W. ALMORO

PRIMER ON PHILIPPINE BIODIVERSITY AND BASIC ECOLOGICAL PROCESSES

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Printed in the Philippines by:
Microbytes Desktop Publishing

ISBN 971-926-40-0-4

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I. Introduction

As the third millenium begins and the 21st century dawned on earthlings, the Earth is not the same place as when the second millenium began a thousand years ago. The earth's human population has passed the sixth billionth mark in 1999 and is expected to triple to 18 billion by the year 2100. Either the earth's natural capacity will not be able to sustain such a huge population, or the human population would have crashed by that time, if not earlier.

The pressure exerted by such huge human population has led to the consumption of resources way beyond the capacity of nature to replenish itself. As a consequence, the world's biological capital or its biodiversity is being exhausted at rates unimaginable. This in turn has caused the Earth to face an extinction crisis that pales in comparison to the time when dinosaurs disappeared, together with the assemblage of life forms present then, about 65 million years ago due to the impact of asteroids slamming into the earth. With the unabated exploitation of natural resources and the consequent degradation of the environment, it is imperative that efforts are made to maintain a balance between utilization and protection of natural resources.

This primer aims to equip the reader with the basic information on biodiversity conservation and basic ecological processes. This is not as exhaustive and as detailed as most ecology information materials are, but it nonetheless provides an easy-to-comprehend presentation of some basic principles and concepts, as well as actual environmental problems that require immediate attention.

It is hoped that, with the publication of this primer, concrete actions would be undertaken to bring about results that will contribute to the sustainability of natural resources and the protection of the environment.

Groundtruths

Our world is made up of living things such as plants, animals and microorganisms and non-living things such as water, air, soil, and minerals. The living organisms are called **biotic factors,** while the non-living things are known as **abiotic factor.**

The **environment** is the surroundings of an organism. It includes both the physical factors and the interaction of living organisms. The air, soil, water, plants, animals, people and their interactions are all part of a dynamic system that is responsible for the existence of life on Earth.

The Earth is inhabited by many different organisms. These organisms are found everywhere—on land, in water, and even under the ground. They are identified according to their individual characteristics and are generally referred to as **species.** Every organism is a species. And each species belongs to an **ecosystem.**

An **ecosystem** is the interconnected system or manner of conducting life that exists between organisms and the environment. It comes from the interactions of organisms with each other and with their surroundings. It also refers to the place where these interactions happen.

Because of these interactions, every organism has a role or function in the environment, particularly in relation to how one produces or captures energy. Each one has a place or position in the natural order of things. Plants, animals, bacteria, fungi, and protozoa- all have roles in the natural world.

Similarly, all organisms have a place to live – an area, space or location where they are naturally found. It is a place where the things needed for them to survive, grow, develop and reproduce are present and available for their use. This place is referred to as their **habitat.** Every organism has a habitat. And habitats vary from one organism to the other.

Biodiversity

The great variety and variablity of organisms found on earth and the environment in which they live is called **biodiversity.** It includes the variety among different individuals, species, and ecosystems. The word biodiversity is the result of a merger of and contraction of two words: biological and diversity.

This great variety of organisms form part of the natural resources of a country. They are the source of material for all sorts of human needs—from food, clothing and shelter, to medicine, recreation, etc. These many millions of living creatures form part of the natural wealth of a nation. It is estimated that more than 100 million species of organisms are present on earth, of which only 10% or 10 million have been identified. There are still a lot of things that we do not know in the whole wide world, yet we are destroying the earth at an unprecedented rate. We are losing species even before we have a chance to find them, much less to know and study them.

Megadiversity

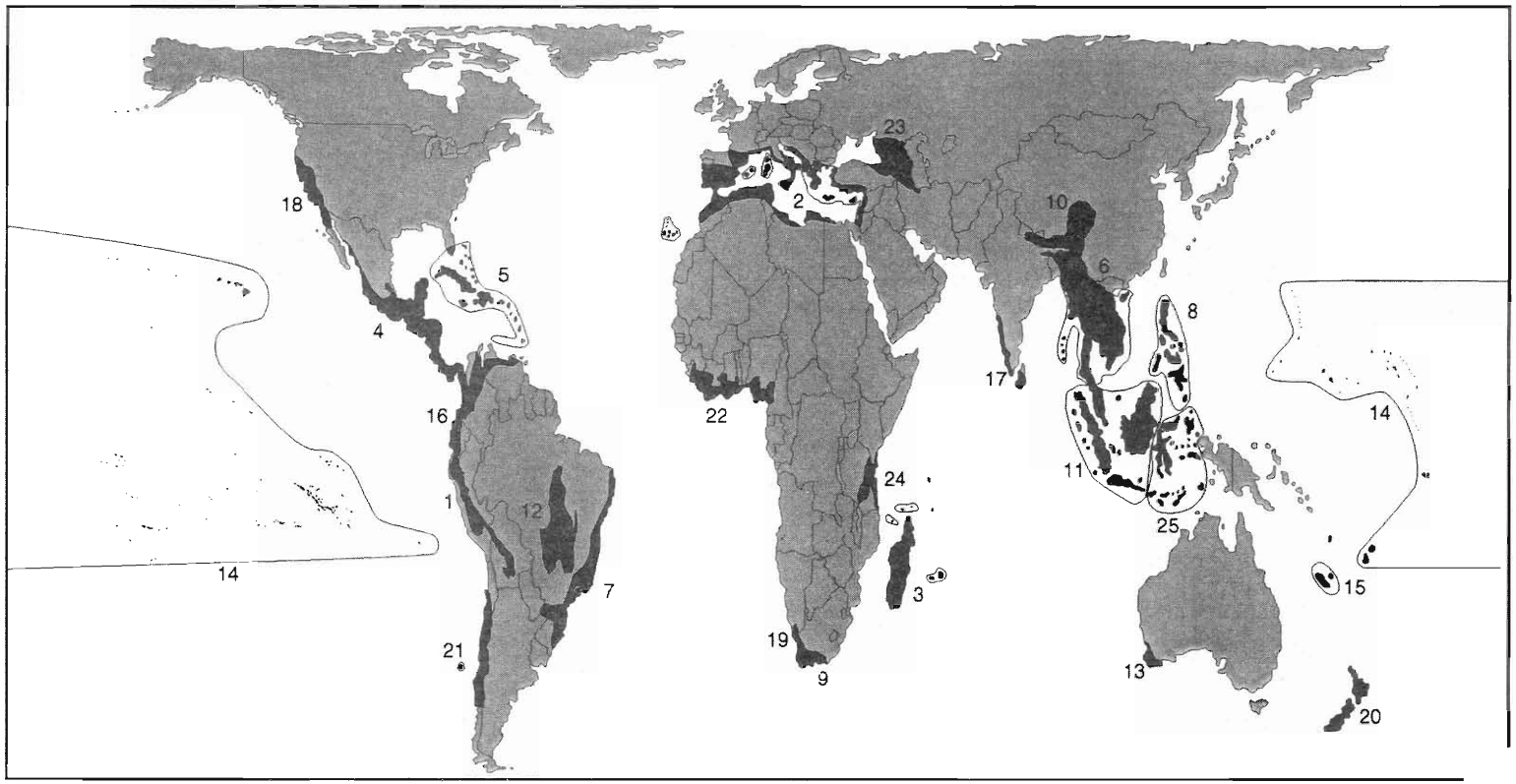
Every place on earth has its own assemblage of biodiversity. However, some countries have more numbers and varieties of plant and animal life than others. When so much variety of plant and animal life and so many different types of ecosystems, particularly marine ecosystem and tropical rain forest exist in a particular place, it is called a megadiversity country. There are 17 countries in the world that are presently identified as megadiversity countries (Mittermeier, *et. al,* 1997). Between the 17 megadiversity countries, they contain up to 75% global biodiversity. Two of the measures used to determine a Megadiversity country are the number of endemic plant species (more than 5,000 at least) and the number of endemic non-fish vertebrates (2% of global diversity) found in that country. The Philippines is one of the 17 megadiversity countries and second smallest after Ecuador. Furthermore, it has the highest number of endemic vertebrate species per 1,000 km^2 in the world.

Biodiversity Hotspots

A **biodiversity hotspot** is a place where there is a high number of endemic species that are presently facing the danger of extinction. Another criterion for being a hotspot is loss of original forest cover such as extent of remaining forest in a place (less than 25% original forest remaining). Currently, there are 25 global biodiversity hotspots (Mittermeier, *et. al,* 1999).

To date, less than 7% of the original forest cover remain in the Philippines. Given the high number of endemic and threatened species and the rapid loss of forest, the Philippines is the hottest of the global terrestrial hotspots. Recently, the Philippines was also identified as the hottest of the global marine hotspots.

BIODIVERSITY HOTSPOTS



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1 Tropical Andes
2 Mediterranean Basin
3 Madagascar/Indian Ocean Islands
4 Mesoamerica
5 Caribbean Islands
6 Indo-Burma
7 Atlantic Forest
8 Philippines
9 Cape Floristic Region of South Africa
10 Mountains of South Central China
11 Sundaland
12 Brazilian Cerrado
13 Southwest Australia
14 Polynesia and Micronesia
15 New Caledonia
16 Chocó/Darien/Western Ecuador
17 Western Ghats & Sri Lanka
18 California Floristic Province
19 Succulent Karoo
20 New Zealand
21 Central Chile
22 Guinean Forests of West Africa
23 Caucasus
24 Eastern Arc Mountains and Coastal Forests of Kenya and Tanzania
25 Wallacea

II. PHILIPPINE BIODIVERSITY: A BIRD'S EYE VIEW

Compared to many other countries, the Philippines has a small land area. But despite its size, the country harbors an enormous number of plant and animal species.

To illustrate, among the animal species identified, there are around 101 species of amphibians (frogs, toads, caecilians, etc.), of which 79 are endemics; 258 species of reptiles (snakes, turtles, lizards, crocodiles), of which 170 are endemics; 556 species of birds, of which 195 are endemics; 201 species of mammals, of which 111 are endemics; and 895 species of butterflies, of which 352 are endemics. There are also 330 species of freshwater fishes and 1,400 species of marine fishes.

The Philippines is also estimated to have around 10,000 to 12,000 species of plants. This estimate includes more than 7,000 identified species of flowering plants, 1,000 species of ferns and allied species, and some 700 species of mosses, among others.

With these great numbers of organisms, the country is home to endemic species, some of which are the most unique plant and animal life that are not found anywhere else in the world.

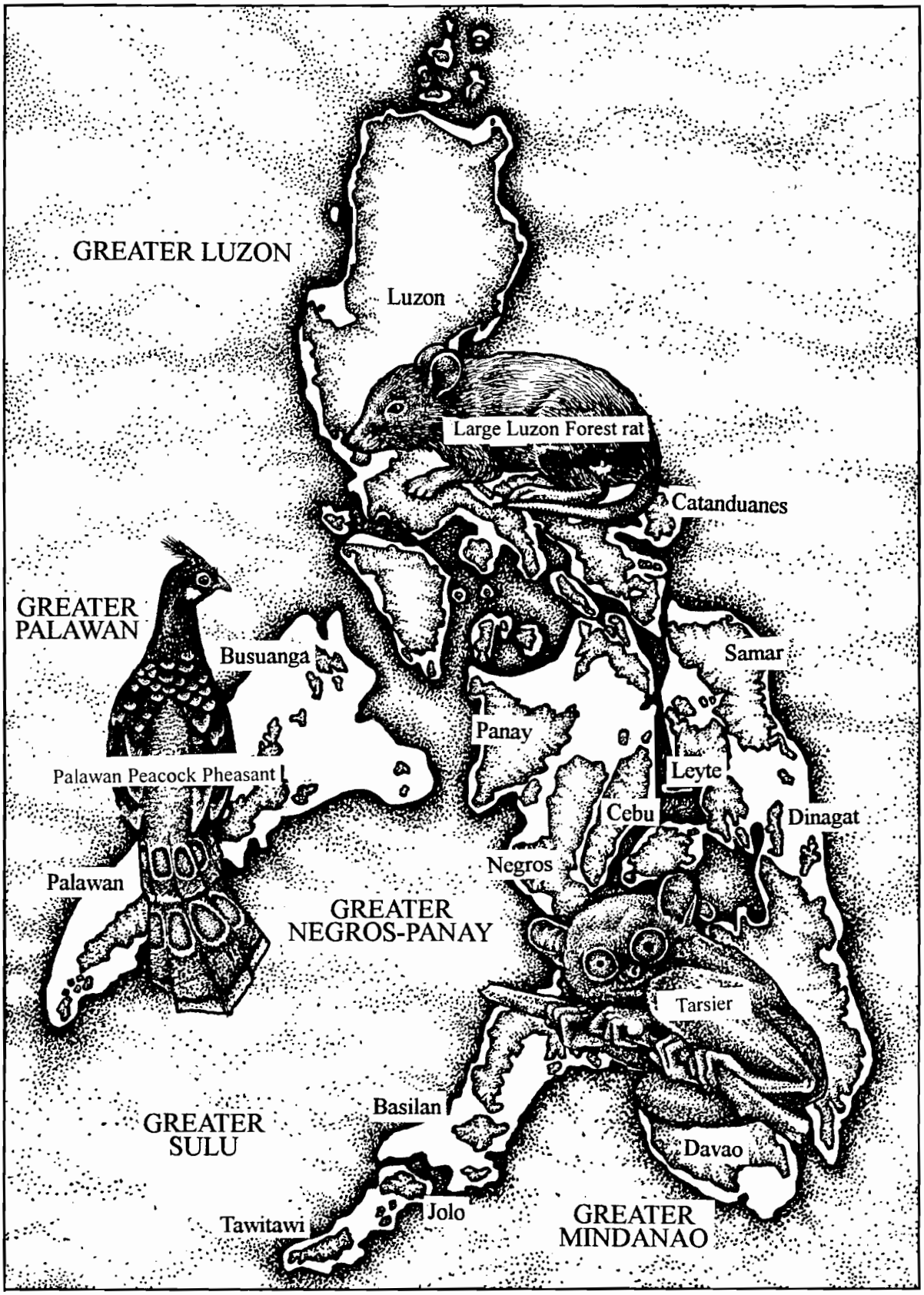
But what are endemic species? Endemic species are organisms found only in a particular place, country or region, and not in any other part of the world. More than half of Philippine Biodiversity are endemic to the country and found nowhere else. As such, it forms not only part of Philippine Patrimony but of global patrimony as well.

