

SCIENCE AND TOMORROW

SCIENCE 909

CONTENTS

I. PEOPLE AND THEIR LAND	2
Ecology	4
Agriculture	9
Waste	14
Population	17
II. PEOPLE AND THEIR WORK ENVIRONMENT ...	21
Energy Sources	22
Industry	31
Transportation	33
Urbanization	35
III. PEOPLE AND THEIR NEW FRONTIERS	38
Outer Space	39
Inner Space	43
Self-Exploration	47

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ECOLOGY

Have you ever seen the smokestack of a large factory belching out fumes? Have you ever noticed the haze that hangs over a large metropolitan city? Have you ever seen an airplane spraying a field? If so, then you have seen man as he affects his environment. This relationship between man and his environment is the science of **ecology**.

Man's location in the biosphere. Man lives in the **biosphere**. The biosphere measures approximately ten miles. This area extends from the greatest depths of the oceans to thousands of feet above the surface of the earth. Man lives within this range.

The biosphere is divided into three parts: air, land, and water. The portion of the biosphere that makes up nearly 70 percent of the total air mass surrounding the earth is several miles high. This small portion of the earth's atmosphere is the **troposphere**. The troposphere contains the global and the local wind systems. It is composed mainly of nitrogen (78 percent), oxygen (21 percent), and argon (1 percent). The air that you are breathing right now is made up mostly of nitrogen and oxygen.

Winds carry such things as pollen, dust, and soil. In fact, even a ten-mile-per-hour wind can carry a dust particle nearly three thousand miles before the particle settles back to earth. In 1934 the famous dust bowl storms in the United States carried almost 700 million tons of topsoil out to sea.

Water in the biosphere comes from a cycle of evaporation and precipitation. Water that evaporates eventually returns in some form of precipitation (for example, rain, snow, or hail). Precipitation results from a condensation of water vapor.

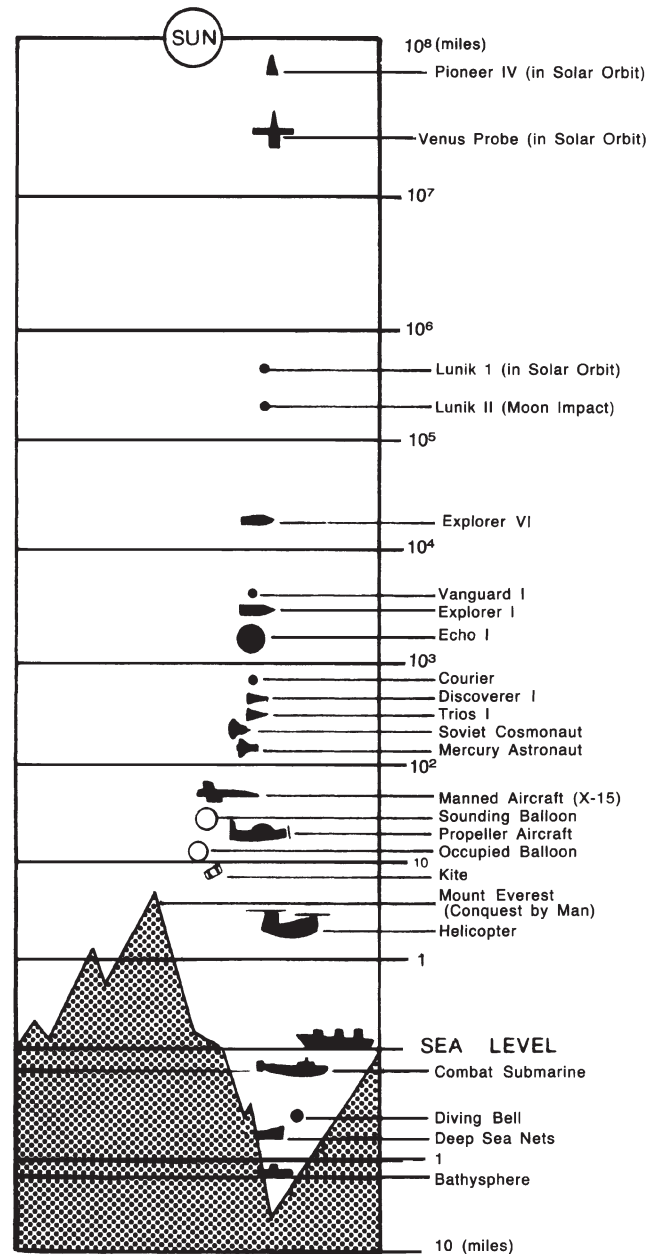


Figure 1: The Biosphere



Try this activity to discover how precipitation results from the condensation of water vapor.

