

NATURE WASTES NOTHING



INTRODUCTION

In nature nothing is wasted. Predator animals in the forests kill only when they are hungry. Once the predator has eaten its share, scavengers like the hyena feed on the remains. What is left of the bones attract insects such as flies. The leftovers are broken up by microorganisms like the bacteria and the fungi. This is a perfect example of want not, waste not. All things that were once alive eventually become part of the earth again.

Mother Nature also has her own 'waste disposal' solutions in place for millions of years (compare this to our inability to handle our wastes in the past one hundred years or so...). Consider the tree outside your house: it 'disposes' off its leaves in the autumn. In the human world this would be considered 'waste' and would be bagged to go to a landfill. Not so with Nature - the soil welcomes its once-a-year feeding each autumn and sets breaking down the leaves to nourish itself. It is really interesting to observe, how in Nature "one organism's waste is another's feast".

NATURE'S CLEAN-UP CREW

DECOMPOSERS – the body disassemblers

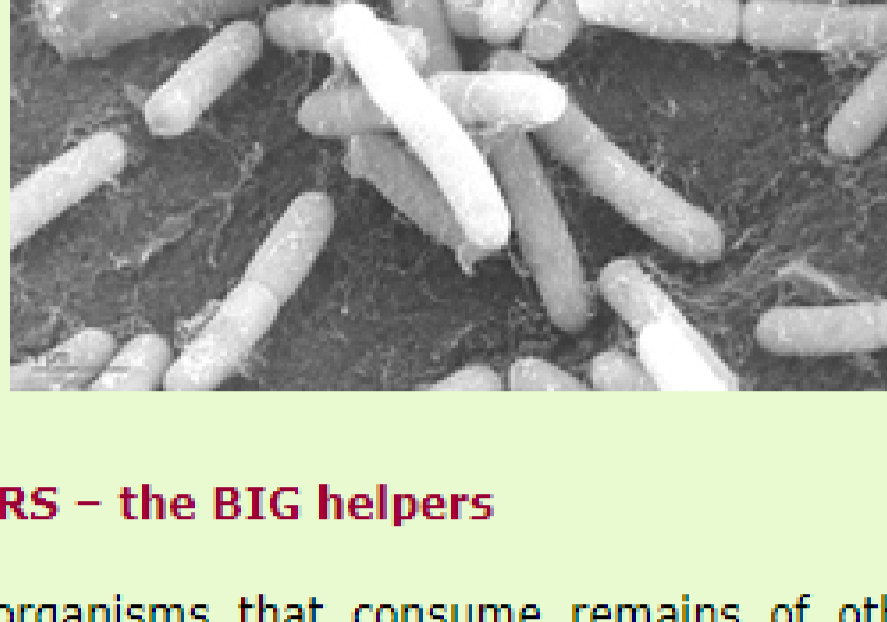
Living bodies assemble themselves by eating, drinking and breathing in nutrients. After the death of the body, disassembly is performed by organisms called decomposers. Decomposers are organisms that transform the bodies of both plants and animals back into the basic constituents they were made from.

- Without them, no life can exist – including humans.
- Without these little recyclers, there would be no nutrients available for new lives to grow.
- Without decomposers, our entire planet would be buried deep in dead plants and animals.

Decomposers are mostly Bacteria and Fungi. They have helpers too. The BIG helpers are the scavengers, while the little aides are the detritivores (also called detritus feeders).

Decomposers as partners

Many decomposers are partners in interesting biological systems. For example, the bacteria in the rumens (first stomachs) of cows, decompose grass that cows eat and pass on more easily digestible substances to the real stomachs. Also, the microbes in the gut "tubes" of earthworms partially decompose plant fragments, making elements and compounds available to the worms and yield nutrient-rich residues that are passed back into the soil.



SCAVENGERS – the BIG helpers

These are organisms that consume remains of other dead organisms or their waste products.

