

5:4a Carrying Capacity

Imagine our planet as a “global bus”



Suppose that
a bus has
enough seats
for fifty
passengers

We would all agree that we could crowd a few
extra persons on board in an emergency

BUT *HOW MANY EXTRA*
COULD THE VEHICLE ACCOMMODATE?

What if 100 passengers climbed aboard?
OR 350? OR 2,748?

Clearly at
some point a
critical system
would fail



the engine would overheat; the tires would blow;
the axles would break; the transmission would fail;
or the engine would blow a gasket

5:4b Carrying Capacity



**In all likelihood, the
*first system to be
affected***

MIGHT BE

THE RESTROOM

AT THE BACK OF THE BUS

**as the amount of waste generated by the
passengers overwhelms its
capacity to accommodate those wastes**

***Why should we suppose that earth's biological
and ecological machinery is invulnerable?***

Biologists employ the term

CARRYING CAPACITY

which is defined as follows

**How many members of a population can an
ecosystem support over a long
period of time without suffering severe or
irreparable damage?**

5:4c Carrying Capacity



Since ecosystems are **FINITE** in size and resources, each has an upper limit to the population that it can support

Each also has **AN UPPER LIMIT** to its ability to provide food, resources, ecological services, maintain itself, resist damage, and to accept, cleanse, and recycle

Limiting Factors

There are a variety of *limiting factors* that help regulate the ultimate size of a population

1. Limited capacity to accept pollution and wastes
2. Physical damage done to the ecosystem and its components
3. Competition
4. Disease
5. Predators
6. Limited food and similar resources

5:4d Limiting Factors

Food supplies ARE NOT always the most important limiting factors

Elephants, when confined, knock down trees, strip them of vegetation, and trample grasses and groundcover



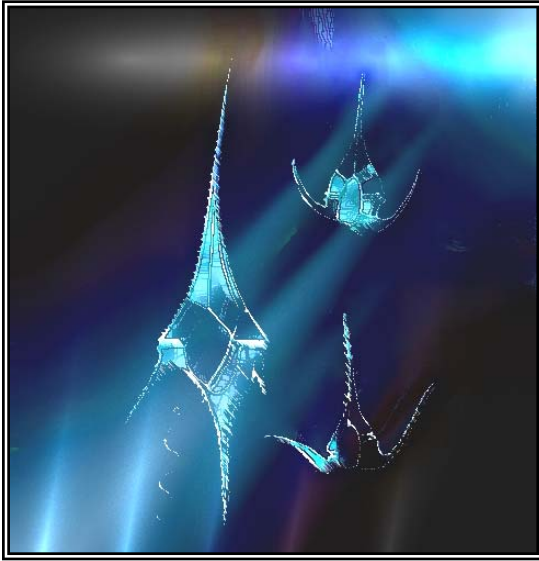
Limiting Factor: PHYSICAL DAMAGE *to the environment*



An exploding population of yeast cells in grape juice generate poisonous WASTES in the form of ethanol

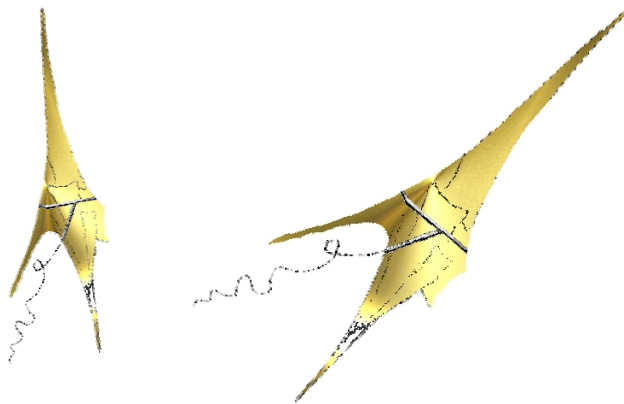
Limiting Factor: *Accumulation of WASTES*