A. Terrestrial Biodiversity

1. Plants

Together with these uncommon animal species, there are plant species found only in the country that are truly extra-ordinary and so unique, that they are aptly regarded as treasures of the Philippine forests. These plants include Waling-waling, jade vine, pitcher plant, mancono, rafflesia or stinking corpse lily, ant plant, lipstick plant, elephant foot yam, kapa-kapa, strangler figs, almaciga, rattans, tree ferns, screw pines, climbing pandans and dipterocarps, among others. Below are some features of these endemic species:

a. Waling-waling *(Euanthe sanderiana)*, considered the "Queen of Philippine Orchids", is known for its exquisitely beautiful flowers that range in color from pale to dark reddish purple. It has a greenish sepal that bears a characteristic pattern of netted lines and crimson-purple spots. It is the largest among Philippine orchids, with individual blossoms measuring 7-12 centimeters wide, clustered in 12 to 16 flowers that open in succession. Known only in the vicinity of Mount Apo, this plant is now believed to be extinct in the wild.


GREATER LUZON
Luzon
Large Luzon Forest rat
Catanduanes
GREATER PALAWAN
Busuanga
Samar
Panay
Palawan Peacock Pheasant
Leyte
Cebu
Dinagat
Negros
Palawan
GREATER NEGROS-PANAY
Tarsier
Basilan
GREATER SULU
Davao
Jolo
Tawitawi
GREATER MINDANAO

b. Jade Vine (*Strongylodon* spp.) is another forest species that bears a characteristically bluish-green flowers shaped like a small boat that gently curve like the upturned beak of a bird. The spectacular flowers are clustered in long bouquets of 60 to 90 centimeters and hangs gracefully from the stem.

c. Stinking Corpse Lily (*Rafflesia* spp.) lives as a parasite on the roots of vines related to the common grape. It does not have leaves nor stem but only roots that spread within the host plant. The flower of the Stinking Corpse Lily is rarely found, as the timing when it blooms is unpredictable. Finding one in the forest is a great experience for anyone who chance upon it. The big brown bud of this lily looks like a cabbage that emerges from the ground. It opens slowly into a big flower with an overpowering smell. It is considered the smelliest flower in the world because of its strong odor that resembles that of a rotten meat.

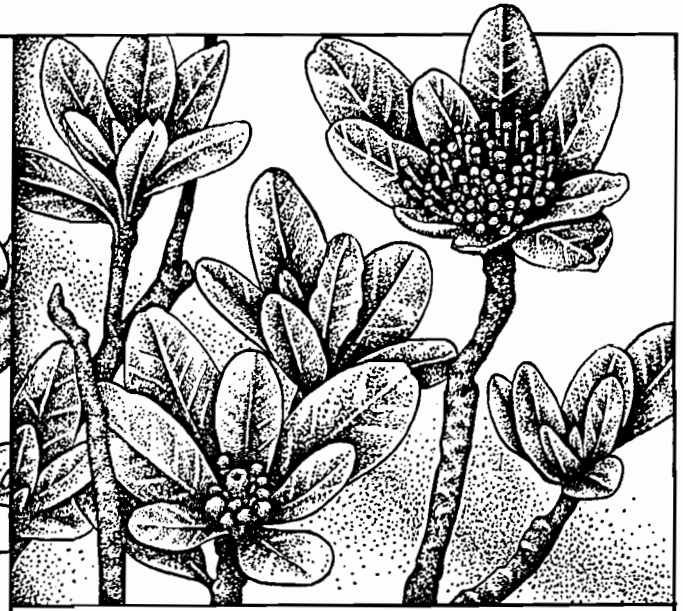
   A new species was recently found in Sibalom, Aklan in Panay Island. This brings to three the number of species of Stinking Corpse Lilies in the country. One of these, the Mt. Apo Stinking Corpse Lily, which spans about 80 cm in diameter, the second biggest in the genus, has not been seen since it was first collected in 1882. It is now considered to be extinct.

d. Insectivorous Pitcher Plants (*Nepenthes* spp.) are peculiar in their habit of "preying" on insects. The pitcher-like part of the plant is actually the portion of a leaf that is modified early in its development and fold around itself to form the characteristic shape complete with a cover. Rainwater collects inside the pitcher and the plant secretes digestive enzymes into it. Insects are lured into the rim of the pitcher by a sedative substance produced with the nectar. Once the sedative takes effect, the insect falls into the interior of the pitcher. The pitcher is usually filled up with water, and once the insects fall in, they drown. The interior of the walls is covered with glands that secrete a protein-digesting enzyme. It is this enzyme that digests the insects, which in turn makes the proteins from the insect available as food to the plants.

   One of the largest known pitcher plants in the world is found in Eastern Mindanao, which may hold as much as 1.5 liters of rainwater.

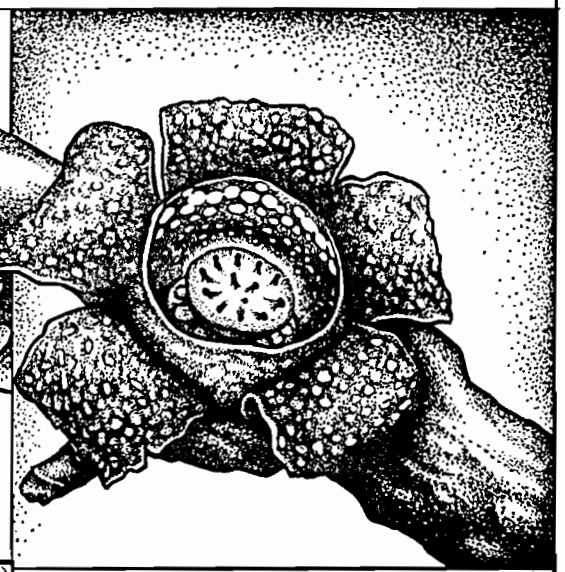
Pitcher plants
(*Nepenthes sp.*)

Jade vine
(*Strongylodon macrobotrys*)



Mancono (*Xanthostemon sp.*)

Waling-waling (*Euanthe sanderiana*)
"Queen of Philippine Orchids"



Rafflesia (*Raflessia sp.*)

2. Butterflies

The Philippines has one of the highest number of endemic butterfly species in the world. Out of its 895 identified butterfly species, 352 are endemic (Mittermeier, *et. al,* 1997). This makes the Philippines the Number Two country with the highest number of endemic butterflies in the world

3. Mammals

The Philippines has the highest number of endemic mammals per unit area of land. Of the 201 identified mammal species in the Philippines, 111 are endemic (Heaney et, al, 1998). Some of the most notable are:

a) Tamaraw *(Bubalus mindorensis)* is a dwarfed buffalo found only in the island of Mindoro. Less than 200 heads are left in the mountains of Mindoro. At the beginning of the 20th century, it was estimated that there were 10,000 heads.

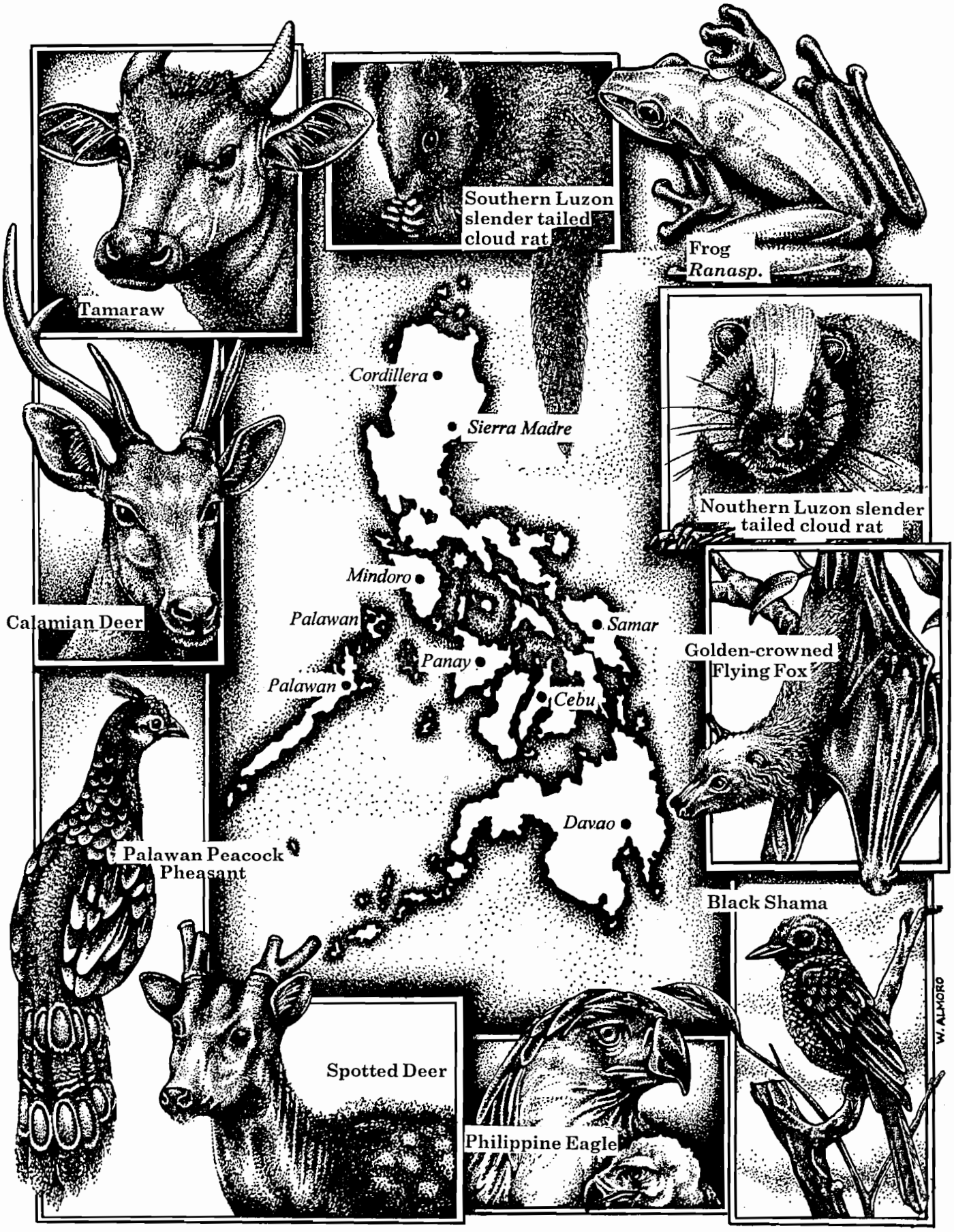
b) Calamian deer *(Axis calamianensis)* are found only in the Calamianes group of islands, north of mainland Palawan. Together with the Visayan Spotted Deer, both are considered the most endangered deers in the world.

c) Golden-crowned flying fox *(Acerodon jubatus)* are found only in the Philippines. Roosting sites of this species used to have more than hundreds of thousands of individuals, but now their numbers have been reduced to thousands;

d) Visayan spotted deer *(Cervus alfredi)*, is found only in Panay and Negros and extinct now in Cebu. Together with the Calamian Deer, both are considered the most endangered deers in the world.

e) Philippine Tarsier *(Tarsius syrichta)*. This unique bug-eyed, lizard-and- insect-eating relative of the monkey, is the only one of its kind in the country. It is found only in the Greater Mindanao Islands which include Bohol, Leyte, Samar and Mindanao.

f) Large Luzon Forest Rat *(Bullimus luzonicus)*. This rodent is a strict forest dweller living in underground burrows or within root networks of trees and other plants. It is a nocturnal animal, or one that is active during the night, feeding on insects, fruits, seeds and other edible root crops in the island of Luzon. It is not found anywhere else but in this largest island of the Philippines.


Tamaraw
Southern Luzon slender tailed cloud rat
Frog
Ranasp.
Cordillera
Sierra Madre
Nouthern Luzon slender tailed cloud rat
Mindoro
Calamian Deer
Palawan
Samar
Golden-crowned Flying Fox
Panay
Palawan
Cebu
Davao
Palawan Peacock Pheasant
Black Shama
Spotted Deer
Philippine Eagle
W. ALMORO

4. Birds

a) Palawan peacock pheasant *(Polypectron emphanum)*, which is a small and beautiful long-plumaged bird that is known to occur only in the island of Palawan.
b) Cebu black shama *(Copsychus cebuensis)*
c) Cebu flower pecker *(Dicaeum quadricolor cebuensis)*
d) Philippine eagle *(Pithecophaga jefferyi)*

These land animals are forest dependent species and are now hanging on for their survival within the remaining forested areas of the country.

B. Aquatic Biodiversity

Aside from having so many endemic organisms, the Philippines is also at the center of the "Coral Triangle," where numerous species of corals exist. The "Coral Triangle" includes Indonesia, Malaysia, Papua New Guinea and the Philippines. These countries contain the widest area of coral reefs, as well as the greatest number of individuals and species of corals known to man. But compared to any other country, the Philippines has the highest number of coral species in its vast marine waters. Out of the 800 identified coral species in the whole world, some 500 species are found in this country (Veron and Fenner, 2000). This condition makes the Philippines a very important place for the conservation of marine biodiversity in the world.

Aside from the great variety of plants and animals that live on land, the Philippines is also home to numerous organisms that live in water. These organisms include the various species of freshwater and marine fishes; crustaceans, such as the freshwater prawn, lobster, jumbo tiger prawn, mud crab, sand crab and the coconut crab; different kinds of freshwater and marine algae; different species of sea grass; the coral reefs (bahura); the mangrove trees (bakawan); the small land turtles (pagong) and the large marine turtles (pawikan); the chambered nautilus (toksi), squids (pusit) and other cephalopods; the sperm whales (balyena) and the whale sharks (butanding); the dolphins (lumba-lumba) and porpoises or sea cows (dugong); the freshwater crocodile (buwaya); and the endemic Lake Buhi goby (sinarapan), which is known as the smallest commercial fish in the world, to name a few.

All these species and many others still unknown, make up a significant portion of the vast natural wealth of the Philippines and its contribution to the natural heritage of the world.

III. ECOSYSTEMS

The rich biodiversity of the Philippines is attributed to its being an archipelago, or being a nation of islands. Its different regions have varied histories of land formation. Combined with this fact is the existence of various landforms and water bodies that support different types of ecosystems. These ecosystems contain varied and distinct life forms.