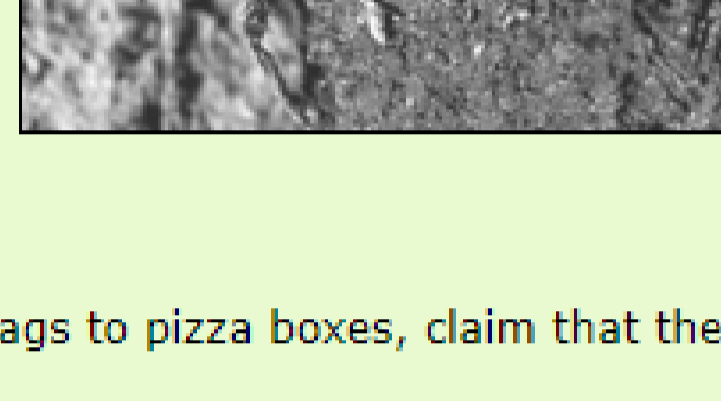
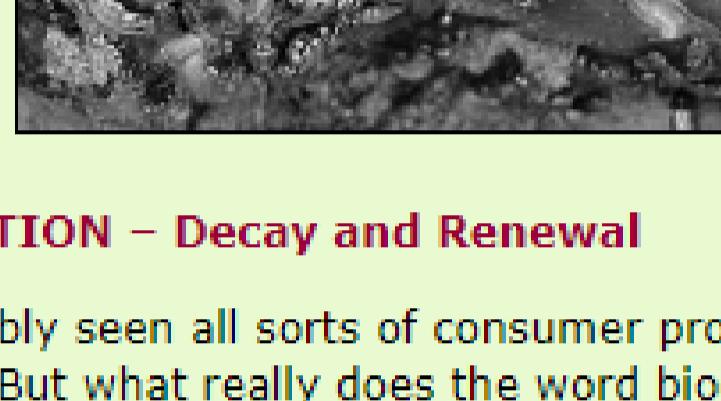
- The scavengers' role in the ecosystem is to prepare bodies for decomposition. They open up the bodies so that others can share the food. Scavengers include fairly large animals. For example, Crow, Crab and Vulture. Many large carnivores such as hyena and lion, which hunt regularly, will scavenge if given a chance.



DETRITUS FEEDERS / DETRITIVORES – the little aides

Detritivores are smaller organisms that feed on detritus or decomposing organic material, which may have been partially or fully decomposed by the decomposers.

- They primarily feed on dead vegetation.
- They also prepare dead matter for final disassembly by bacteria and fungi.
- Worms and insects are important detritivores. For example, Earthworm, Beetles and Mussels.
- They play a very important role in soil formation
- The detritus feeders are enormously important in the oceans too, because everything that dies eventually comes down to the seafloor, or benthos. In the seafloor mud, vast numbers of sea worms and other small organisms prepare dead matter for the final decomposition by bacteria.



BIODEGRADATION – Decay and Renewal

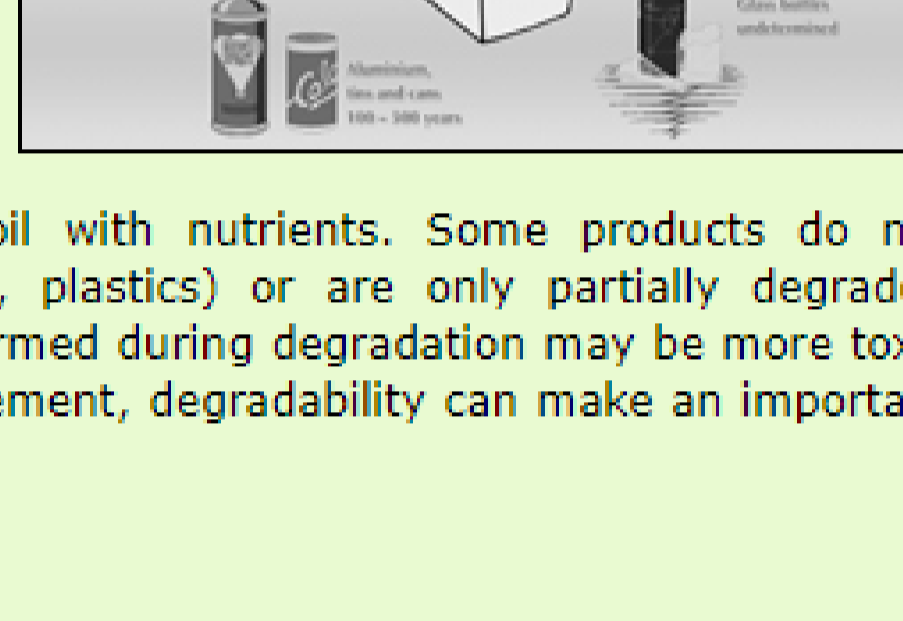
You have probably seen all sorts of consumer products, from paper bags to pizza boxes, claim that they are biodegradable. But what really does the word biodegradable mean?

