

Chapter I
Introduction
(The Beginning)

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CHAPTER I

INTRODUCTION

(The Beginning)

1. HISTORY AND MEANING OF THE WORD ECOLOGY

1.1. Soon after Charles Darwin wrote his revolutionary book, “The Origin of Species” in 1859, ecological thoughts began to hover upon the minds of biologists. In 1870 German biologist Ernst Haeckel coined the word **Oekologie** using two Greek words **oikos** meaning “home” and **logos** meaning “science”. From Oekologie arose the word **Ecology** and it was first used in 1892.

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1.2. Briefly, Ecology is that branch of biology which deals with the interactions between various living beings and their environments. Or more simply, Ecology is the art which shows us how to live in harmony with Nature.

1.3. The general concept of ecology however, is not post-Darwinian but definitely pre-Darwinian. While voyaging round the world in H.M.S. Beagle from 1827-31, Darwin was much taken by the glowing accounts tropical scenery of the Amazon river valley of South America by a much earlier German naturalist traveller Alexander von Humboldt (1769-1859). Like Humboldt, Darwin too was much struck with the varieties of animals and plants of different countries visited by him during this voyage.

*Darwin's voyage in
H.M.S. Beagle*

1.4. So one can fairly say that Alexander von Humboldt laid the seeds of modern ecology in the minds of biologists. Humboldt’s book “Personal Narrative” & Darwin’s book “The Origin of Species” (1859) are classics of Natural History. These surely can be looked upon as the starting points of today’s ecology.

1.5. Since Humboldt, Darwin and Haeckel, all over Europe and North America many ecological studies began. Gradually a general meaning of the word Ecology emerged. Today Ecology means the studies of the relationships of living beings with their non-living environments and **vice-versa**. Naturally ecological processes are complex varying from species to species and involving several factors according to the environments they live in. As a matter of fact ecology to-day has become so important that once a renowned biologist Thiodosius Dobzhansky said, “Nothing in biology makes sense, except in the light of ecology—that is,

in terms of interactions between organisms and their physical, chemical and biological environments” (Preface—pp. vii. of ECOLOGY by Begon, Harper & Townsend; Blackwell 1990).

2. ECOLOGICAL CONSCIOUSNESS IN ANCIENT WORLD

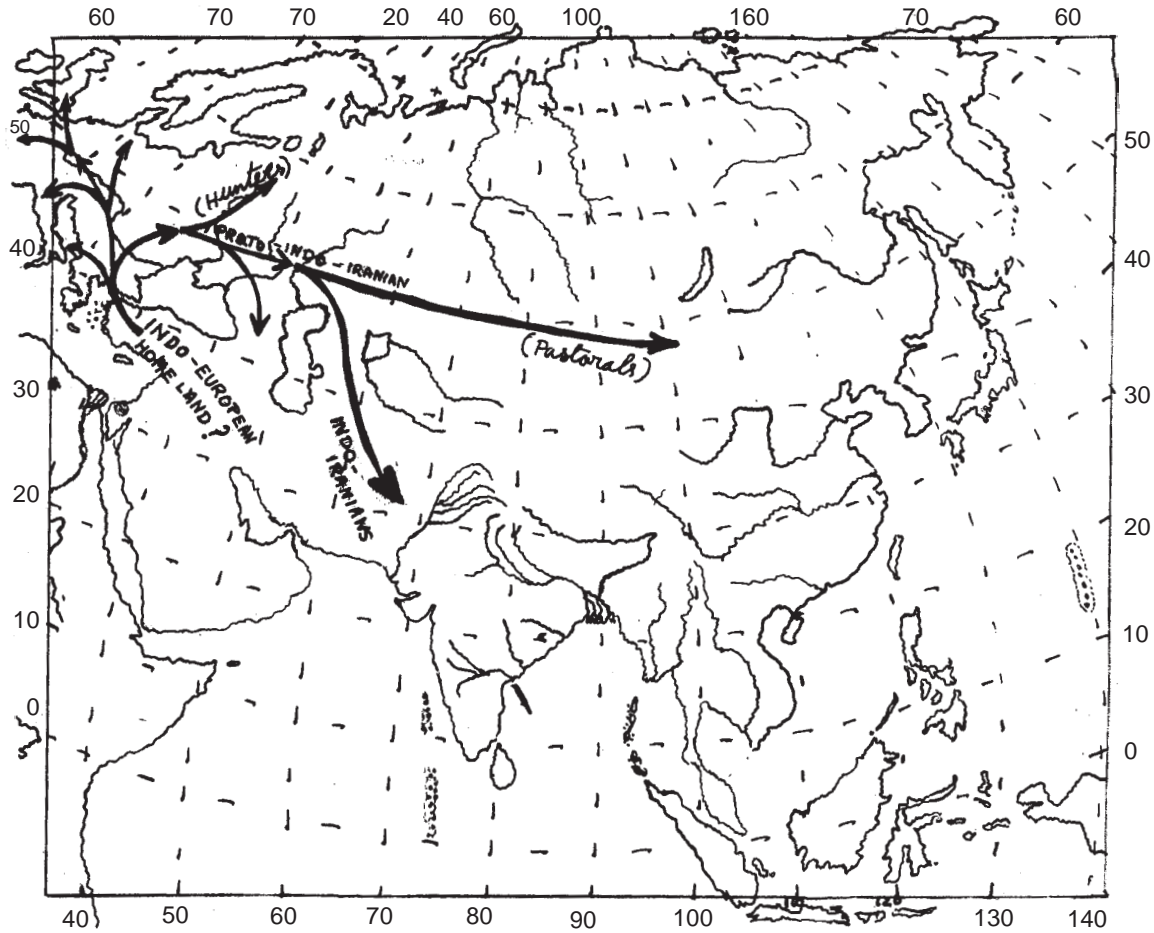
2.0. Wise men of the past were very much aware of the importance of plants and animals although they did not have any specific knowledge ecology so, they established traditions which when respected would automatically protect parts of their environment and thus ensure prosperity to their future generations. Following are a few such examples.