A. Terrestrial Ecosystems

The ecosystem found on land is called terrestrial ecosystem. This type of ecosystem includes the following:

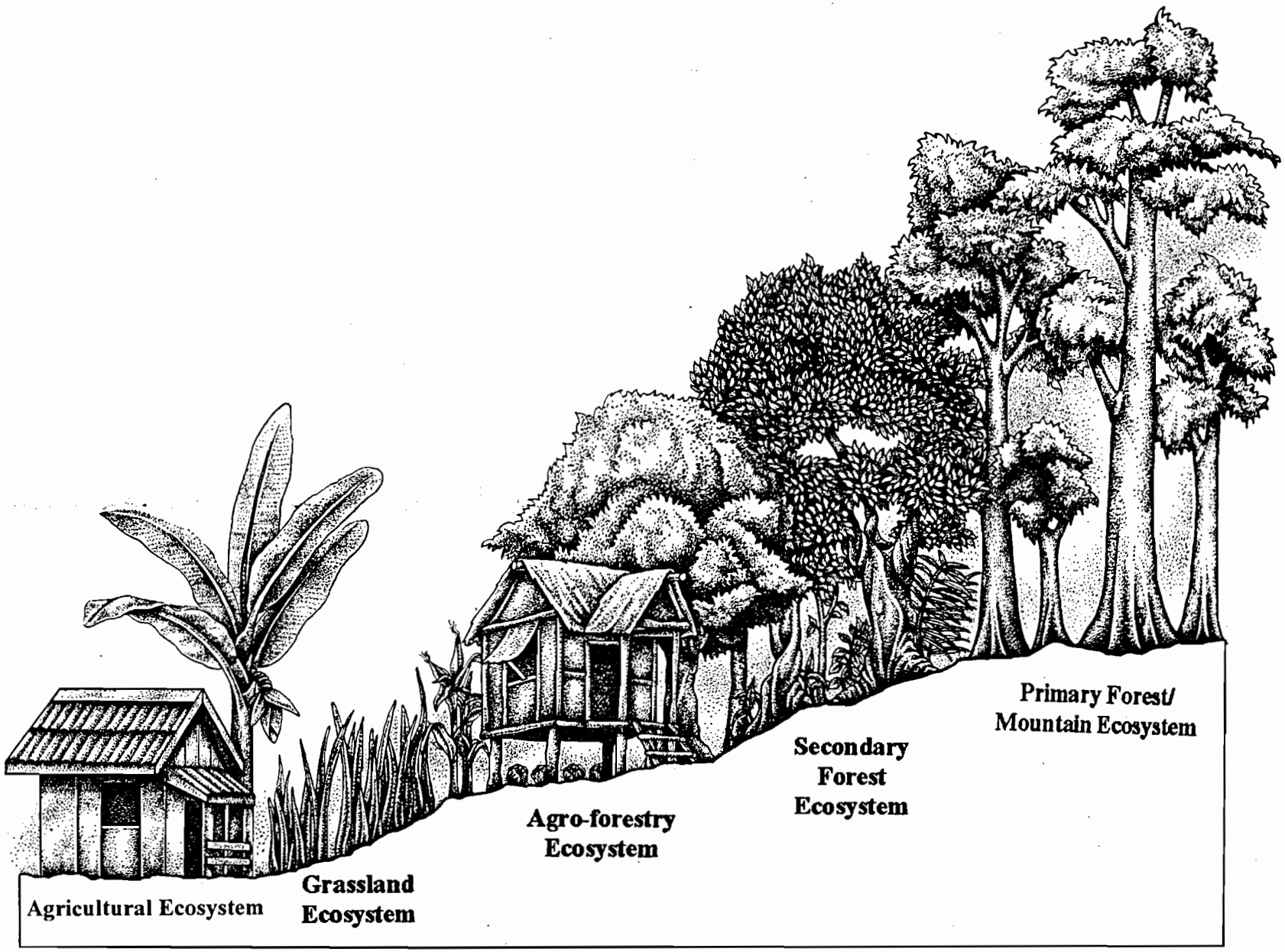
1. Primary Forest Ecosystem

The primary forest ecosystem is usually referred to as virgin forests. This is where large trees usually abound. It has high diversity of plants compared to secondary forest. The complexity and enormous variety of plants in this ecosystem make it difficult to identify all plant species within a short period of time. Hence, some plants in the primary forest remain unknown or uncommon to most people. These plants are among the rarest and most unique in the world.

The existence of such dense growth of vegetation, particularly those large, tall trees, makes the primary forest a close canopy ecosystem. This is a peculiar characteristic of the primary forest. Tall trees, with many huge branches supporting numerous leaves of its own or those of some intertwining vines and other plant species, prevent sunlight from reaching the ground. Generally, because of the absence of sunlight, there is also the absence of undergrowth in primary forest.

Primary forests are often imagined as a "jungle" because of the numerous wildlife species that live in there. The various organisms that inhabit the primary forests occupy different niches and live in different habitats. Some live in the canopy of trees, others on the trunks of big trees, while still others on the forest floor and some even live underground!

Shrubs and creeping vines profusely growing beneath the trees which characterize secondary forest ecosystems, are not usually found in primary forest ecosystems. Instead, very thick plant litter collects underneath the big, old trees of this particular ecosystem. The thick plant litter deposit nutrients to the soil that the trees absorb. Aside from these, various small animals and microorganisms live in the plant litter. The thick deposit of plant matter and the lifeforms it sustains are another peculiar characteristic of the primary forest ecosystem.


Agricultural Ecosystem
Grassland Ecosystem
Agro-forestry Ecosystem
Secondary Forest Ecosystem
Primary Forest/ Mountain Ecosystem

The Philippine forests belong to the tropical rain forest. All tropical rain forests are located close to the equator. The equator is the central region that separates the Northern and Southern parts of the Earth. In this equatorial or tropical region, the climate is warm. It has plenty of rain and clouds throughout the year. And the temperature of the surroundings is perfect for the growth of a lot of plant species.

2. Secondary Forest Ecosystem

One distinguishing feature of secondary forest ecosystem is the presence of fast-growing, light demanding, and usually invasive pioneering plant species. Secondary forest ecosystems were once primary forests which were logged and are in the process of regeneration. Through time, all the big, old trees that once dominated this ecosystem have either died naturally or cut extensively for use by man. As a result, creeping vines, woody shrubs, and new growths of various tree species grow in place of those big, old trees. These new plants now form the secondary forest vegetation.

Although the secondary forest ecosystem may harbor many different kinds of plants and animals, they are usually the common kind and are widespread in distribution. In terms of species count and level of endemism, they are a poor second to the level found in the primary forest.

3. Grassland Ecosystem

Grasslands are large open areas dominated by certain groups of plants that belong to the family Gramineae (bamboo, talahib and cogon, etc.). These plants have shallow roots that spread wildly in order to reach and take in water and nutrients from the soil. With this kind of roots, grasses grow even in areas where the soil is dry, or where there is little rainfall.

Generally, grasslands are often the areas where logging had taken place and trees were not allowed to regenerate. Instead, humans settle in, only to abandon it when the land is unable to sustain human survival. These then form the transition areas between forests and urban or built-up areas.

However, there are unique places in the Philippines where natural grasslands exist such as Mount Pulag in the province of Benguet. The peak of Mount Pulag is covered by a different species of dwarf bamboo that grow so thick and close to each other, forming an enchanting two-color carpet of brown and green. The grassland of Mount Pulag is so unique for being an Alpine type, or one that is populated by cold-loving genera of plants.

Grasses are capable of producing a continuous supply of new leaves. The shoots of many grasses grow only about less than a centimeter above ground. Despite being short, they continue growing at their base even if their tips are eaten. Because most grazing animals cannot reach very close to the ground, the grass shoots are left untouched as they are grazed.

Some people clear grasslands to grow vegetables and other crops in these places. They convert these areas into farm lots. Aside from vegetables, fruit trees are also grown on cleared grasslands. When the trees grow big, the ecosystem of the grassland changes. It now becomes an agro-forestry ecosystem (see below).

4. Urban, Agricultural and Agro-forest Ecosystems

Characterized by the presence of human population, urban and agricultural ecosystems include cities, towns, barangays, sitios and other such places where the people live. In these ecosystems, the people dominate all other organisms in terms of space as well as in the utilization of natural resources. They raise animals as livestock, grow various species of plants, drive away pests, and maintain a way of living that is highly dependent on other organisms and the environment for human survival.

Other features of the urban and rural ecosystems are the existence of human dwellings (houses and similar structures), network of streets and foot paths, various areas cleared for use by humans, presence of domesticated plants and animals, among others.

The agro-forestry ecosystem is populated by trees, both cultivated and non-cultivated species. Grasses are usually removed from these areas to prevent them from competing with trees for water and nutrients from the soil. This allows the trees and other crops to grow better and bear more fruits for use by man.

Also included in the agro-forestry ecosystem are the farmlands wherein some species or just a single species of plant is allowed to grow or cultivated for economic purposes.

B. Aquatic ecosystems

The ponds, rivers, lakes, seas, and oceans are all bodies of water form the aquatic ecosystems.

There are two types of aquatic ecosystems, namely: the freshwater and the marine ecosystems. The most important feature that distinguishes one type from the other is the presence of salt. Marine or saltwater has very high concentration of salt, while freshwater is almost lacking in any salt content.

The physical and chemical properties of water such as the levels of dissolved oxygen, temperature, salinity or saltiness of water, turbidity or water transparency (which affect the availability of sunlight) are the major factors that affect aquatic ecosystems.

1. Freshwater Ecosystem

Freshwater ecosystem includes all bodies of freshwater, from small streams to large rivers, and from small ponds and water impoundment to great lakes.

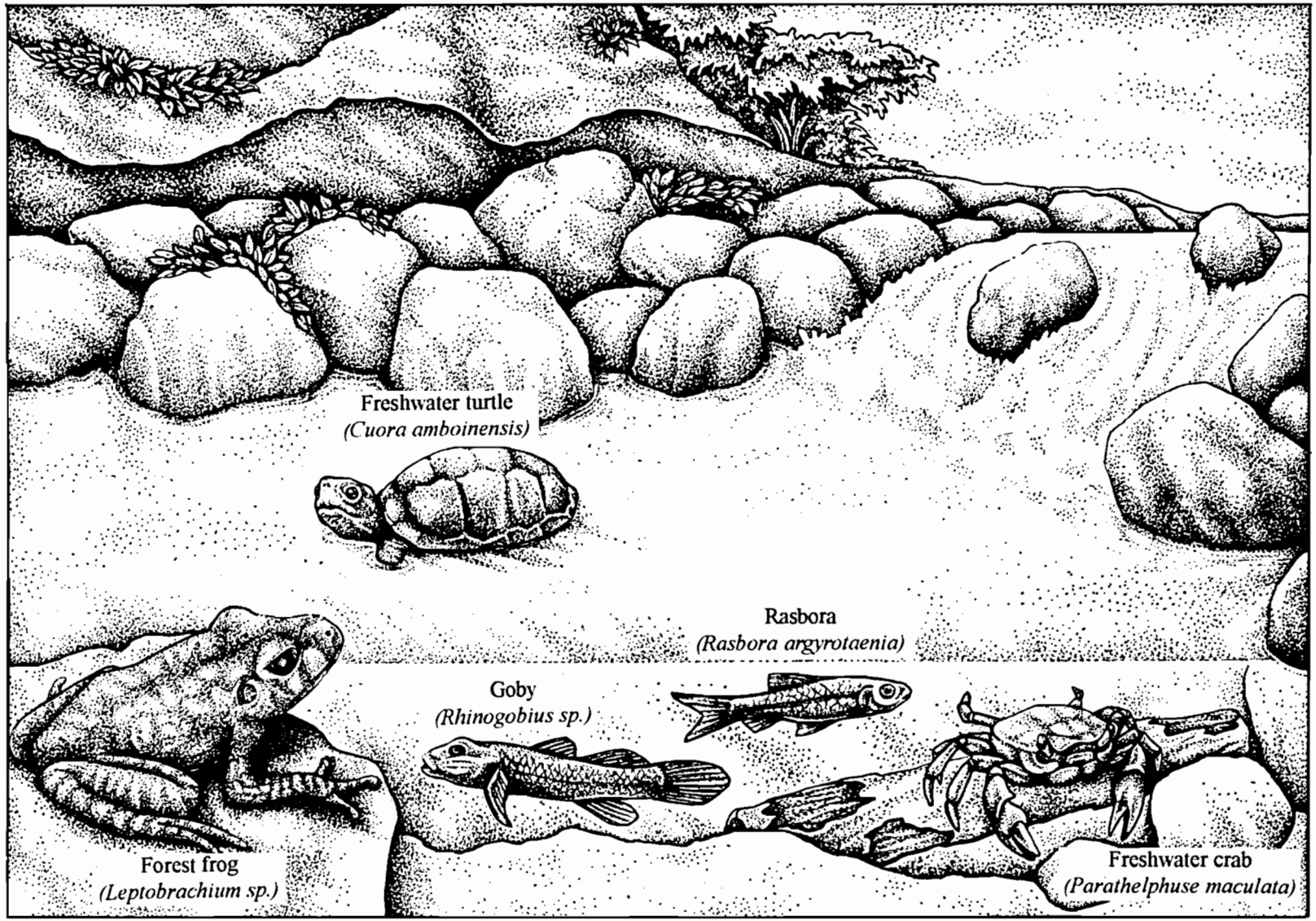
Freshwater ecosystems are divided into two: the lotic or running water ecosystem such as streams and rivers and the lentic or stagnant water ecosystem such as ponds and lakes. Also included in the stagnant water type are the swamps, marshes and wetlands. These freshwater ecosystems are the places where many animals breed and produce their young. Freshwater ecosystems sustain organisms that could not live in saltwater environment. They could not tolerate or withstand high concentration of salts. Thus, they host a different assemblage of plants, animals and other microorganisms.

Freshwater ecosystems are ready sources of water for use in homes and industries. These also provide man his transportation needs. Unfortunately, they also serve as the cheapest means of disposing wastes from both urban and rural human communities. Thus many of our river systems and lakes are now very polluted. Worst of all, a large number of streams, small rivers and tributaries have disappeared as people built settlements over these natural water systems.