Biodegradation is a natural process that happens when microorganisms, such as bacteria and fungi, secrete enzymes that chemically break down or degrade dead plants and animals. In other words, biodegradation means to rot or decay. It is actually nature's way of getting rid of dead plants and animals or the things made from them.



Biodegradation is important for two reasons

- It causes the breakdown of the wastes products and remains of dead organisms, so that they do not pile up.
- It releases valuable nutrients into the environment for re-use by other organisms.



Biodegradable matter is any material that will biodegrade. Most organic wastes are biodegradable under normal environmental conditions. Given enough time, these wastes will disintegrate into harmless substances, enriching the soil with nutrients. Some products do not detectably degrade (non-biodegradable) at all (for example, plastics) or are only partially degraded (plastics, paper products). In some instances, intermediates formed during degradation may be more toxic than the starting material. Thus, in waste disposal and management, degradability can make an important difference.

Factors affecting Biodegradation

Remains of organisms do not always decay at the same rate; in some conditions they can be quite well preserved for long periods of time. The rate of decay is affected by:

- Temperature: decomposers work faster at higher temperatures.
- Moisture: decomposers work faster when there is a sufficient amount of water vapour in the air.
- Air: most decomposers use the oxygen in air to cause decay.

Cheating the decomposers

Bodies decompose through the feeding activities of a variety of organisms. The body will be preserved if the body is made unpalatable (embalming the mummies) or the environment is made too hostile for the decomposer organisms (iceman).

BIOREMEDIATION – Nature's way of cleaning human mess

Humans have a habit of making their environment messy – oil, pesticides, toxic chemicals and other harmful wastes ruin otherwise healthy ecosystems. Each year enormous quantities of organic and inorganic wastes are released into the environment. While in some cases releases are deliberate (industrial emissions), in other cases it is accidental (oil spills). Cleaning up of such wastes by conventional chemical or physical methods is both time-consuming and expensive. Nature has several processes in place for treating wastes and pollutants, but the amount generated by the human population would overwhelm the natural treatment processes.

Bioremediation is an enhanced form of natural treatment that focusses on the use of biological agents – microorganisms, plants or enzymes – to rapidly transform or degrade pollutants in the environment.

Advantages

- It is natural and safe
- It is cost-effective
- It can be performed in-situ or on the site unlike alternatives like landfills, incinerators, etc.