2.1. Ancient Egyptian Customs. In ancient Egypt animals played a very prominent role in the lives of its people. It is apparent from the paintings and etchings in the tombs of the Pharaohs. One animal—the jackal was given the status of God—“Anubis”. Anubis the jackal-god was the protector to them. Crocodile was another God—the God of Fertility. There were other gods as well. They were all protected.

2.2. Hindu customs—ancient and present. (a) **Cow worship.** The Aryans—predecessors of Hindus who moved into India from Bacteria and Northern Iran during early second millenium B.C. (Map - I.1), were hunters and herdsmen consuming both milk and meat of cows. During that time beef-eating was so much in vogue that a guest was particularly entertained by being treated with food prepared by sacrificing a young cow or calf. (Sanskrit was the language of the early Aryans. So in sanskrit literature there is a word ‘GOGHNA’ meaning a cow-killer. Thus a honoured guest was a ‘GOGHNA’. The word ‘GOGHNA’ was used by the famous sanskrit poet Kalidasa in his book ‘ABHIGYANA SAKUNTALAM’).

2.2.(a) Origin of Cow-worship amongst Hindus. But in the Gangetic valley cattle suffered from high humidity resulting in premature death. So the Aryan scholars aiming to protect the cattle attributed holiness to cows so that cows would no longer be used as beef. Thus the cow-worship or at least veneration for cows amongst many Hindus (who are mostly discendants of Aryans and the local tribes of India who gradually adopted Aryan Culture, is really socio ecological adaptatian to protect the cows of India from premature death and thus help their owners (The Continent of Circe by Nirad C. Chaudhuri, 1966, Jaico, Delhi).

2.2.(b) Bishnois of Rajasthan. In some villages of Rajasthan, India, there lives a sect of people called Bishnois; Bishnois neither kill nor allow anybody else to kill an animal—even wild ones, in their village or its vicinity. Wild animals move very freely in Bishnoi villages. Recently a very popular filmstar from Bombay went into a forest in Rajasthan, near a Bishnoi village and shot two ‘nilgais’ (*Boselapus tragocamelus*; Bovidae; ARTIODACTYLA). This enraged local people, Bishnois so much that they



Map I.1 Dispersal of Proto-Indo-Iranians from north of Caucasus Mountains to the Gates of Western India (4th - 1st. Millennium B.C.)

forced the police to take action against this film-star.

2.2.(c) Feeding ants by Jains. Jains a sect of Hindus who are not only strict vegetarians they even do not kill insects. Often, in the morning, they put sugar in front of the ant hills so that the ants can begin the day with a hearty breakfast!

