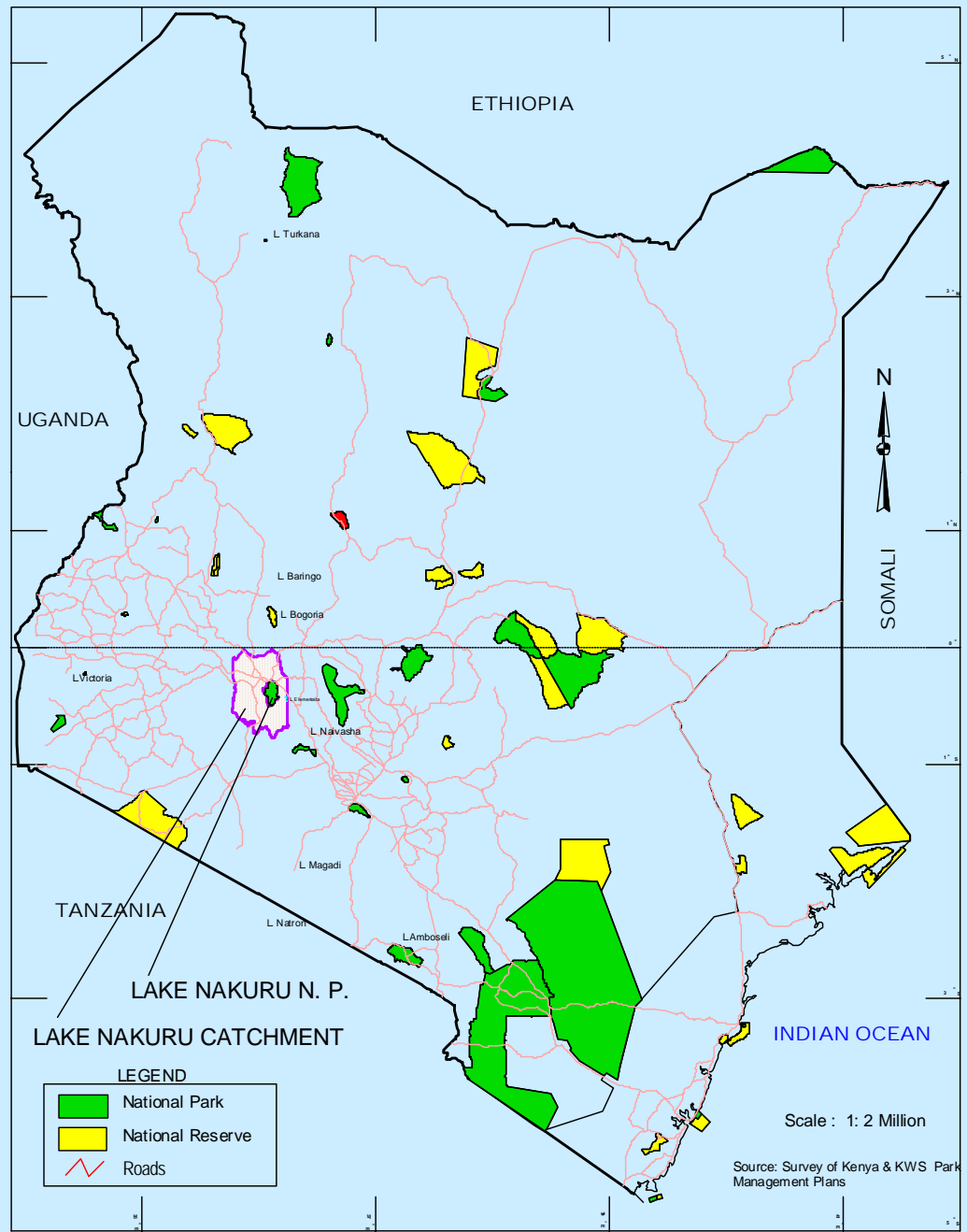


Figure :1. Location of Lake Nakuru Catchment Area





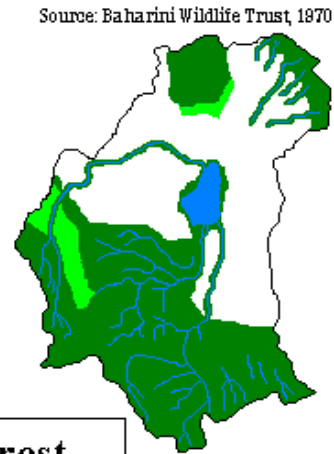


LAKE NAKURU CATCHMENT BASIN

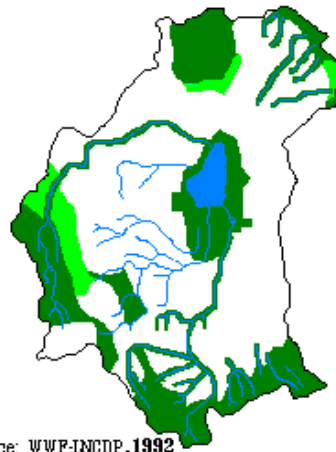
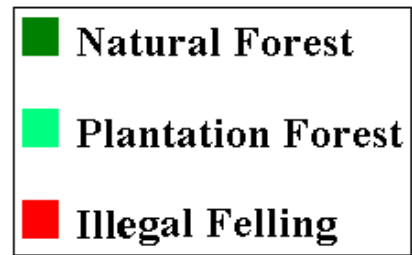
CHANGES IN FOREST COVER - 1930-1998