These supplies are needed:

screw-top jar lid
paper toweling
plastic sandwich bag

bird seed, radish seed, or other small seeds
rubber band or wire tie
water



Follow these directions and answer the questions. Put a check in the box when each step is completed.

- 1. Cut several thicknesses of paper toweling to the size of the jar lid.
- 2. Place the paper toweling in the jar lid.
- 3. Drop enough water on the paper toweling to saturate it.
- 4. Sprinkle a small amount of the seed on the wet toweling.
- 5. Place the jar lid in a plastic sandwich bag and tie the bag with a rubber band or wire tie.
- 6. Store your "garden" in an area shaded from direct sunlight.
- 7. Daily observe your "garden" noting any change regarding water droplet formation or anything else significant.

1.1 What kind of change do you notice regarding water formation within the bag after two days? _____

1.2 Where does most of the water appear to be collecting? _____



Complete these activities.

1.3 List the three stages involved as water travels from earth to the atmosphere and back to earth again.

a. _____

b. _____

c. _____



Write true or false.

1.4 _____ Water that evaporates from the earth returns to the earth again in a usable form.

1.5 _____ Precipitation can take many forms.

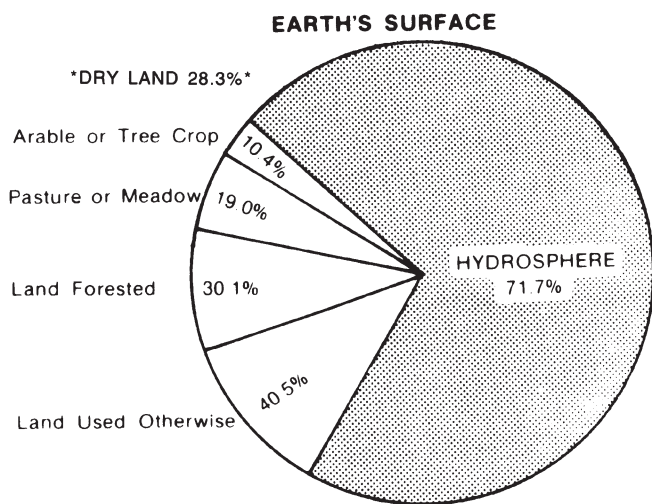
1.6 _____ Precipitation is the result of condensed water vapor.

Man lives primarily in the **terrestrial** portion of the biosphere. Because the earth has more water area than dry land area, man is limited in space for living and for agriculture. Man is able to use only 25 percent of earth's dry land. In this small area man lives, farms, and cares for large animal populations. The remainder of the dry land area lies in uninhabitable regions: deserts, jungles, icecaps, and mountain peaks.

Man can grow food on only a small portion of his land. Man is always looking for new ways and new places to grow his food. In the future

man hopes to develop new and better fertilizers. Someday we may see outer-space farming as well as inner-space farming or sea farming. Today, though, man must continue to use wisely his present farming lands. The land must be properly cared for and maintained. If not, it may become unproductive through neglect or abuse, and the limited area that man possesses for agriculture will be reduced even further.

The thin layer of topsoil is the life of farmland because it contains plant nutrients. In the past man has misused this vital topsoil. The result of



*The Percents Shown for Dry Land Are Based on 100%

Figure 2

this misuse has been a decreased agricultural production and a disfigured environment. This result occurred in the Oklahoma dust bowl storms of the 1930s.

The oceans of the world cover more than 70 percent of the earth's surface. In that space lives four-fifths of all the animal life on earth, as well as most of the earth's vegetation. Inner space calls out to man for exploration. Barely 1 percent of all sea organisms have been studied. Much work still remains to be accomplished by the scientists of tomorrow.

The oceans of the world hold many possible uses for man. Many nations depend largely upon a seafood diet. In the future, man may be forced to look to the oceans for his supply of

food for several reasons. Ocean animals grow faster than land animals. If man were able to grow more ocean crops he would have fewer weather problems. The oceans offer rich mineral resources that man has already begun to extract. The water of the oceans, after being **desalinated**, could also provide man's irrigation needs in farming. In fact, ocean water then could provide man with one of his basic needs of life—fresh water. In the past, desalination has seemed impractical to man. Today this process is possible by combining nuclear-power and fresh-water generating plants. This method already produces over 50 million gallons of water per day.

In spite of their great potential, our oceans are being contaminated by man's dumping of sewage and industrial wastes. While man has been searching the ocean for mineral resources, accidents have occurred. Sometimes spills occur from oil-drilling platforms and transporting sea tankers. Certain ocean species have almost become extinct because of man's excessive hunting and fishing of them.