2.2.(d) No-Fishing Day amongst Bengalee fishermen. During some specific days in June, fishermen of West Bengal (India), & Bangladesh would not cast their fishing nets in water so that fishes can breed uninterrupted and thus ensure abundance of fishes for the future.

2.2.(e) The monkey-god—'Hanuman'. According to 'Ramayana' the famous sanskrit epic, a langur (*Semnopithecus entellus*, Colibidae. PRIMATE) named 'Hanuman' and his friends helped Rama the hero of Ramayana to wage war against Ravana and finally defeat him. Since then

to Hindus the monkey god 'Hanuman' has become a most respected god and hence not killed. In many states of India, particularly Rajasthan there are numerous small temples dedicated to Hanuman. Also, wherever possible these temples are erected under a specific local acacia tree—*Prosopis spicigera*. These trees are very useful to the locals. The branches which are lopped before the winter, are used as fuel, and leaves as camel food. So along with this species of monkey this acacia tree also enjoys some amount of protection.

2.3. Noah's Arc and Christian Culture. The account of Noah's Arc in Bible is a very nice way of implanting the seeds for respect for animals and plants in the minds of people. Many excellent works, mostly by Christians, have now been initiated all over the world to protect wild life and Nature.

2.4. The Mongol Hunt and Ban on Hunting during Breeding Season of animals. During thirteenth century the great Venetian traveller Marco Polo travelled all over Asia, including China and India for nearly a quarter century. He stayed in the court of the of the famous Mongol ruler of China, Kublai Khan the descendent of Genghis Khan, for seventeen years and left a very picturesque description of the ways of the Khan's Court and the countries he travelled through as Khan's emissary. Mongols were very fond of hunting. The annual hunting expedition of Kublai Khan consisted of even 10,000 men and as many as 5000 hounds. (Travels of Marco Polo by Maria Bellonci; Tr. by Teresa Waugh 1984 pp. 83) A very vivid description of a Mongol hunt during Genghis Khan's reign is given by Harold Lamb in his book "Genghis Khan: "Emperor of All Men". (1927, 57). pp. 137-40. Nevertheless Mongols very well understood that unless the animals are allowed to breed uninterrupted during breeding season, their hunts would not last long. So the Great Kublai Khan decreed that no King or Nobleman throughout his empire can hunt hare, does, roebuck, stags or such like animals between the months of May to October as, this is their breeding season. Anybody violating this decree would be severely punished. So strictly this decree was observed by the subjects of Khan that even the animals understood this and hence during these months they would come near men without fear (Teresa Waugh 1984 vide supra p. 85). It is an irony of fate that after quarter century, when Marco Palo returned to venice and told people what he saw, nobody believed him. He ended his life behind bars.

2.5. Surely there were and are many more worthy traditions all over the world which helped to protect the environment amongst the erstwhile and present communities of the world. An anthology of such traditions throughout the world would verily form an worthwhile theme of a book.

3. RENAISSANCE AND ANTHROPOCENTRISM

3.1. In the ancient world there existed a reasonable balance between men and their living environment. But with renaissance all these changed.

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Renaissance had a dual effect on the course of human history. Men shook off the shackles of blind orthodoxy and took up reason and experiment as their guides. This soon led to an explosive growth of knowledge in all directions. Knowledge of Navigation, Mathematics, Astronomy, Physics, Chemistry, Natural History, Medicine and many other areas all grew very fast. Sadly though these people who did all these were, not only men of keen minds and indomitable courage but of insatiable greed as well. They not only crisscrossed the earth and discovered new countries (e.g. Americas, New Zealand and Australia) but soon found out which produce of Mother Nature—be it from any country—is economically most useful to them. Soon with the help of firearms and superior discipline in group-activity, these intrepid people mastered the Earth and started a ruthless exploitation of Nature. They tore open the Earth and began looting her bounty. Almost the entire earth surface was carved out and distributed amongst the European nations—the renaissance countries. Never before Earth was ravished so ruthlessly, so thoroughly and in such a short time. The trend is still on. Handful of Europeans including Russians, directly or indirectly, colonised the entire North America, South America, Australia and New Zealand. The combined area of these Europe-colonised countries would be 2.11 times of Europe including Russia and Europe minus Russia 15 times (Table I.1).