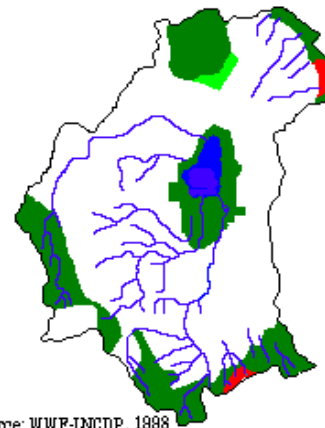
Source: J. Dawson, 1898



Source: Baharini Wildlife Trust, 1970



Source: WWF-INCDP, 1992

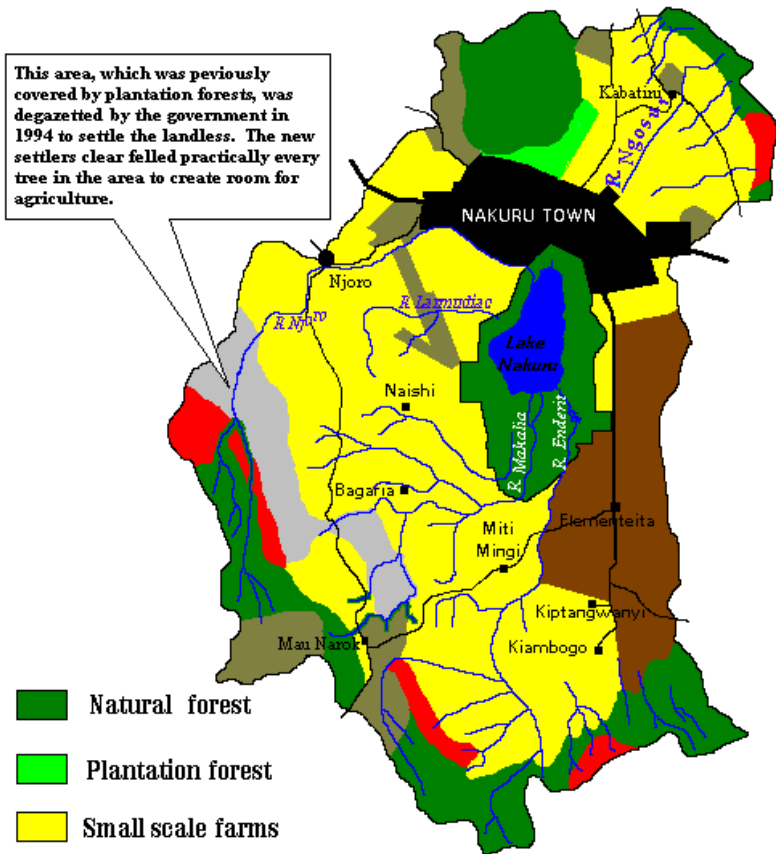


Source: WWF-INCDP, 1998

LAKE NAKURU CATCHMENT BASIN

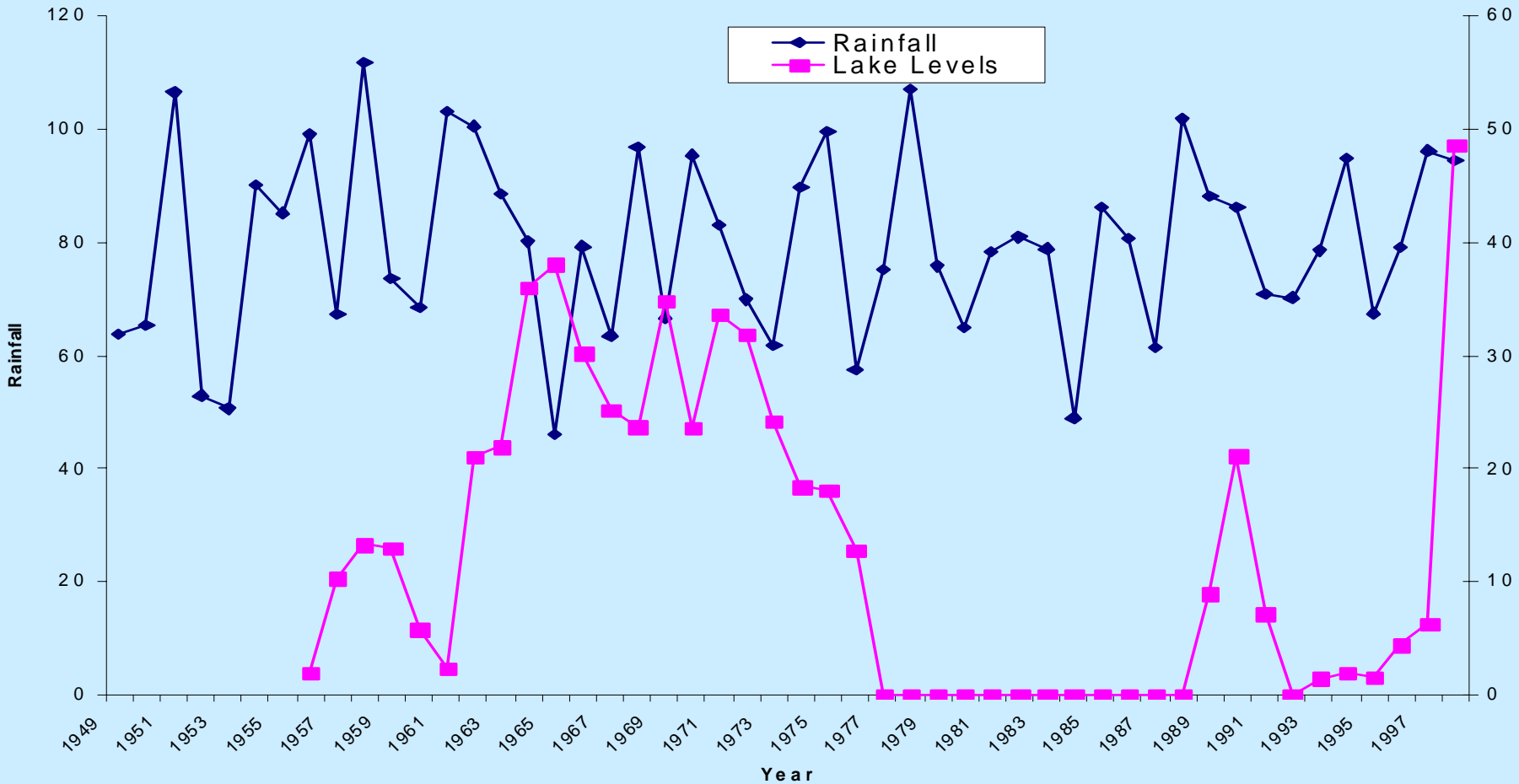
LAND USE - 1998

This area, which was previously covered by plantation forests, was degazetted by the government in 1994 to settle the landless. The new settlers clear felled practically every tree in the area to create room for agriculture.