Some examples of bioremediation technologies

Oil zappers - Oil-eating microorganisms

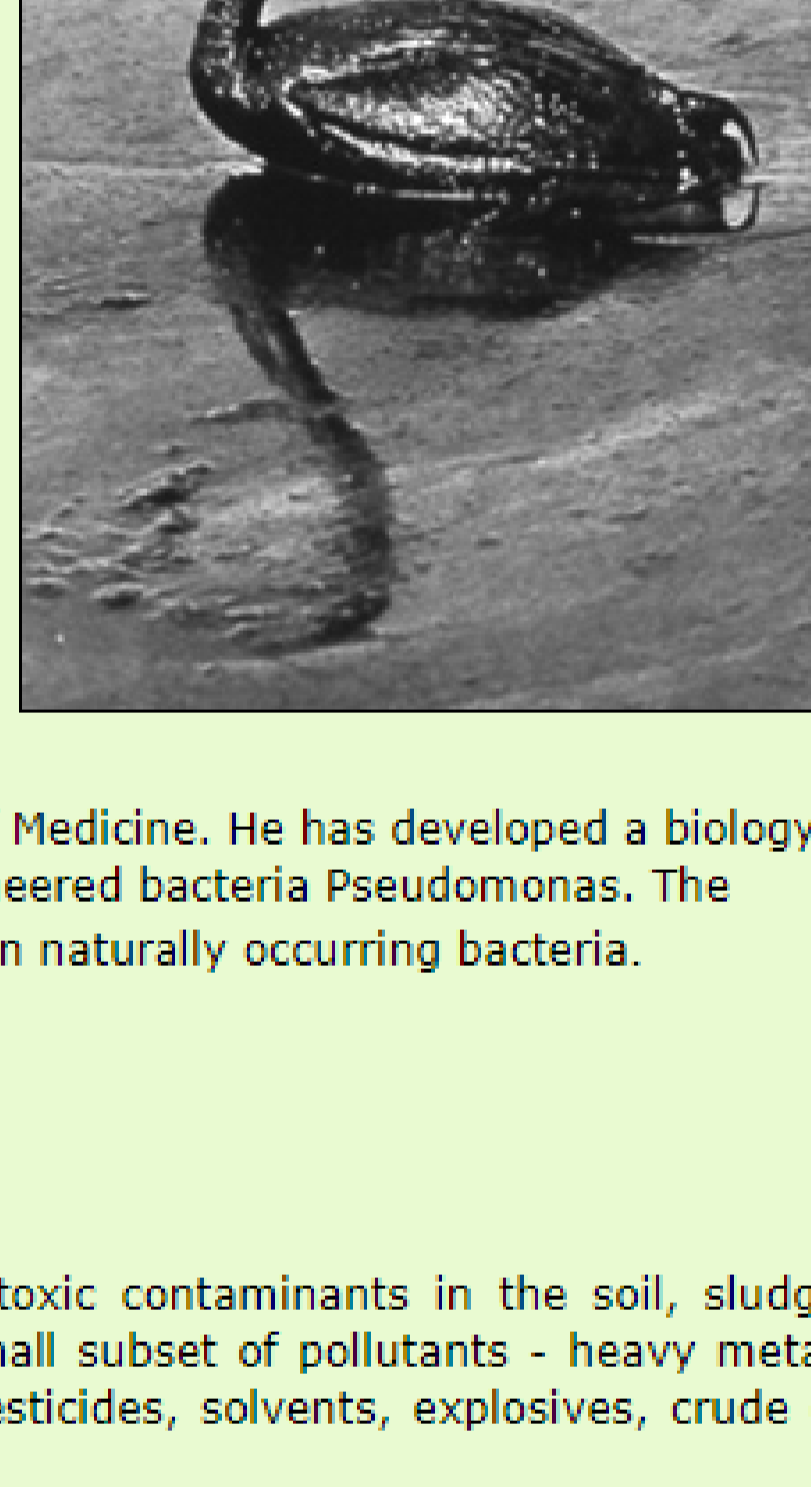
An oil spill is the leaking of oil (generally, petroleum) into the natural environment, usually the ocean. It happens when people make mistakes or are careless and cause oil to leak. The biggest spill ever occurred during the 1991 Persian Gulf War when about 240 million gallons spilled from oil terminals and tankers off the coast of Saudi Arabia.

Oil spills have serious economic impact on coastal activities and on those who exploit the resources of the sea. They also pose danger to many species of plants and animals.

One of the proposed clean-up techniques for spills is the use of microbes like *Pseudomonas* and *Bacillus*, which break down the oil into methanol, water and carbon dioxide. Fertilizers are spread out over the spill to promote the microorganism's growth. As the bacteria reproduce they eat more and more oil until the oil slick vanishes. Once the slick is gone, their food source is depleted and the bacteria die, leaving literally nothing behind. There is one problem with these bacteria – what if they find their way to the oil wells?

An Indian's contribution

Dr. Ananda Chakrabarty is a distinguished professor of microbiology and immunology at the University of Illinois' College of Medicine. He has developed a biology-based solution for cleaning up toxic spills using the genetically engineered bacteria *Pseudomonas*. The bacterium (which is now patented) can digest oil at a faster rate than naturally occurring bacteria.