2. Marine ecosystem

Water makes up much of the Earth's surface. It is estimated that more than 70 percent of this planet is water. The large bodies of water that cover the Earth are the seas and oceans. These are all salty or marine waters.

The open sea is also an ecosystem where many organisms live. Some organisms are found only in the water column, while others live, grow, and reproduce in the soft ocean or sea floor.


Freshwater turtle
(Cuora amboinensis)
Rasbora
(Rasbora argyrotaenia)
Goby
(Rhinogobius sp.)
Forest frog
(Leptobrachium sp.)
Freshwater crab
(Parathelphuse maculata)

Planktons and other decaying marine materials produce the nutrients in the seas. These are very small floating organisms that naturally flow with the water current. Planktons can be grouped into two-the phytoplankton and the zooplankton. Phytoplanktons are minute plants that produce its own food through the process of photosynthesis. They use water, carbon dioxide and sunlight to do this. These organisms also serve as food of minute floating animals or the zooplanktons. Planktons are eaten by small marine animals, which in turn are fed upon by large marine organisms. The process is a continuous cycle that ensures the supply of nutrients in the marine ecosystem.

When marine organisms die, their bodies are acted upon by bacteria and broken down into nutrients. The nutrients produced from the decay of marine organisms are deposited on the sea floor. These nutrients are made available to the living marine plants and animals by the process known as upwelling. This process happens when the upper and lower layers of ocean water turn over and exchange places due to some factors affecting the environment. When this happens,. the oxygen dissolved in the upper layer of the ocean goes down, while the nutrients formed and deposited on the ocean floor go up.

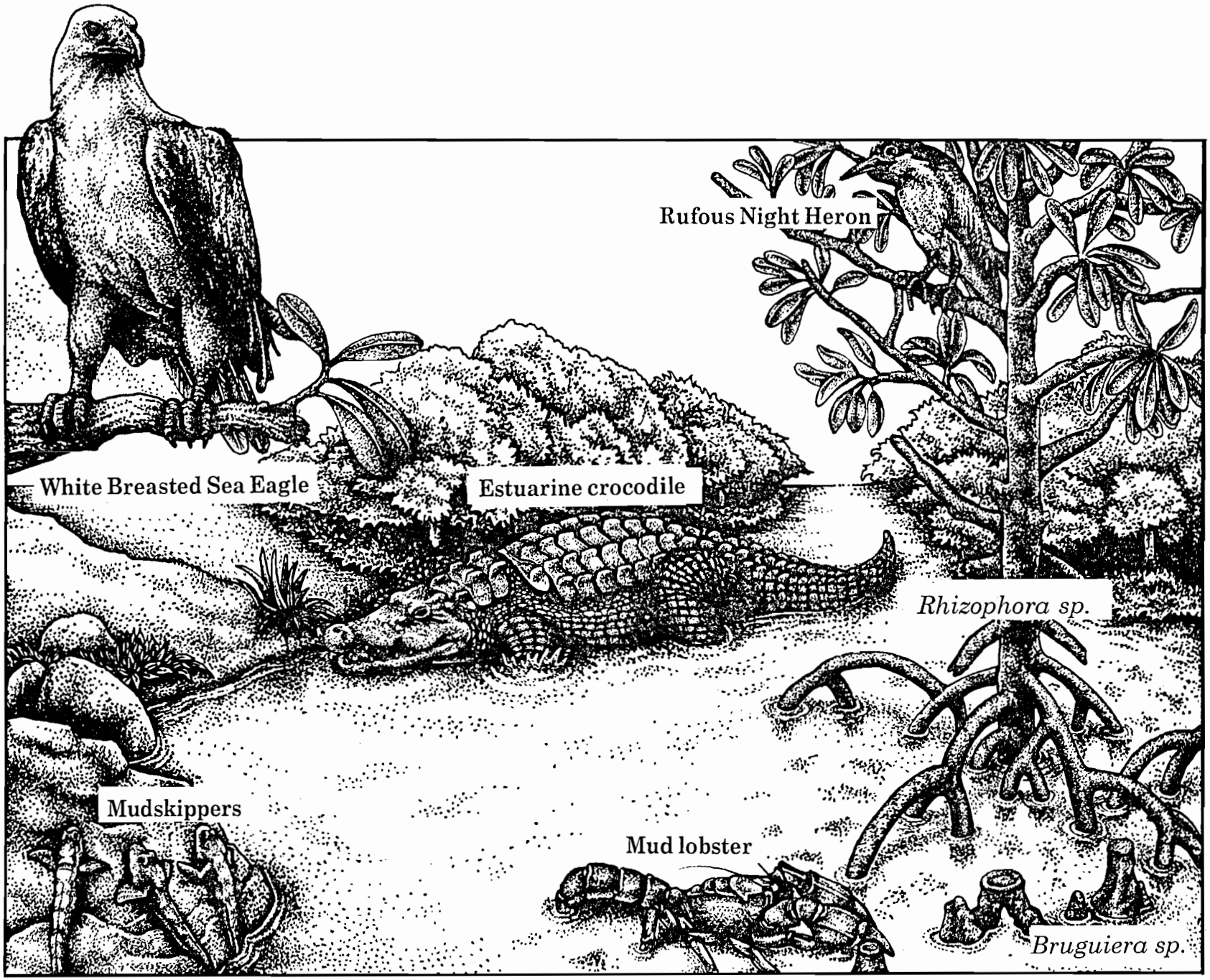
Because of this condition, upwelling areas all over the world become naturally rich fishing grounds. This is because of the availability of nutrients that the fish and other marine organisms need.

a) Mangrove ecosystem

In areas where the freshwater from rivers and streams meet with saltwater from the sea, there exist an ecosystem that is characterized by a swampy surrounding and an assemblage of plants, animals and other microorganisms. This is the mangrove swamp. The water in here is not as salty as the sea or as fresh as the river. It is brackishwater, the mixture of salt and freshwater. This type of water is what mangrove plants need.

Mangroves are trees that thrive in areas along the coast. It is distinguished from other trees by having a different root system. The roots of mangrove tree extend from its trunk upwards out of the water and arch back towards the bottom or ground that is covered by brackish water. These are called prop roots. Prop roots enable the mangrove tree to get oxygen from the air above the surrounding water. These intertwining root systems serve as shelter and refuge of aquatic organisms living in the mangrove swamp.

Like the forest ecosystem on land, mangrove is a very productive and rich ecosystem. The leaves and flowers of the mangrove tree fall and collect on the muddy bottom giving so much nutrient to the whole surroundings. This is why, mangrove is the sanctuary of many marine organisms. It is here where they get their food, seek shelter from predators, and find a place for breeding and reproduction.


Rufous Night Heron
White Breasted Sea Eagle
Estuarine crocodile
Rhizophora sp.
Mudskippers
Mud lobster
Bruguiera sp.

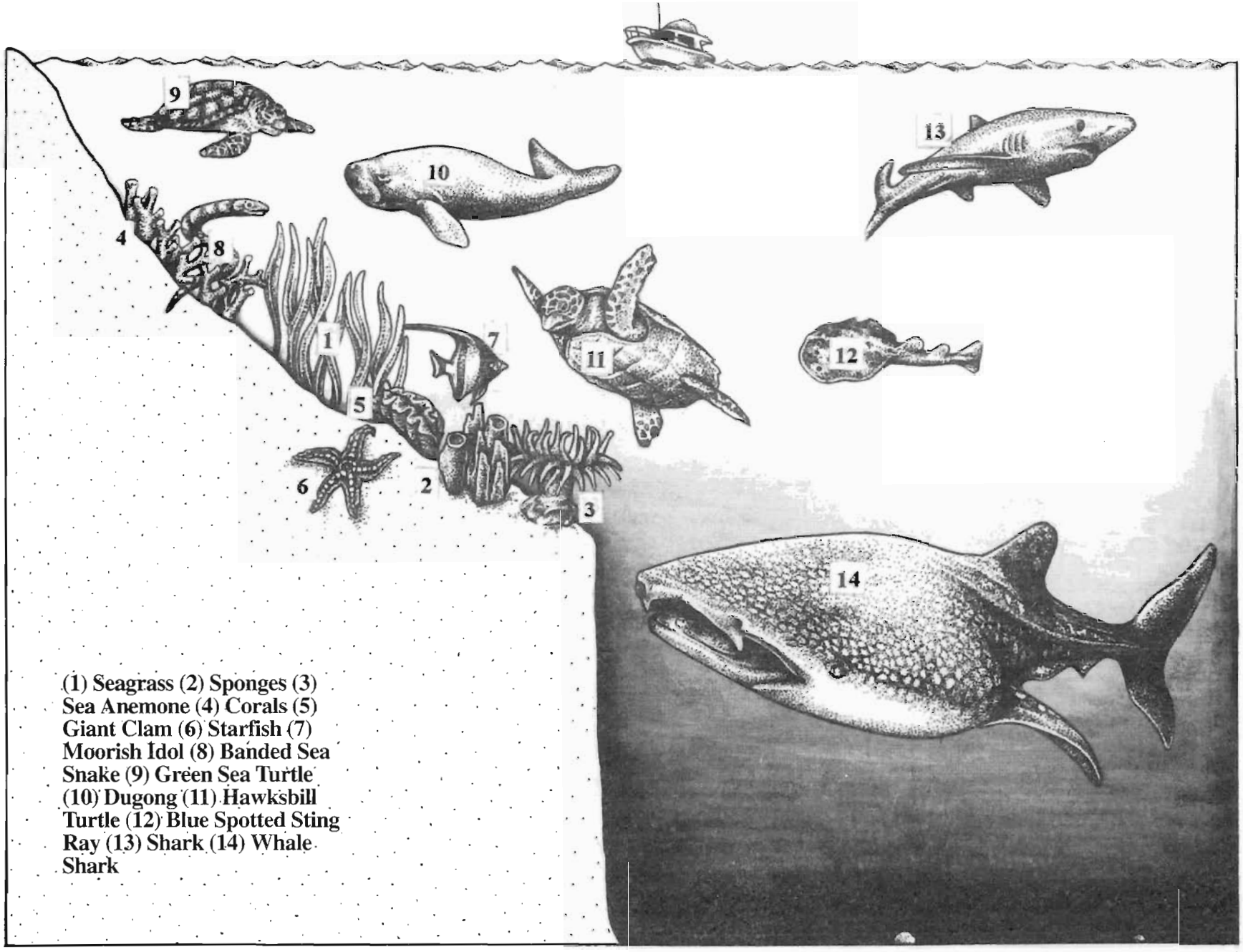
Aside from the diversity of marine organisms that are gathered or harvested by man for food, mangrove ecosystem provides wood for domestic fuel needs and serves as windbreaks for the coastal communities during bad weather. However, much of the country's mangrove areas are now cleared and converted into fishponds where fish such as bangus or milkfish and other species of marine animals such as sugpo or jumbo tiger prawns, alimango or mud crabs, are raised for commercial purposes.

b) Coral Reef ecosystem

The Philippines is one of few countries in the world with so many species of corals in its vast marine waters. However, much of our coral reefs are now destroyed due to dynamite fishing and other destructive means of catching fish.

Corals are marine organisms that require strong substrate or forms of attachment. The coral animal, known as zooxanthelae, has some form of skeleton that becomes hard and rocky when the animal dies. The hard and rocky skeleton becomes the substrate where new living corals attach their bodies. By attaching themselves to this substrate, the corals are protected from the action of waves and water current. Thus zooxanthelae are called reef-building organisms.

Reefs are formed through thousands of years. They also provide the home to many marine organisms. It is a very productive ecosystem, much like the mangrove along coastal areas and the forest on land. Many fishes and other marine organisms breed and reproduce in coral reefs. They get both food and shelter from the reef surfaces and from the crevices in between the hard corals.



(1) Seagrass (2) Sponges (3) Sea Anemone (4) Corals (5) Giant Clam (6) Starfish (7) Moorish Idol (8) Banded Sea Snake (9) Green Sea Turtle (10) Dugong (11) Hawksbill Turtle (12) Blue Spotted Sting Ray (13) Shark (14) Whale Shark

C. Islands as Critical and Sensitive Ecosystems

An island is a unique ecosystem. From the surrounding marine waters to the mountain peaks inland, all the other ecosystems described above are found in an island. Yet, an island is an ecosystem in itself.

The existence of plant and animal life in an island depends on how the island is formed. Some islands rise from the ocean floor due to the geological forces or events thousands or even millions of years ago. Others come into existence because of volcanic eruptions. Still others are thought of as part of a large mass of land that, because of the movement of the Earth's crust, were separated from the mainland or continent. There are also islands formed from coral reefs. These coral reefs were once located under the sea. But when the sea level fell, the coral reefs became dry lands, forming the first stages of island formation.

The Philippines is a group of islands called an archipelago. An archipelago has so many ecosystems that harbor numerous plant and animal life. The different ecosystems and organisms in every Philippine island are believed to be due to their different origins.

One peculiar characteristic of the island ecosystem is the development of opportunities for genetic isolation and species evolution. This means that the origin, development and variation of organisms, happen only within a single confined locality. They do not or could not mix with similar species from other places to produce a different variety of the same species. Being so, this condition gives an island its unique biological characteristic.

As a result of this condition, many species in the island ecosystem are not found in any other place on Earth. For example, more than 510 species of land-living mammals, birds, reptiles and amphibians live only in the Philippines. Aside from this, it is estimated that 85 percent of the identified mammals that cannot fly are found only in the many islands that make up the Philippines (Mittermeier *et. al.*1997).

This feature and many others partly explain why the Philippines has a high level of biodiversity, and is thus considered as one of the biologically wealthiest nations in the world.

IV. NATURAL CYCLES AND ECOLOGICAL PROCESSES

Ecosystems are dynamic complexes of plants, animals and microorganisms, as well as their non-living environment that interact as a unit. Thus, a specific group of organisms interacting with a particular environment will produce a unique ecosystem (e.g forest over ultramafic soils will be different from a beach forest, etc.). This means that the elements needed by plants and animals in order to live, grow, develop and reproduce are naturally present in sufficient quantities. These elements include energy, water, nutrients and minerals, among others. The variations in the quantity and quality of the above elements will produce a unique ecosystem.