- Natural forest
- Plantation forest
- Small scale farms
- Large scale farms
- Ranches
- Illegal Felling
- Area degazetted and allocated to small scale farmers in 1994

Rainfall and Lake Level relationship



Pressures and Changes at Lake Nakuru - 1

- **Electric fence - no migration of large mammals**
- **No lions or elephants**
- **Declining girafes, bush bucks, reed bucks and other specialist browsers**
- **Declining palatable grass species & spread of unpalatable shrubs**

Pressures and Changes at Lake Nakuru - 2

- **Increasing bare soil**
- **Declining tree cover**
- **Siltation and nutrient and heavy metal pollution of the Lake - from the town and farms**
- **Irregular and declining streamflow**
- **Increasing agriculture and urbanisation, with bore holes contaminated by sewage and agrochemicals**

The Ecosystem Processes in the Lake Nakuru Catchment

Water Cycle -

degraded, with increased evaporation and run-off from bare soil areas, reduced soil moisture, reduced infiltration to soil and groundwater.

Mineral Cycle -

reduced nutrient cycling and availability in areas with loss of tree cover and no presence of herding animals.

The Ecosystem Processes in the Lake Nakuru Catchment

Community Dynamics -

declining diversity, including loss of rarer species and some predators, and increase in some commoner species.

Energy Flow -

reduced capture of the sun's energy in the ecosystem, with reduced plant biomass and growth rates, less trees and more shrubs, less palatable grass.

Improved Management of which Ecosystem Process will give the greatest impact to increase wildlife populations and ecosystem services?

Water Cycle - limited water for plant growth and wetland habitats and aquifer recharge.

Mineral Cycle - not limiting growth, except for palatability of grazing.

Community Dynamics - most species and trophic groups still present.

Energy Flow - not limiting wildlife populations, except as lack of palatable grazing.

Management to Improve the Water Cycle around Nakuru

**(focus on the Ecosystem Processes at the soil
surface)**

TOOLS:

**Technology - e.g. use machinery to break capped
soil, herbicides to remove bushes**

**Rest - e.g. remove or cull animals, limit tourist
vehicles**

Fire - e.g. controlled burning

Management to Improve the Water Cycle around Nakuru

TOOLS:

Grazing - e.g. manage herds to encourage new grass growth

Animal Impact - e.g. concentrate herds for trampling of bushes and to break capped soil

Living Organisms - e.g. introduce lions!

***Monitoring and Indicators for Management
Actions to improve the Ecosystem Processes
around Nakuru***

Percentages of bare soil, bush and tree cover

Soil moisture and organic / humus layer

Percentage of palatable grazing species in quadrats

Streamflow and turbidity

Assume wrong in ecosystem management decisions!

Summary and Conclusions - 1

Why think about Management and Conservation in terms of Ecosystem Processes?

- the Ecosystem Processes sustain all the other services and benefits of our ecosystem and natural environment;
- to increase a desired species or reduce a problem one, look at the Ecosystem Processes. How have they changed to reduce or favour this species?

Summary and Conclusions - 2

Management and Conservation in terms of Ecosystem Processes -

- Don't need considerable data to make a preliminary description of desired and current functioning of the Ecosystem Processes;
- Use adaptive management principles:
 - a hypothesis of the situation
 - select tools and options
 - identify indicators and monitor for change

Still need to count populations, survey habitat, etc. and have a good knowledge of species' life cycles & ecology

Discussion Questions

- 1. Could you add descriptions of desired and current states of Ecosystem Processes to your project areas?**
- 2. Would describing and managing your projects from a perspective of Ecosystem Processes help achieve your goals?**
- 3. What capacity do we (Managers/ Conservationists) and the 'Public' need to manage for Ecosystem Services?**