*Anthropocentric
attitude & its
consequence*

Table I.1.
**AREAS COLONISED BY EUROPEAN
COUNTRIES SINCE RENAISSANCE ***

<i>Continents</i>	<i>Countries</i>	<i>Areas (Sq. Km.)</i>	<i>Total Areas of Continents (Sq. Km.)</i>		
EUROPE	Chekoslovakia	78703	(1) Total of Europe including Russia is 19871290		
	France	547030			
	Germany	356910	(2) Europe minus Russia is 2796090		
	Italy	301230			
	Poland	312683			
	Russia	17075200			
	Spain	504750			
	Sweden	449964			
U.K.	244820				
NORTH AMERICA	Canada	9976140	21577781	Total of these European colonies is 41853710	
	Mexico	1972550			
	U.S.A.	9629091			
SOUTH AMERICA (Selected countries)	Argentina	2766890	12320399		Total of these European colonies is 41853710
	Brazil	8511065			
	Nicaragua	129494			
	Venezuela	912050			
AUSTRALIA NEW ZEALAND	Australia	7686850	7955530		
	New Zealand	268680			

*Summary by author from C.I.A. data—1997-98.

3.2. Along with this exploitation of Nature, the growth of knowledge of modern medicine gave a spurt in the growth of human population. So since renaissance, human population of the world has grown very fast. Between 5000 B.C. and 1000 A.D. the growth in human population was quite slow. But from about 1500 A.D. or so (soon after renaissance) the rise in human population became spectacular and fearful (Fig. I.1.). This explosive growth of human population however, is not due to any rise in human fertility (as is commonly believed) but mostly owing to drop in child mortality as a result of modern medical care.

3.3. Gradually the native populations of North America, South America, Australia & New Zealand were almost decimated or withered away and replaced by more energetic and demanding people of European stock (The Oregon Trail Francis Parkman; 1967. Bantam Books pp.298). Other European colonies in Asia and Africa could not however decimate the native populations but the control passed on to European hands. Only China and Japan in Asia remained free of European control. A glance at pages 244/5 of Harper Collins Atlas of World History edited by Geoffrey Barraclough (1998) will corroborate the above statement. Here is one sentence form the same. “The late 19th century saw a new imperial outburst of an intensely competitive kind. In the scramble for territory, resources, markets and outlets for capital investment, an immense part of the world’s total land area passed under European control” (p. 245) (Map I.2). North & South America have already passed under European hands (Map I.2).

3.4. Thus without perhaps conscious knowledge of the indigenes—native Americans, Africans, Asiatics and Australians, their lands became gignatic