The supply of these things is continuously produced by natural cycles. Some of these cycles are:

A. The Energy Cycle

The first law of physics states that energy is neither created nor destroyed. Thus, all the energy that circulates on earth comes from the sun. As primary producers, plants absorb energy in the form of sunlight. Through the process of photosynthesis, this solar energy is transformed into food energy by plants. In this process, plants produce sugar and starch from sunlight, carbon dioxide and water. Sugar and starch are forms of food energy stored in the cells and tissues of plants.

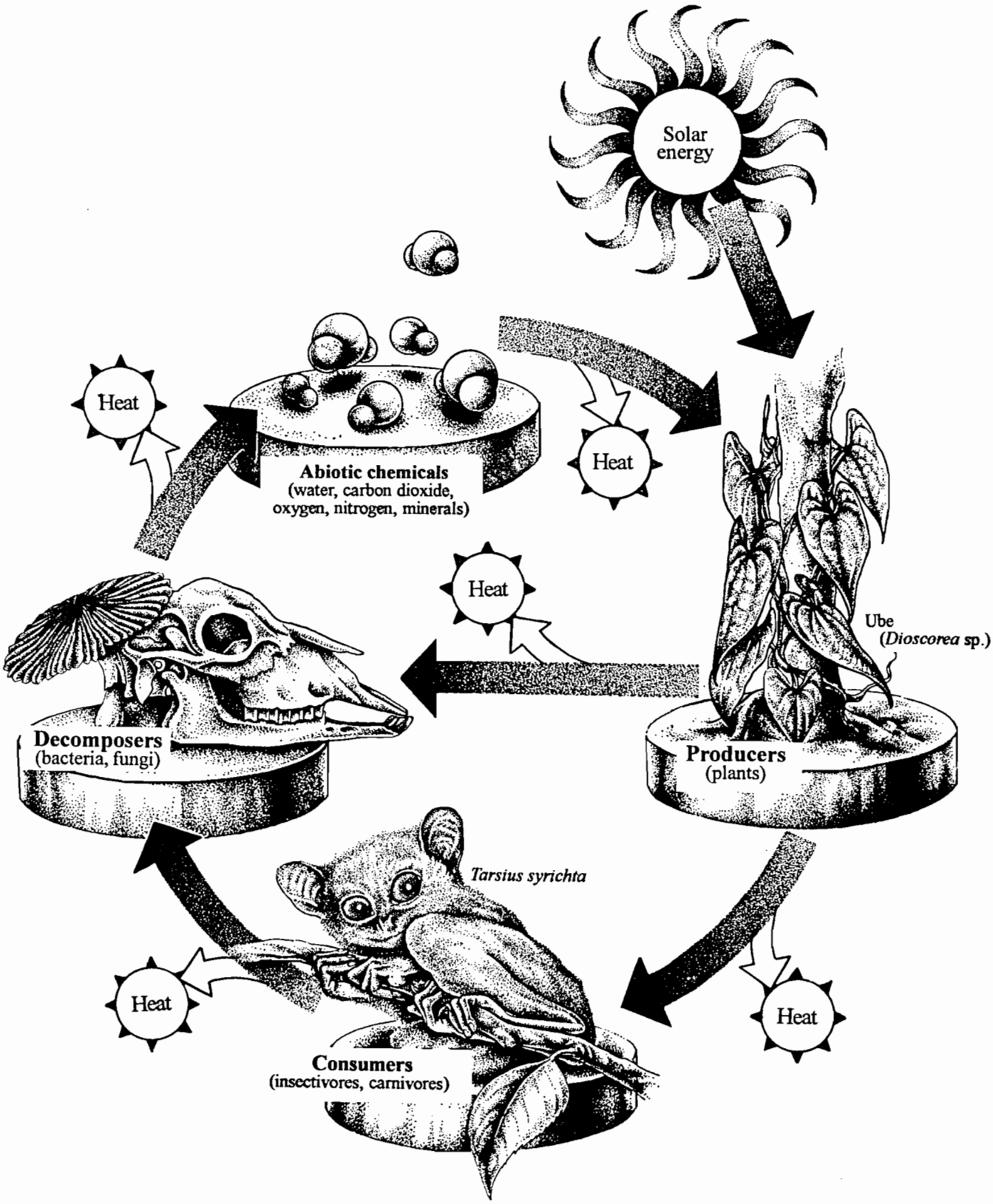
When animals feed on plants, they break down sugar and starch to release the energy stored in it. Part of the energy obtained from the plants they eat are then transformed and stored in their body for growth and reproduction.

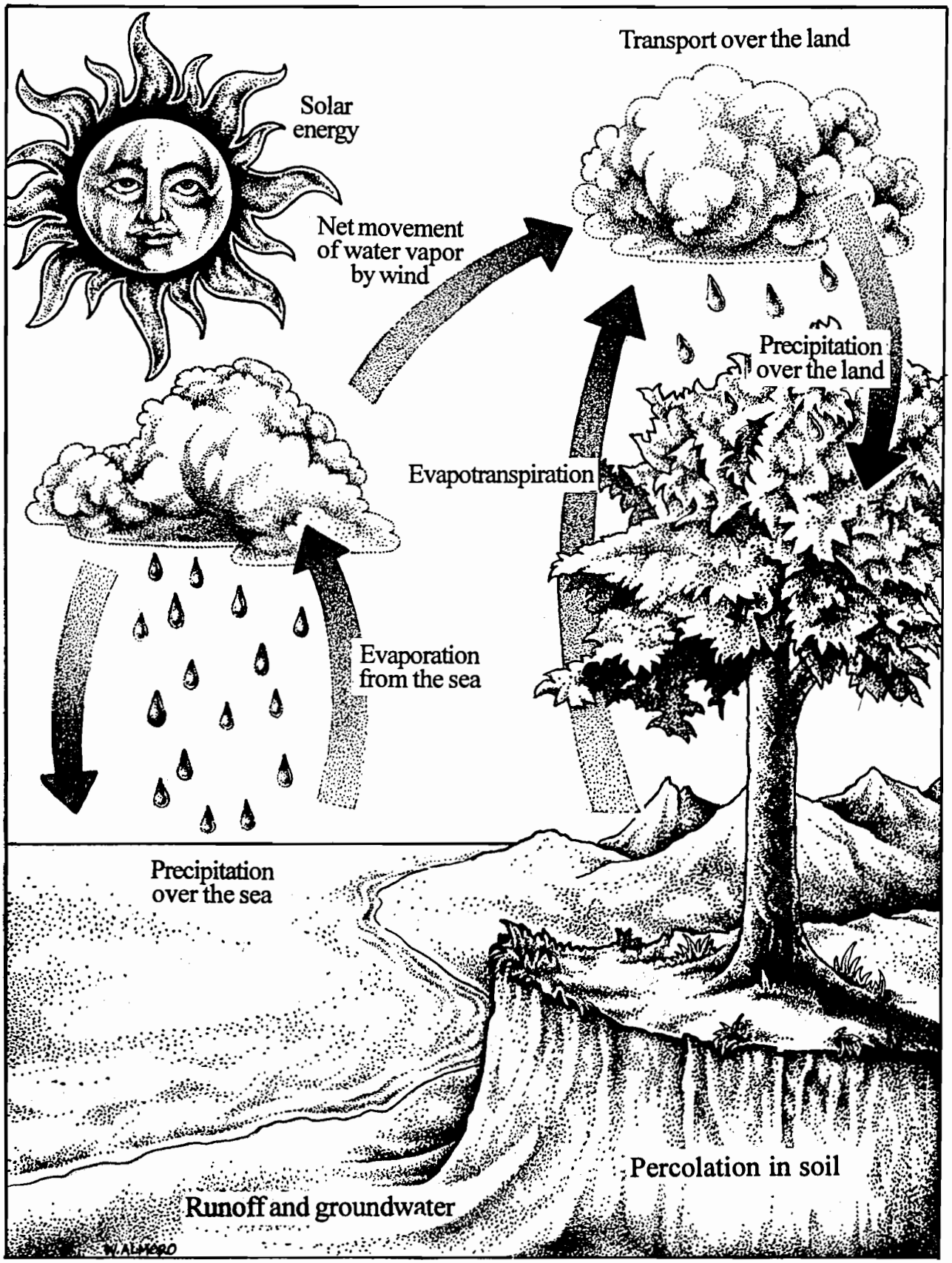
When plants and animals die, they are acted upon by bacteria and other decomposers. These organisms break down animal tissues and plant matter into their original chemical components. These substances are released to the environment and are again used by plants for new growth. New plants are again fed upon by living animals, thereby repeating the cycle.

B. The Water Cycle

Water is returned to the Earth in the form of rain. Like any liquid, water seeks its own level. Thus, rainfall follows its own natural pathways. On land, rainwater either flows on the surface or seeps to the ground.

Surface water is called runoff, and it goes into the watersheds of the different landforms, into streams, rivers, lakes and farther down into the oceans. The water that enters the ground passes through the porous soil material and collects at the water table. This is called groundwater. The water in the soil is then absorbed by plants and used for growth and photosynthesis.


Solar energy
Heat
Abiotic chemicals
(water, carbon dioxide, oxygen, nitrogen, minerals)
Heat
Heat
Ube
(Dioscorea sp.)
Decomposers
(bacteria, fungi)
Producers
(plants)
Tarsius syrichta
Heat
Heat
Consumers
(insectivores, carnivores)


Transport over the land
Solar energy
Net movement of water vapor by wind
Precipitation over the land
Evapotranspiration
Evaporation from the sea
Precipitation over the sea
Percolation in soil
Runoff and groundwater
W. ALMERO

Water returns to the atmosphere by evaporation from water bodies, from soil surfaces and from the leaves and stems of plants. The process by which water is given-off by plants during respiration is called evapo-transpiration.

As water molecules continuously collect in the atmosphere, rain clouds are formed, and water pours down again back into the ground, thereby completing the cycle.

C. The Nitrogen Cycle

One of the nutrient requirements of living organisms is nitrogen. It forms the building blocks of cells and tissues, and nourishes the growth of all living things.

Nitrogen naturally occurs in the form of a gas called ammonium. However, plants and animals cannot use nitrogen in this form. It must first be converted into nitrates. Nitrates are nitrogen-containing compounds that dissolve in water and are readily absorbed by plants.

Nitrates are made available in the environment by means of lightning and by the action of nitrogen-fixing bacteria. Lightning causes chemical reactions in the atmosphere that release gases, which is then dissolved in rainwater to form nitrates. When rain falls, nitrates are carried with it and deposited in the soil.

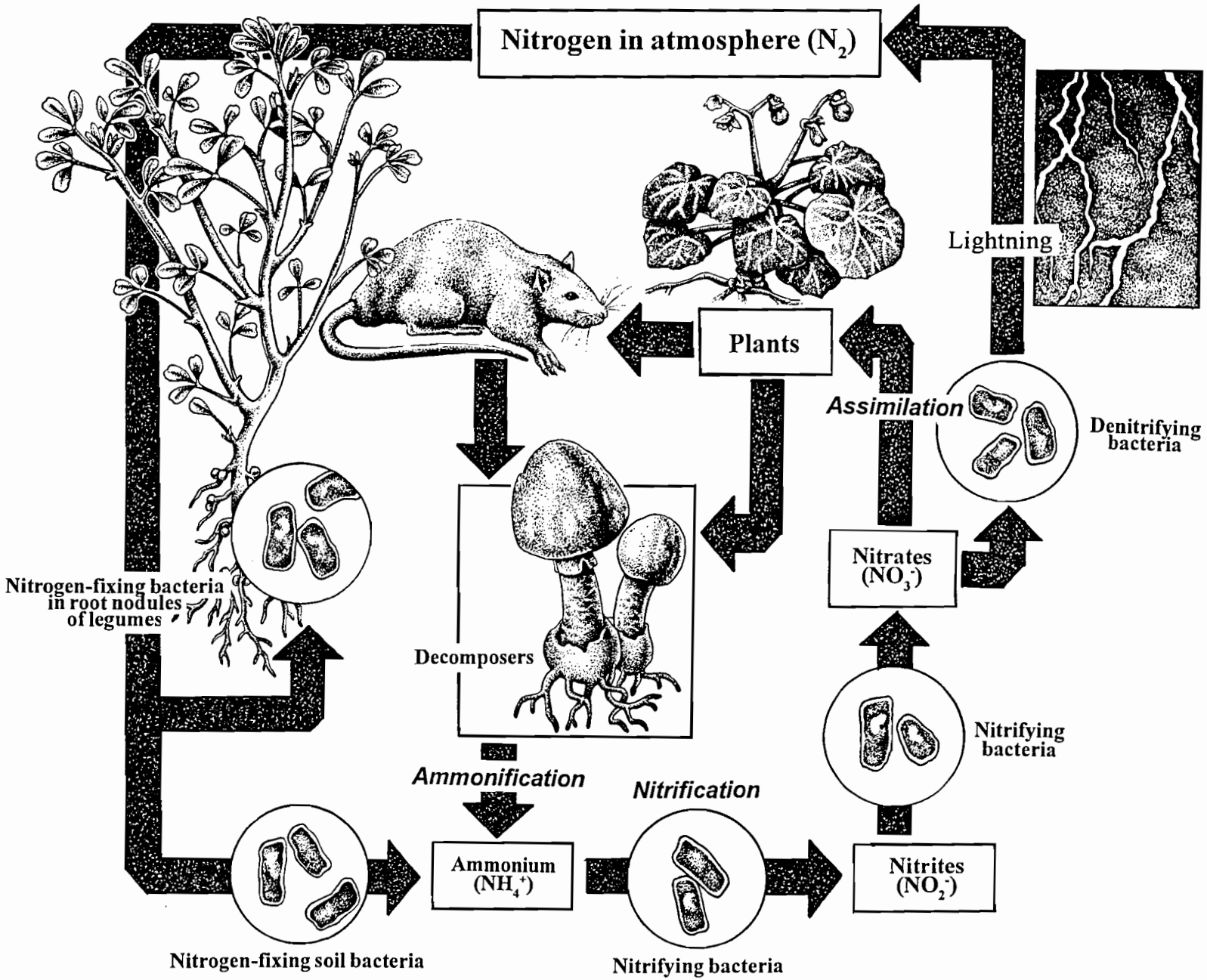
In the root nodules of some leguminous plants like beans, peas, and Ipil-ipil trees, there are bacteria that has the ability to get nitrogen from the atmosphere and change it into nitrates. They change nitrogen into usable nitrates by a series of chemical reactions that include ammonification. Through this process, ammonium compounds are formed before they are acted upon by nitrifying bacteria to form nitrates.