5:4e Carrying Capacity



**Population
explosions of marine
DINOFLAGELLATES can
produce deadly
RED TIDES
and fish kills**

**Each dinoflagellate releases tiny amounts of a
poisonous neurotoxic WASTE into the environment**



***At some point, the environment's capacity to
dissipate, cleanse, and recycle
the poisonous wastes is exceeded***

5:4F Carrying Capacity

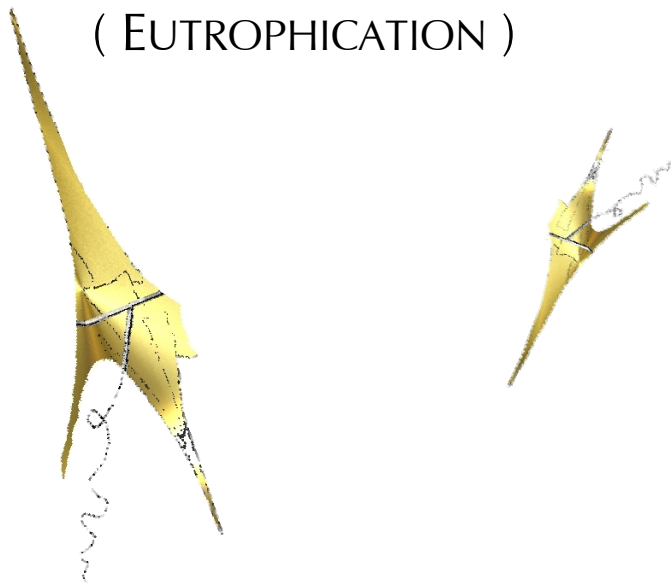


In a similar way, a population explosion of algae in a pond

can quickly deplete the water of its dissolved O_2

catastrophically changing the entire environment to ANOXIC conditions that kill most other life forms

(EUTROPHICATION)



5:4g Carrying Capacity

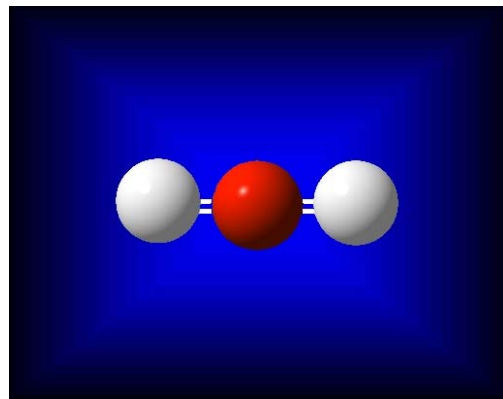
**Human body wastes are unlikely
to affect our entire planet**



**But the collective
impacts of all
our industrial and
societal wastes**

such as

- ✓ Chlorofluorocarbons
- ✓ Heavy metals
- ✓ Radioactive nuclear wastes and
- ✓ Rising levels of greenhouse gases



**already represent significant challenges
to earth's ecological systems**

5:4h Carrying Capacity



Today our
population is well
on its way toward
our SEVENTH
billion

Are there any “warning lamps”
beginning to light up on our “global dashboard”

- ✓ Ozone depletion
- ✓ Greenhouse gases
- ✓ Melting ice
- ✓ Acid precipitation
- ✓ Hunger and starvation
- ✓ Deforestation
- ✓ Disappearing wilderness
- ✓ Collapsing fisheries
- ✓ Desertification
- ✓ Extinctions of wild plants and animals



*If all these stresses are occurring NOW,
what will happen as we add three or more
ADDITIONAL billions over the next half century?*

5:4i Carrying Capacity



**Finally, WE ARE
NOT ALONE on
our global bus**



**Other
passengers
(species)
occupy much of
the available
seating**



***Today, as more and more human passengers
climb aboard, other species are being
displaced at an accelerating RATE***

**If we do not yet have all the answers, we can at
least think about some of the important questions**