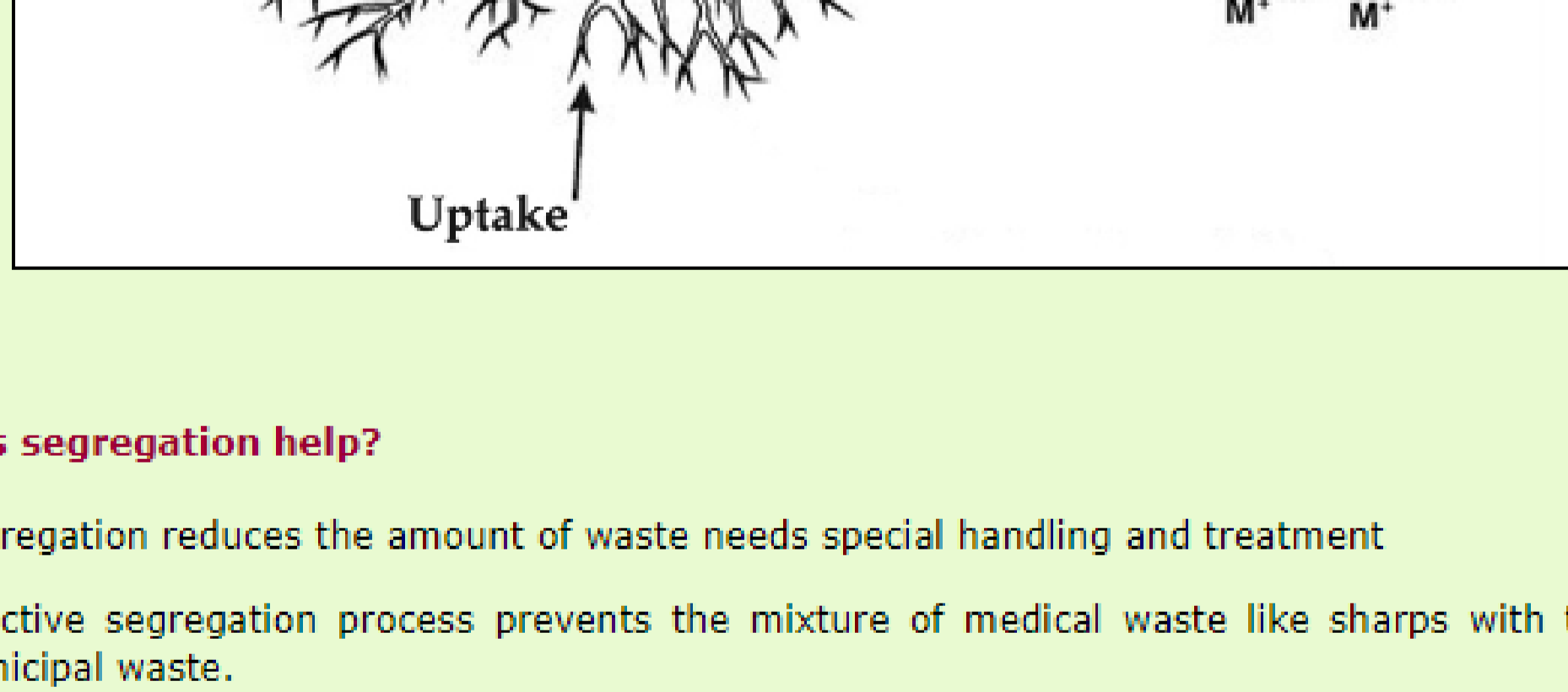
Green to clean - toxic munching plants

Phytoremediation is the use of plants to absorb or break down toxic contaminants in the soil, sludge, sediments or groundwater. This is currently available only for a small subset of pollutants - heavy metals (Cadmium, Arsenic, etc.), but can also be used for cleaning up pesticides, solvents, explosives, crude oil and landfill leachates.

Phytoremediation usually involves one or more of the following processes –

- Phytoaccumulation – uptake and accumulation of the contaminants
- Phytovolatilization- absorption and subsequent release into the atmosphere
- Phytodegradation – breakdown of the contaminants
- Phytostabilization – reduction of the movement or availability of the contaminant.

Some examples of plants used in phytoremediation practices are water hyacinth (*Eichhornia crassipes*), alfalfa (*Medicago sativa*) and the common arrowhead (*Sagittaria latifolia*) amongst others.



How does segregation help?

- Segregation reduces the amount of waste needs special handling and treatment
- Effective segregation process prevents the mixture of medical waste like sharps with the general municipal waste.
- Prevents illegally reuse of certain components of medical waste like used syringes, needles and other plastics.
- Provides an opportunity for recycling certain components of medical waste like plastics after proper and thorough disinfection.
- Recycled plastic material can be used for non-food grade applications.
- Of the general waste, the biodegradable waste can be composted within the hospital premises and can be used for gardening purposes.
- Recycling is a good environmental practice, which can also double as a revenue generating activity.
- Reduces the cost of treatment and disposal (80 per cent of a hospital's waste is general waste, which does not require special treatment, provided it is not contaminated with other infectious waste)

Garbage into gold - composting

Composting is the controlled decomposition of organic matter. Rather than allowing nature to take its slow course, composting provides optimal environment for various decomposers to thrive. It is a great way to recycle household and lawn wastes. There are a variety of ways to reuse or compost your organic waste. Composting can be as simple as making a pile in your backyard, or burying organic wastes in a pit.