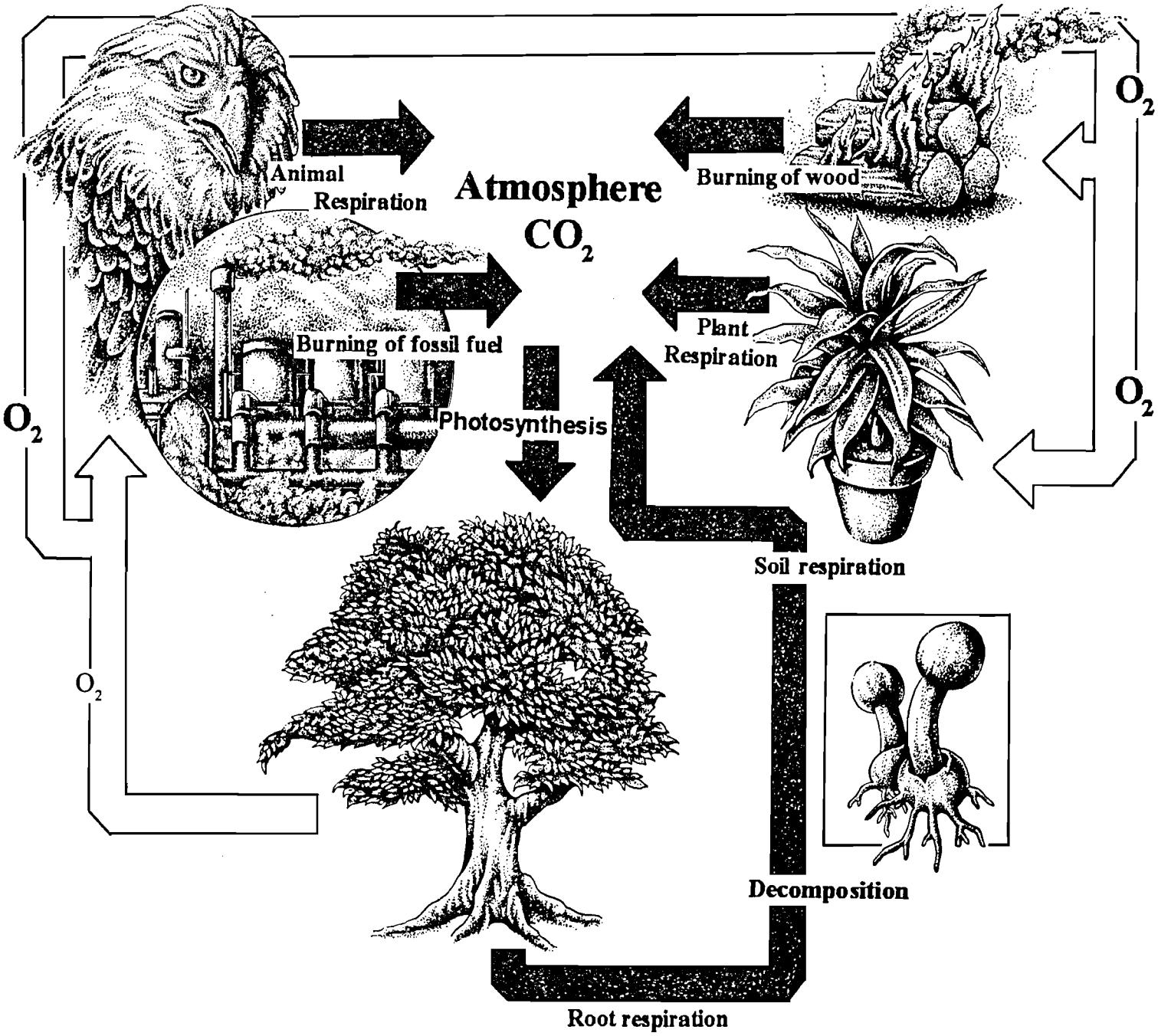
Nitrates are then taken in by plants and stored in their cells and tissues. When eaten by animals, the nitrogen present in the plant matter is then transformed into animal flesh.

When plants and animals die, they are acted upon by bacteria and other decomposers, making nitrates available in the soil. These nitrates are further acted upon by other bacteria and changed into nitrogen, which is then given-off to the environment, thereby completing the cycle.

D. The Carbon Cycle

From the atmosphere, carbon is absorbed by plants and changed into plant matter by photosynthesis. With energy trapped from the Sun, plants produce its own food using carbon dioxide and water, and store the same in their bodies. When animals eat plants, they in turn transform plant matter into animal tissues.


Nitrogen in atmosphere (N_2)
Lightning
Plants
Assimilation
Denitrifying bacteria
Nitrogen-fixing bacteria in root nodules of legumes
Decomposers
Nitrates (NO_3^-)
Nitrifying bacteria
Ammonification
Nitrification
Ammonium (NH_4^+)
Nitrites (NO_2^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria


Animal
Respiration
Atmosphere
CO_2
Burning of wood
O_2
Burning of fossil fuel
Plant
Respiration
O_2
O_2
Photosynthesis
Soil respiration
O_2
Decomposition
Root respiration

Carbon is primarily a product of oxidation, or the burning of oxygen with other substances. When plants and animals respire, they are actually burning food materials to release energy. This happens only in the presence of oxygen. This is why animals need oxygen in order to live.

Aside from plant and animal respiration, other sources of carbon in the atmosphere include soil respiration, burning of wood and other organic compounds, and the burning of fossil fuels such as coal, gasoline and oil.

Some rocks and other soil materials naturally dissolve in water and produce carbonates and bicarbonates. These substances are brought into the different water systems where they are deposited. They further react with water to produce acids and carbon dioxide. When these water bodies are disturbed, carbon is released back into the atmosphere.

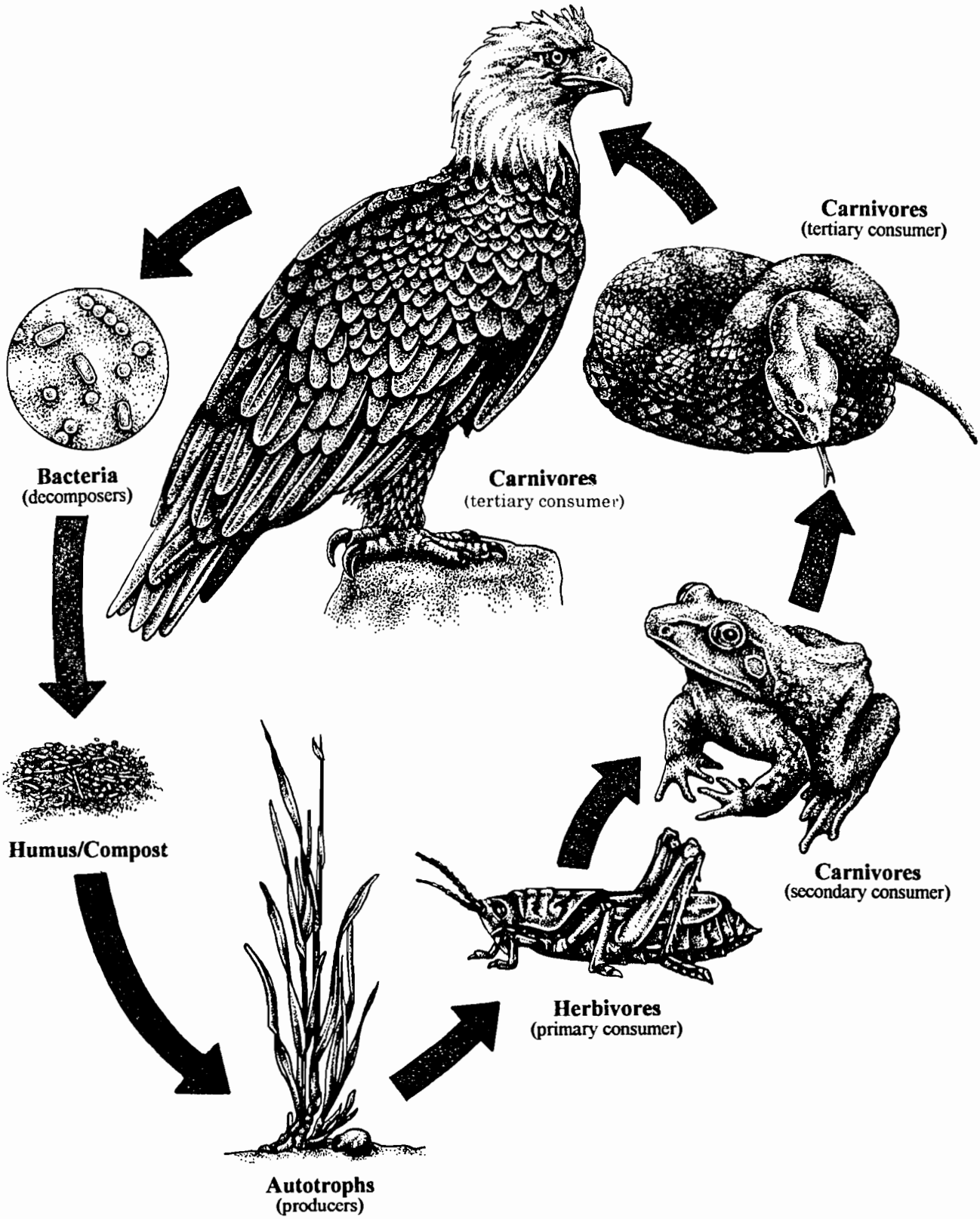
Similarly, the decomposition of plant matter and animal flesh also releases carbon to the environment, making this substance available again for plants to use in the manufacture of their own food.

E. Food Chain

All natural cycles are linked to the primary need of organisms to acquire energy. For plants, this is by trapping solar energy from the sun and transforming this energy into food, while for animals this is the capture of the food stored by plants and transforming this into tissues for growth, development and reproduction.

The food chain is the sequence or order by which food is captured by different organisms at different levels. For animals; this is in the process of eating and being eaten, as energy is transferred from one kind of organism to another.

For example, the grass makes its own food using water and nutrients from the soil, carbon dioxide from the air and energy from the sun (sunlight). It grows and serves as food to animals and insects like the grasshopper. The grasshopper feeds on the grass, which in turn is then eaten by the frog. The frog that ate the grasshopper becomes the food of the snake. And the snake that eats the grasshopper becomes the food of the eagle. When the eagle dies, its body is acted upon by bacteria and decompose into nutrients that are deposited in the soil. The nutrients released by the dead body of the eagle are then absorbed by the grass, through the soil for new growth and development.


Carnivores
(tertiary consumer)
Bacteria
(decomposers)
Carnivores
(tertiary consumer)
Humus/Compost
Carnivores
(secondary consumer)
Herbivores
(primary consumer)
Autotrophs
(producers)

F. Food web

A food chain, like the one described above, is not an isolated sequence. It usually forms a part of a larger network of food chains. The interconnected food chains are called food web. Numerous food webs exist in every ecosystem, because organisms living in every kind or type of ecosystem have different characteristics, preferences relationships and niches.

For example, in a pond ecosystem, snails eat the water lettuce or kangkong. Both the snails and kangkong are eaten by the duck. And the duck, in turn, is eaten by man. Some food webs can be simple like the one described in the pond ecosystem or complex as described in the grass-grasshopper-frog-snake-eagle example.

In an estuary ecosystem, phytoplanktons are eaten by shrimps, which in turn are fed upon by different fish species. The different fish species are in turn eaten by larger fishes and later by larger mammals. Finally, the fishes and the mammals, as well as other predators are then eaten by man.

The water lettuce (kangkong), the snail, the duck, the shrimp and the fish are all food of man. All these organisms occupy different niches and similarly different habitats and ecosystems. They too, have different food chains. Yet, they are all connected with one another as energy is transferred from, transformed into, and absorbed by one another.

Hence, food chains, no matter how long or short they may be, are interconnected at one point or another, such that when patiently traced, one is sure to arrive at some web-like connections linking one to the rest.

G. Relationships

From the need of organisms to obtain food, and sometimes to occupy a favorable space or form of attachment, different relationships are formed between them. Some of the common relationships between organisms include:

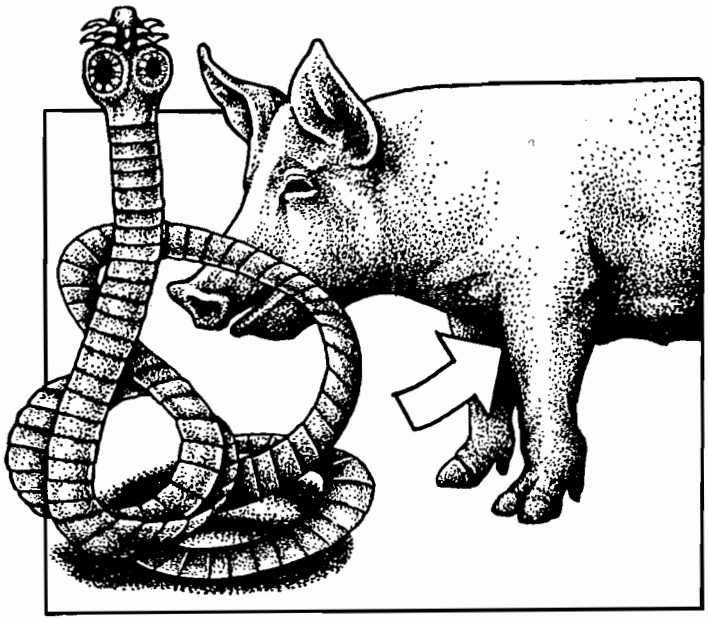
1. Mutualism

Mutualism happens when two dissimilar organisms live together and both benefit from the relationship. This type of relationship is characterized by the give-and-take act of the organisms involved.

For instance, the relationship of fruit bats and the fig tree: fruit bats, such as the golden crowned flying fox, usually take in the fruits of fig tree together with those of many other trees. Fruits are their main food, and the fig tree is one of its sources. When the fruits of the fig tree are eaten by the fruit bat, the seeds are processed by the animal's stomach such that it make the seeds break out easily and grow. The eaten fig

Mutualism (Flying fox and Fig tree)

Commensalism (Sea anemone and Clown anemone fish)



Parasitism (Tapeworm and Pig)

tree seeds go through easily in the digestive organs of the fruit bat. As the bat flies, the processed fig tree seeds are released to the ground. This makes the bat a very efficient agent of spreading the fig tree seeds to grow into new fig trees.