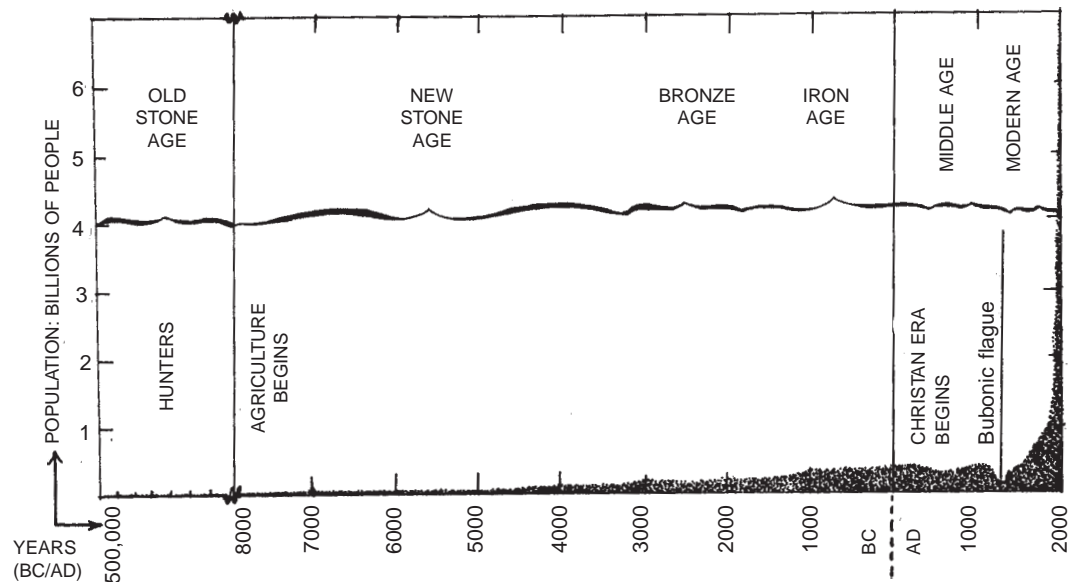
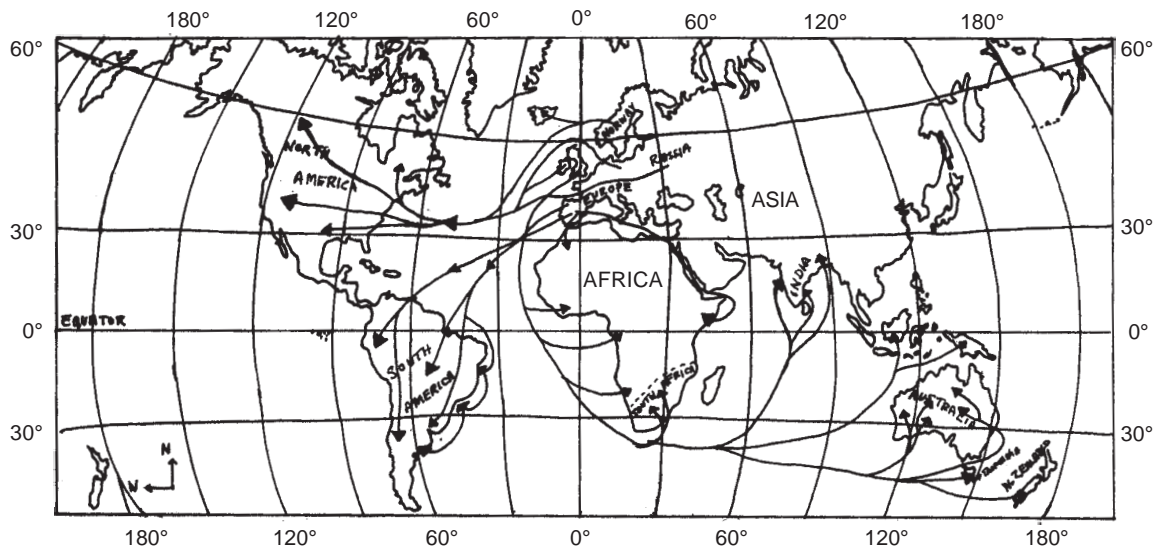


Figure I.1 Growth of human population in the past half a million years.



Map I.2 & 1.3 Growth of European Colonial Empires into different parts of the world (1535 – 1914)

hosepipes through which riches from these countries were sucked into Europe to provide the Europeans with unprecedented grandeur and comfort which is now termed as 'quality of life'. Save China, Japan and middle East there were perhaps no big country which could resist the canons and economic exploitation of Europe. So the inevitable happened. Gradually the natives of these colonies sank into a morass of poverty and ignorance. Both their wealth and population dropped and their cultures lost their vigour while the Europeans became richer and their populations rose very fast.

3.5. Before coming to the end of this topic we shall only cite two examples of exploitation of the same resource one pre-renaissance and another post-renaissance. According to the renowned Venetian traveller Marco Polo of 13th century, the island of Scotora in the mouth of Gulf of Aden was a great whaling centre. Large quantities of ambergis—a whale product was sold here. Whalers then used to kill sperm whales and other large whales by using tuna fish as baits and then harpooning these by tying ropes with the harpoons. This method of whaling for centuries however, did not endanger the species but within the last few hundred years of so, when the harpooners used explosive tipped harpoons and huge factory ships with their pod of whaling boats so that they can whale non stop for months while roaming all the seas including the antarctic and artic, the inevitable happened. The whales who ruled the seas for centuries became so scarce during the last century, that to-day whaling is strictly controlled by International Whaling Commission. Thanks to efforts of the Commission, the number of whales are now rising again. Hope the whales will live and not share the same fate as dodos and Tasmanian Tigers (*Felis dingo*. MARSUPIALIA), i.e., become extinct.

*Whaling:
pre-renaissance
and post-
renaissance*

3.6. There are many examples of accelerated eco-deterioration during 19th and 20th century including decimation of specific human populations. Those may not be relevant here. But one thing should also be admitted that 20th century also saw rebirth of man's interest in ecology and people started working for nature conservancy so that before it is too late all living beings of the world, other than human beings would have a place to live and breed in peace.