Disrupting the natural balance

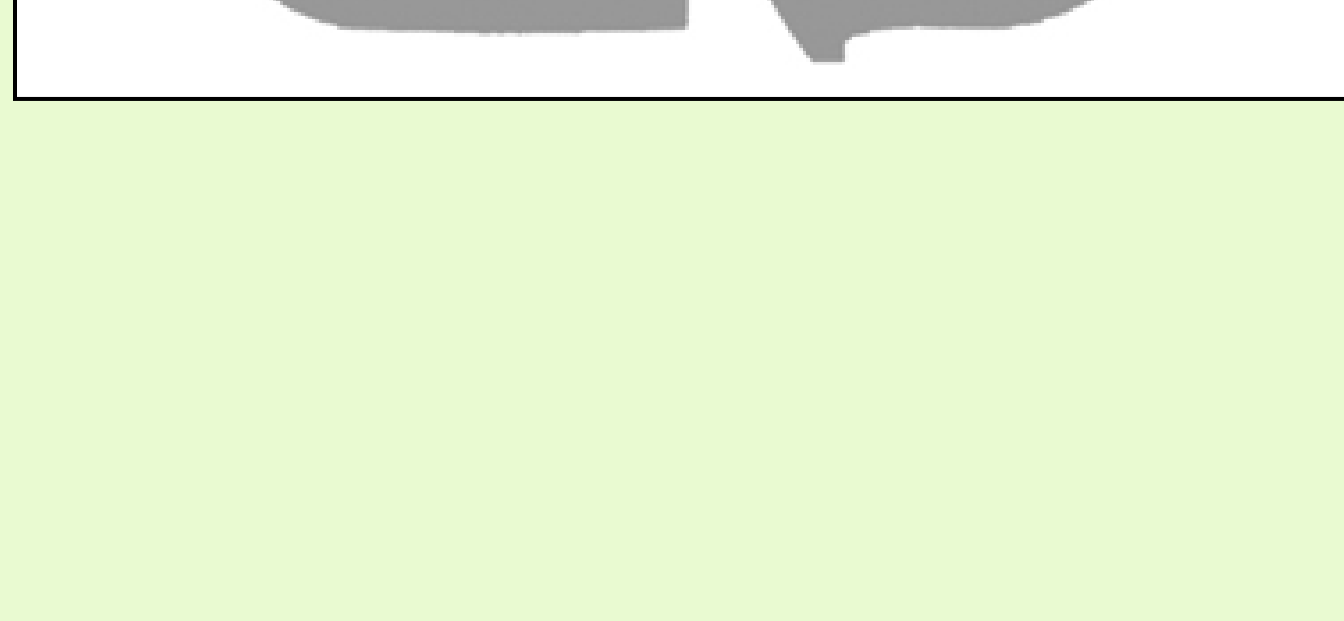
Nature's cycles form a balance in the natural world in which there are no wastes. Everything is broken down and reused. However, in recent times, human activities are changing the environment and disrupting the natural cycles. We are upsetting the fine balance that exists in nature, and the results may be DISASTROUS.

Nature recycles - shouldn't we too?

Our planet and all life on it have survived for millions of years because natural processes recycle life. We can be part of it by –

- Recycling everything (paper, glass etc.) that can be recycled.
- Using products made from renewable resources.
- Avoiding the use of toxic products (pesticides, plastics etc.) that are harmful to all life.
- Stop interfering in nature's recycling process (like when we put garden waste into plastic bags and ship them to a landfill instead of adding them to a compost heap)

We often speak of scavengers with contempt as cowardly, dishonorable creatures, who sneak up on the predators we admire and steal what they have caught. Yet they are the cleaners of the ecosystem. We need to realise that every part of nature including the scavengers and decomposers is essential for our own well-being.



References

- www.nhptv.org
- www.wikipedia.org
- www.bookrags.com
- www.worsleyschool.net
- www.hardbargainfarm.org
- www.compost.css.cornell.org
- www.uga.edu
- www.absorbentsonline.com