In effect, the fruit bat gets food from the fig tree while the fig tree is helped in the dispersal or growing of new fig trees. Hence, both the fig tree and the bats benefit from each other.

2. Commensalism

When two different organisms live together and one of them gets benefited without giving anything back nor doing harm to the other, they are called commensal organisms. This relationship is known as commensalism.

An example of this type of relationship is the association between the damsel fish or clownfish and the sea anemone. The damselfish is a very colorful fish that is gentle and not aggressive. Hence, it is easily hunted and eaten by some marine animals. In order to protect itself from its predators or hunters, the damselfish stays inside the polyps of sea anemone and gets protected from its pursuers.

The polyps of sea anemone have stinging cells in the tentacles that stun fish and other organisms that get near it. However, with the damselfish, it could not do this. The damselfish has slime in its body that makes the sting of the sea anemone ineffective. When hunted by other marine animals, the damselfish hides inside the polyps of the sea anemone and consequently is unharmed by other predators. This way, the damselfish gets protection without harming or giving benefit to the sea anemone.

3. Parasitism

Parasitism exists when one organism (the parasite) gets its nutrient, partly or wholly, from another organism (the host). It is a one-sided relationship wherein the parasite gets benefits from the host, which is detrimental to its host. This relationship sometimes leads to the death of the host.

One example of this type of relationship is the infestation of the tapeworm in pig. This parasite lives in the intestines of the animal. It feeds on the blood of its host! When the level of the tapeworm becomes enormous inside the pig, the pig loses a lot of nutrients in its body to the tapeworm. The tapeworm grows, lays eggs, and reproduces inside the pig's body. When this happens, the organs of the infested pig are badly affected, and the animal gets sick. When this condition continues for a long time, the pig may die. If this condition remains unchecked and the infected pig is slaughtered without the tapeworm being detected, the infected pig ends up on the table of man as food. If the infected pig is improperly cooked, the tapeworm can transfer to the human body and a new round of tapeworm infestation will occur in the man's body.

4. Predation

Predation, or predator-prey relationship, is the association between two organisms wherein one hunts (predator) and kills the other (prey) for food.

One example of this kind of relationship is between the eagle and the civet cat. The eagle is a big bird that eats animals smaller than itself. It hunts and eats animals such as small snakes, lizards, some birds and their young, e.g., the chicks of fowls, such as ducks, chickens, etc., rats and civet cats. When hunting for its food, the eagle positions itself on the branch of a tree and looks around for its prey. Once it sees an animal that it can eat, the eagle swiftly dives from its perch and quickly grasps the prey with its sharp and strong claws (talons). The predator-prey relationship has a built-in balancing mechanism. When the predator commits over-predation, it can lead to the decimation of prey levels which will in turn lead to the dwindling of prey numbers. This low numbers in turn will lead to the drop in predator population levels until such time that it can allow for sufficient number of prey to build up and the whole cycle repeats again.

V. DIRECT CAUSES OF BIODIVERSITY LOSS

Nature, if left alone, has the capacity to heal itself and make adjustments to reach a balance on its own. Nature has done this in the past and has all the time in the world to do it. However, with the emergence of humans as the dominant species over the whole world, this balance is being upset. We are using more resources than nature can replenish. With more than six billion people on earth before the end of the 20th century and predicted to triple to 18 billion people by the year 2100, unless corrective interventions are undertaken now, the human population will simply implode by that time if not earlier.

Man's presence on the planet has been the cause of much of the destruction although there are other natural made causes as well that reduced considerably the biodiversity around us. All those which remain are in serious danger of being lost forever.

Take our natural forests for example. The Philippines is blessed with great forests that sustain an enormous number of plant and animal species. However, much of these natural resources are now gone. Illegal logging, uncontrolled cutting, and irresponsible burning of trees and other vegetation greatly reduced the country's forests and caused the loss of numerous organisms because they were deprived of their sources of food, habitats and breeding places.

The rate at which our forests are destroyed is alarming. At the beginning of the 20th century, it was estimated that we still had 70% forest cover or about 21 M has. At the close of the 20th century, we were down to about 18.8% or a little over 6 Million has. We lost more forests in the last 50 years of the 20th century than the past 450 years!

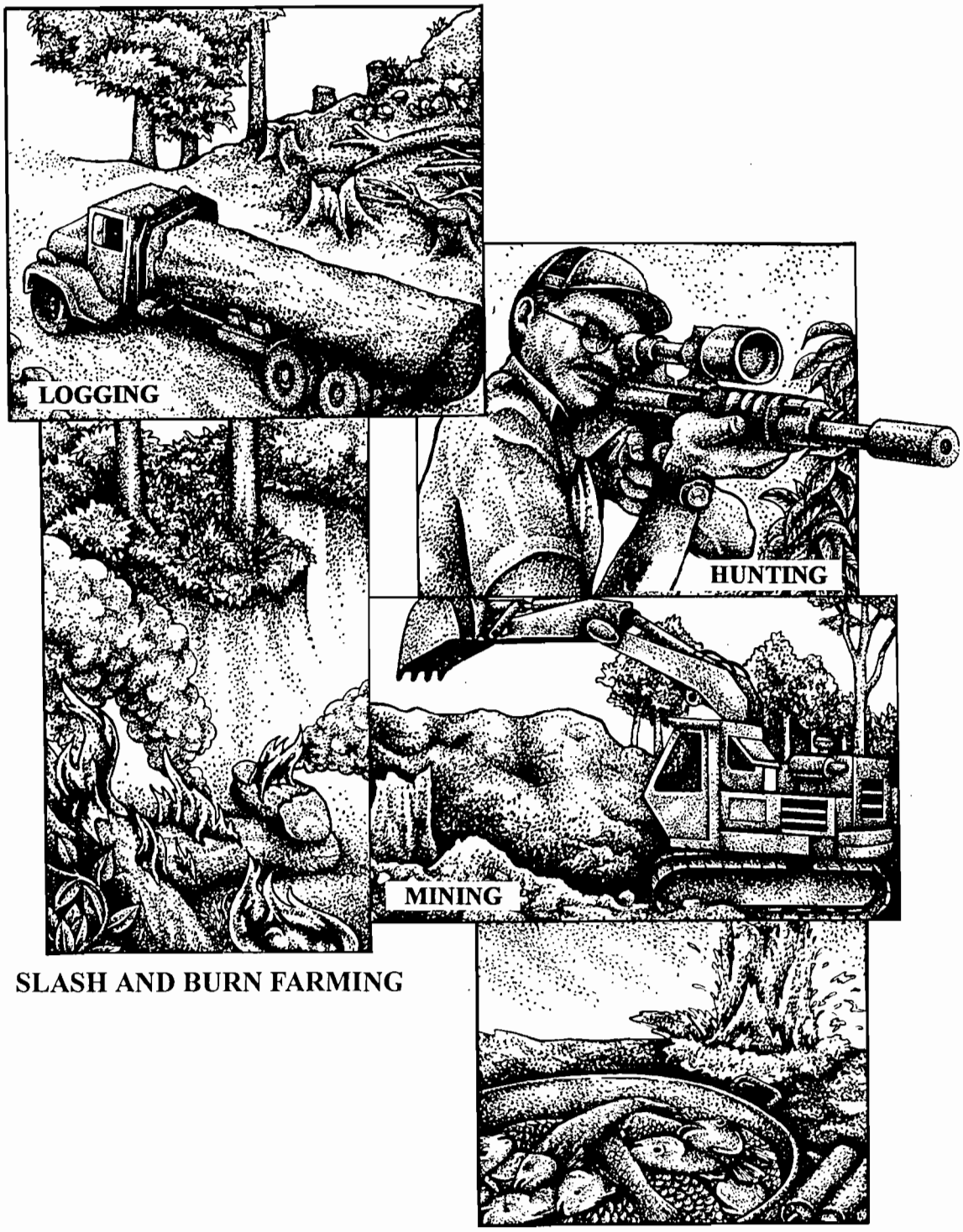
The loss of our forests has led to the continuing sufferings we are experiencing from natural disasters such as big floods, extreme droughts, massive soil erosion, siltation of rivers and coral reef areas and drying up of groundwater. The intensity of these disasters is becoming greater and the frequency between them becoming shorter.

Some of the direct causes of biodiversity are briefly discussed below:

A. Logging

Forests are the source of materials for some, if not most, of man's basic needs. However, because of man's greed and extreme desire to enrich himself, the forests are continuously exploited for so many generations now.

Foremost of man's exploitative acts is logging. Both lawful and illegal logging, no matter how one looks at it, is destructive and harmful to the forest ecosystem in particular, and to the environment, in general. The uncontrolled cutting of big, mature and residual trees, results in the clearing of vast forest areas of the vegetation that otherwise would



SLASH AND BURN FARMING

ILLEGAL FISHING

have absorbed carbon dioxide and release oxygen or clean air. Aside from this, logging loosens up the ground and causes soil materials to move as run-off down the mountain slopes.

When wide forest areas are cleared of major vegetation, the microclimate in those areas dramatically changes as a result of the imbalance created to the environment around those areas.

As in the aquatic ecosystems, many people believe that the forest is a renewable resource, taking whatever they want, doing it the way they want it, and whenever they can. They think that forests, much like the oceans, are unlimited and would continue producing the materials they need. So they cut down trees and destroy everything in the process.

People are unmindful of the fact that it took a long time for a single tree to grow that big and produce sufficient volumes of lumber for their use. Never do they think that once a tree is felled, it will take the same long period of time to grow another and reforest the areas that have been cleared. While not all loggers are irresponsible, the experience of the past hundred years has led people to believe that loggers had done more harm than good to the forests. Some loggers are so irresponsible that they don't even think of reforesting the areas they cleared.

While harvesting resources from the forests can be a renewable activity, this should be undertaken only if and when nature is given the time to recover from the effects of extraction. Otherwise, it will become an unsustainable activity and would lead to severe consequences not only to the environment but also to ourselves!

So what do we get? Disaster! The Ormoc tragedy of 1990 is a classic case of how unsustainable activities and human greed caused the disaster to happen. In the past, the mountains surrounding Ormoc City were thickly covered with primary forest. However, unscrupulous businessmen saw the big opportunity and literally mined the mountains of Ormoc for their own personal profits. But nature has a way of getting back at people for such wanton degradation of the natural forest and the environment. Hence, when enormous volumes of floodwaters came rushing in from the denuded mountains, it caused the death of thousands of city residents overnight.

B. Small-scale Upland Agriculture

In the past, slash and burn farming practices were sustainable as farmers follow a rotation pattern that allowed fallow or rest periods in between farming regimes. However, with the surge of landless migrants from the lowlands to the uplands, the practice became unsustainable as more people were practicing slash and burn farming than what the forest can accommodate.

Slash-and-burn usually follows the end of logging operations. Slash-and-burn farming involves the cutting and burning of trees, shrubs and other plants to clear selected areas in the forest. Once cleared, the area is planted with cash crops. Cash crops are plants such as upland rice, corn, root crops, vegetables and others that grow easily and are harvested within a short period of time.

With the growing number of practitioners, slash-and-burn farming results in the destruction of a large portion of the forest, thus rendering the wildlife living in it homeless and deprived of food and natural breeding places. Just like logging, slash-and-burn farming also contributes to the worsening problem of soil erosion, soil nutrient depletion, and the overall degradation of the delicate forest ecosystem.

C. Hunting

People hunt animals for food, for trading and for fun or recreation. Hunting destroys biodiversity, as it prevents the different elements of the ecosystem such as the wildlife species from performing their regular functions, resulting in an imbalance of the ecosystem.

Some species of animals are hunted and killed at a rate much faster than they could reproduce. As a result, the population or number of these animals is considerably reduced. They are threatened with extinction and are classified as critically endangered or endangered species. These endangered species are in danger of becoming lost and gone forever from the face of the Earth.

The most familiar endangered species in the country is the Philippine Eagle. This big, majestic and beautiful bird has the distinct characteristic of producing only one chick every breeding period. Furthermore, the Philippine Eagle breeds only every other year, thereby reducing the frequency by which chicks can be produced. This is why, the intense hunting for this bird in the past years, plus the wanton destruction of the forests where it lives, made the Philippine Eagle one of the most endangered species not only in the country but in the whole world as well. Less than 200 pairs are estimated to be left in the wild. This is why, there is a need to exert a lot of effort, expertise, money, and other resources to ensure that the remaining eagles survive, for they are an important part of our ecosystem. The eagles are naturally good in controlling the population of various pests in our forests and farmlands. Moreover, they are part of our national and global patrimony.

Worse than the increase in number of threatened and endangered organisms is the extinction of species. Extinct species are those organisms that were once living in this world but are no longer around today. They have been killed, destroyed and wiped out, from the face of the earth due to various causes. And hunting is one of the causes.

D. Mining

Another human activity that is destroying biodiversity and the environment is mining. It is the process of digging and dumping of earth materials during the process of getting metal ores and other substances that are used by man both for his home, for trade and for industry. During mining, seabeds, farmlands, and even whole mountains are dug up in search of precious metals and valuable substances. As a consequence, ecosystems are destroyed.

To illustrate, in the 1970's, the mining of copper in the serene and picturesque island of Marinduque was undertaken by a foreign-owned company. Initially, the local people were happy because many of them got jobs in the mining sites and had better lives economically. Never did they foresee that in the long run, they were actually destroying themselves and the very island that is their home.

The process of mining copper requires digging enormous volumes of earth material from a very large area in the small island. Thus, it destroyed forests, farmlands, and even places that were settled by the island residents. But more than the dislocation of their homes and the destruction of croplands and forests, that mining activity created various health problems to the people. The processing of copper ores produced a lot of waste materials that were dumped directly into the sea. The dumped waste is called mine tailings. The mine tailings destroyed much of the marine ecosystems and led to the decline of the fish catches of the fishermen. Aside from this, the people were exposed to pollutive and toxic chemicals that were harmful to their health. As a result, many people got sick, and subsequently died. Those who survived today continue to suffer from pollution-related sickness that remains incurable.