4. REBIRTH OF ECOLOGY & ITS MULTIDISCIPLINARY NATURE

4.1. Now let us come back to Ecology. Ecology although in spirit is as old as Egyptian culture, but is reborn in its modern garb after first World War when all the analytical tools of applied sciences were available to aid its pursuit. Ecology today is an applied science. It aims to unravel the complex relationships between animals and plants and each animal species and with each plant species and also the complex relationships which exist between each species and their non-living environments such as, soil water, light, heat and air etc. Hence Ecology has to draw upon various relatively pure sciences such as, morphology, taxonomy, behaviour, embryology, physiology, genetics, chemistry, physics, mathematics, geology, geography and meteorology etc. Thus a true ecologist does not hesitate to draw upon any branch of knowledge which suits his need—particularly physics and chemistry and statistics. With time and experience ecologists are increasingly drawing from other areas of science besides these (as above). So the tree of ecology has many roots and many branches (Fig. I.2).

5. AIM OF THIS BOOK

5.1. Despite its relevance in today's context the basic concept of ecology is still understood by only a few. The literature is full of technicalities and not easy to follow. Interestingly however, the basic principles of ecology can be presented to the general public without using technical jargon.

5.2. This small book is an humble attempt by the author to take the basic concepts of ecology to the common man. It is common man or woman who matter as, it is he and she alone who by their intelligent or unintelligent acts can make or mar their environment. Much of the future happiness of mankind is hinged upon how man uses his environment and habitat.

5.3. I have deliberately avoided technicalities lest these would limitise the size of the target population and thus the effectiveness of the book. Also my experience of teaching ecology in university has convinced me that the ecological principles can be understood without technical jargon. For interested readers however, information regarding technical literature is given in appropriate places.

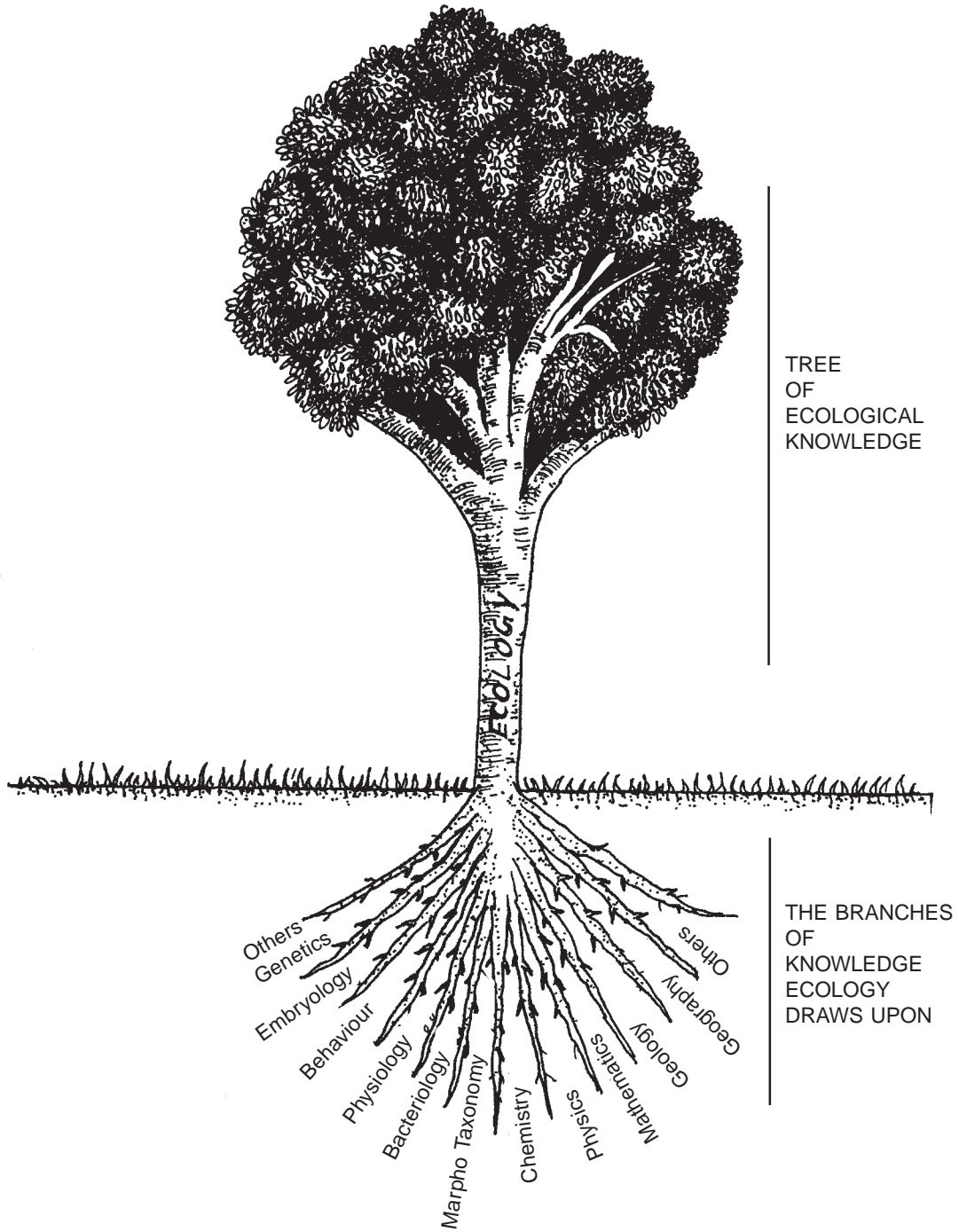


Figure I.2 Areas of Sciences which Ecology presently draws upon.

6. A BIRD'S EYE VIEW OF THIS BOOK

6.0. Efforts are made to explain step by step the basic principles of ecology and show our readers how these principles can be used for judicious use of the abundant resources of Nature for benefit of all and with detriment of none.

6.1. At the outset, a few words have been spent to trace the dawn of ecological consciousness amongst early human societies & also emergence of the formal word of "Ecology" amongst branches of sciences (Chapter I, INTRODUCTION : The Beginning).

6.2. Then it has been shown how, when a piece of "Nature" if left undisturbed, leads to a mutually-reactive but self-sustaining situation generally known as ecosystem. Thus a forest is an ecosystem, a lake is an ecosystem, a desert is an ecosystem and so on; (Chapter II, ECOSYSTEM : The Garden of Eden).

6.3. In the following chapter endeavour has been made to show how bountiful Mother Nature is and how her bounty and blessings can be managed so that there is enough for all including animals (Chapter III, PRODUCTIVITY : Mother's Bounty).

6.4. Here it has been shown how the energy from sun, which is the ultimate source of energy of our planet Earth, is trapped by green plants for synthesising biomolecules which in their turn power all the activities of living beings. In the final analysis energy from sun is the fountainhead of the entire human civilisation since its dawn (Chapter IV, BIOENERGETICS : Sun the ultimate Source of Energy in Earth).

6.5. Following these chapters we have taken up the elucidation of the methods which Nature adopts to ensure the continuity of the flow of life on earth and how her bounty, or in other words how the cycle of birth and death are really supportive of each other and leads to the establishment of an eternal cycle (Chapter V, BIO-GEO CYCLES OF CHEMICALS : The Eternal Cycle).

6.6. and 6.7. Our next two chapters will lead us gradually into the areas which show us what regulate the increase or decrease of a population in a place and how skilful tending of Nature is primal for survival and growth of all living beings. These will also show us how application of this knowledge can help us to provide for all plants, animals and human beings (Chapter VI, POPULATIONS : The Milling Millions & Chapter VII, COMMUNITIES : The Noah's Arc).

6.8. After these a brief presentation has been made of the specialities and beauties of the various parts of Earth (Chapter VIII, BIOMES : Nature in Her Splendour).

6.9. Near the end of this small book an outline has been drawn up of the various types of disturbances in ecosystems, most of which are caused

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by human activities. The various causative agents of such disturbances are broadly termed POLLUTANTS. These pollutants are gradually throttling our 'Garden of Eden' (Chapter IX, POLLUTION : Tortures to the Nature).

6.10. Finally before closing this book I have tried to put down to the best of my understanding of and in brief, what are our duties and obligations to Nature who nourishes all of us and how best we can discharge these duties and obligations in the light of our newly acquired perception of Ecology (Chapter X, PROBLEMS AND SOLUTIONS: Challenges and Rising to Them).