E. Illegal Fishing

In aquatic ecosystems, the most common cause of biodiversity loss is the use of destructive fishing methods and over-fishing. This includes the use of dynamite, poisonous chemicals, fine-meshed nets, and drag nets, among others. These fishing methods are prohibited by law as they destroy the fishing grounds, kill the breeders and fingerlings and other marine organisms, and make our rivers and seas less productive. Yet, despite the existence of many fishery laws in the country, many people are still catching fish through these destructive systems. Thus, we continue to suffer from increasing fish prices and fewer fish on our tables.

Aside from these illegal means of fishing, our fishermen do not allow our fishing grounds to rest such as the imposition of close season that allows the fish and other marine organisms regenerate or reproduce anew to repopulate these fishing areas. They catch fish almost everyday, thinking that the fishery resources are inexhaustible. Never did they think that by continuously catching fish in these waters, they are actually destroying and killing the very source of their livelihood.

If these practices continue without us, the people, doing something to save the remaining fishery resources of our country, the time will come when even the less edible marine organisms will find its way into our own stomachs. Worst than this, we may find ourselves without a single marine organism to catch for food.

F. Greenhouse Effect

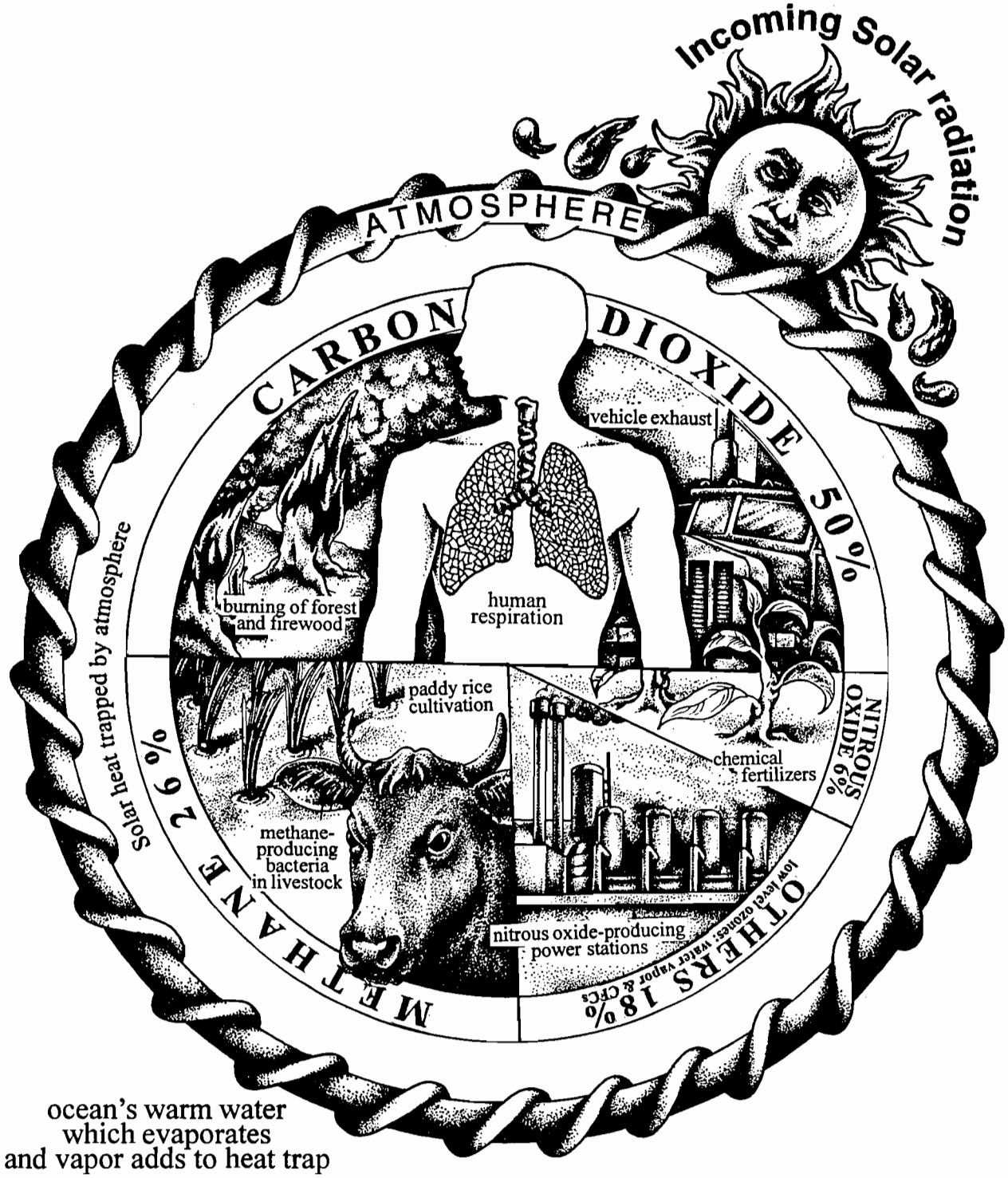
Aside from the causes of biodiversity loss discussed above, there is another equally important factor that affects mankind on a much wider scale. This is known as the Greenhouse Effect. The Greenhouse Effect is the condition in our environment wherein some gases in the atmosphere trap heat from the biosphere, resulting in the increase in temperatures on the Earth's surface.

The Earth is protected from direct heat of the Sun by gases that form a very thick layer of material in the atmosphere called the ozone layer. The ozone layer prevents solar energy from directly shining through the Earth.

The natural pathway is for the heat from the Sun to be absorbed by the Earth and part of it is reflected back into outer space. This reduces the temperature level on the Earth's surface and is then maintained that way. However, the atmosphere had greatly changed through time. Instead of allowing heat energy to dissipate into space, some of these gases became a form of shield that traps the heat and returns it back to the Earth's surface. This creates a condition wherein heat on the Earth's surface is accumulating through time and consequently causes an increase in temperature, which in turn leads to the melting of polar ice caps and glaciers. The effect of the melting is the increase of sea levels and eventually cause great floods in low-lying areas all over the world. It is predicted that if present trends continue, this will lead to the increase in sea level by up to one meter or more. And in a country like ours, a lot of islands will definitely sink once the full impact of the greenhouse effect is felt. Furthermore, because of the continuous increase in temperature, climate will change worldwide, thus, negatively affecting all living things on Earth.

The Greenhouse Effect is brought about by the accumulation of carbon dioxide, methane, nitrous oxide and other heat-trapping gases. These gases, together with water vapor in the air, do not allow heat to escape into space. Presently, the composition of heat-trapping gases in the atmosphere is estimated to be 50% carbon dioxide, 26% Methane, 18% levels of ozone, water vapor and chloro-flourocarbons (CFCs), and 6% nitrous oxide. These gases are the results of various human activities and some naturally occurring processes.

Some of the more common human activities responsible for the build up of greenhouse gases include the burning of wood and other organic matter, burning of fossil fuels to run vehicles, machines and equipment, and the cutting and burning of the Earth's forests. More than the gas produced, burning of the Earth's forests greatly reduced the number of trees and other plants that otherwise would have readily absorbed carbon dioxide and released life-sustaining oxygen in the process. With more carbon dioxide in the air, we get more heat-trapping gases in the atmosphere and less oxygen available for use of plants and animals.



ocean's warm water
which evaporates
and vapor adds to heat trap

VI. WHAT CAN WE DO TO SAVE AND CONSERVE BIODIVERSITY?

The loss of biodiversity is the most important environmental problem that man has created and one that threatens his own survival as a species as well. As some concerned environmentalists said a few years back, we have lighted the "green fuse" a long time ago. And like a bomb, it has been ticking since then.

We live in a delicately balanced world that if we continue to destroy our forests, pollute our rivers and seas, directly kill and eliminate our wildlife, it will not be long when this delicate balance will be totally upset. And when this happens, we will have to suffer the consequences of this imbalance, as we are now beginning to feel the impact of the imbalance.

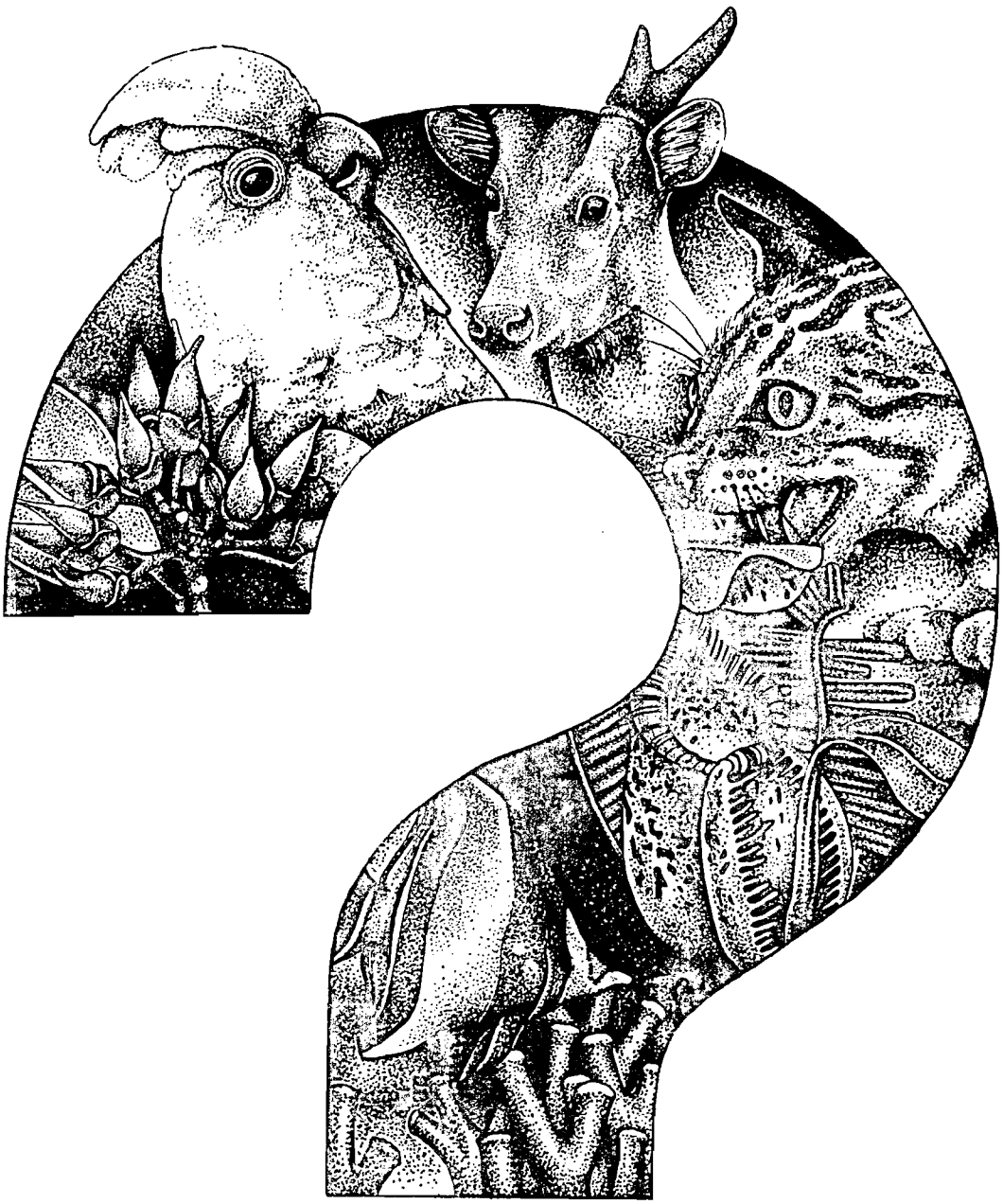
Indeed, it is alarming to note that time may run out on us, if we do not significantly increase our efforts and **ACT TOGETHER NOW** to reverse this threatening situation. Because if biodiversity, particularly our forests and oceans, were lost forever, we would be left with nothing to support our need for food, medicine, water and even the air we breathe. In short, the consequences of biodiversity loss are such that we are looking at the survival of the human race as a species as well.

So...

Now that you know these things about the loss of our biodiversity and its consequences, as well as the dangers we are facing because of its continued destruction, what are you going to do? What are the possible things that you can contribute in order to control, or at least lessen, the negative effects of human activities to the world around us?

In the first place, this is not just about plants and animals, nor just about the environment. More than all these things, this is all about us, the people, who only have this Earth as our natural home. As they say, "good planets are hard to find."

The challenge before us as individuals is how to protect the species and habitats we may lose while learning to live more wisely, and how to reduce our 'ecological footprint' on the earth. Before we can know how to do things differently and better, we need to know what we're doing well now, as well as what we're doing inefficiently, less effectively or unnecessarily.



Some ways to attain biodiversity conservation:

- At the global level, negotiations for trade incentives for carbon storage and sequestration efforts are underway. This could lead to the protection of forests as carbon sinks to reduce the release of greenhouse gases.

- At the national level, the government can make policy changes, provide economic incentives and adopt environment- and conservation- friendly practices.

- Regionally, protected areas can be created, strengthened and expanded, including the development of biodiversity corridors that will link fragmented ecosystems and protected areas.

- At the local level, sustainable development projects such as ecotourism, and harvesting of non-timber forest products together with the development of education/ awareness outreach and creation of conservation concessions instead of logging concessions, are all possible conservation-friendly activities.

What can you do?

- Buy smartly so as to prevent waste rather than create it.
- Buy products with pre- and post- consumer waste (PCW).
- Buy products with recycled content whenever possible in order to encourage closing the loop of material use and re-use.
- Buy products with reusable components and materials that encourage further reuse and recycling.
- Divert from the waste stream all possible recyclable materials, compost a organic waste.
- Be an informed consumer, purchaser and user of not just products but also of companies and species.
- Make lifestyle choices that help reduce your impact on earth, such as energy efficient appliances, local organic foods, etc.
- Invest in and support environmentally sound business.
- Support local, national and international conservation efforts.
- Minimize consumption of gasoline, electricity and material goods.
- Be informed about legislation affecting the world's biodiversity and share your concerns with your elected officials.
- Link up with other like-minded individuals to create a critical mass of conservation advocates.
- Encourage schools, students and researchers to make conservation issues part of academic activities (teaching, research and extension work).
- Take initiatives to talk to the general public about conservation issues and the need to do conservation actions as another step in creating the critical mass of conservation advocates.
- Create alliances and partnerships with non-traditional stakeholders to work together and promote conservation issues.
- Make sure that politicians at all levels are aware that you are building a critical mass of conservation advocates and that this critical mass will be a force to reckon in future elections.

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