The oceans, if used wisely, could provide additional space in man's environment as well as important answers for many of the problems he faces. The oceans could yield an abundant supply of food, mineral resources, and water for agricultural needs. They also can provide recreation possibilities for man's enjoyment. We must remember that with benefits come responsibilities. God expects man to do all that is humanly possible to care for his environment, whether it be in the air, sea, or on the land.



Look at Figure 2 and answer these questions.

- 1.7 What percentage of the earth's surface is water? _____
- 1.8 How much of earth's dry land is pasture or meadow? _____
- 1.9 How much of earth's land is presently forests? _____



Write true or false.

- 1.10 _____ Man can live on most of the earth's surface.
- 1.11 _____ The combined percentages of forests and meadowland nearly equal that of land used otherwise.
- 1.12 _____ Almost three-fourths of the earth's surface is covered with water.

 **Complete these sentences.**

- 1.13 The oceans of the world cover more than _____ percent of the earth's surface.
- 1.14 The fraction of all sea organisms studied is less than _____ percent.
- 1.15 Man has already begun to extract rich _____ resources from the oceans' depths.
- 1.16 To be used for agricultural purposes, seawater must first be _____.
- 1.17 Excessive fishing and hunting have resulted in the near _____ of certain ocean species.

 **Answer this question.**

- Δ1.18 What difficulties do you think might arise from a major oil spill just off a coastline? _____

Man's use and abuse of the biosphere. Man must live in the biosphere and use the natural resources that surround him. Too often man has been guilty of abusing the resources that supply his needs. Sometimes the abuse is through neglect or ignorance. Sometimes the abuse is intentional. Air pollution is an example of both intentional and thoughtless abuse.

Air pollution affects almost everything in our environment. It affects the clothes we wear, the buildings we live in, as well as our own bodies. Damage from air pollution is estimated to cost over \$1 billion annually. Smog in the United States alone is blamed for a large amount of damage to vegetation. When the smog is combined with other fumes and pollutants, the problem is greatly increased. Every year livestock from our farms are diagnosed as suffering from the effects of air pollution. Air pollution slows plant growth, withers plant leaves, and causes bleaching (loss of green color). To avoid an agriculture disaster some **horticulturists** believe that scientific help must be provided to protect plants from the problem of air pollution.

Pesticides have been used greatly by man for the benefit of all, but they have also caused some problems. The chemicals used to protect our crops have also contaminated our soil, lakes, and rivers. A recent example of this problem occurred in the Gulf of Mexico when

nearly 10 million fish were killed in the area of the Mississippi River Basin. The cause was traced to a pesticide runoff. Crops upstream had been sprayed with a powerful pesticide to protect them from insects. The rains had flushed the chemicals into the streams and rivers that flow toward the Gulf of Mexico. These chemicals then collected in the area where the Mississippi River flows into the Gulf. The concentration of the chemicals was so high that the fish in that area were killed.

Often man's use of the environment has become abuse, and the seas also suffer from the effects of pollution. Wastes from our factories and homes flow daily into our seas, rivers, and lakes. Man has attempted to treat wastes chemically before allowing them to enter the world's water supplies. Such treatment is often not sufficient to protect the waters from pollution. In fact, 10 to 40 percent of the polluting materials remains in the sewage and is not filtered out. The unfiltered materials are left to accumulate in the world's water supplies. Sewage has an unpleasant effect upon our waters and upon the creatures and plants that live in an aquatic environment. The problem caused by sewage, as serious as it is, cannot outrank that of industry. Industry adds three times more waste than sewage adds to the world's water supplies.

Several serious problems arise from water pollution. Bacteria are encouraged to grow and to produce an increase of disease. Chemicals collect in the water and poison aquatic life. **Algae** plants are stimulated to grow by **organic pollutants**. This growth results in the formation of slime. It also robs the water of its oxygen content because the overabundance of algae plants die and decompose.

The cost of treating all wastes effectively before they reach the oceans is very high. Water pollution is a complex problem that will require much thought and effort. We must work to develop a more effective means of reducing water pollution before the problem becomes uncontrollable.



Try this investigation to discover some of the causes of water pollution.



These supplies are needed:

jar with a lid
water

small amount of soil
timepiece



Follow these directions and answer the questions. Put a check in the box when each step is completed.

- 1. Fill the jar three-fourths full with water.
- 2. Pour a small amount of soil into the water.
- 3. Tighten the lid on the jar and shake the contents vigorously.
- 4. Place the jar on a table, allowing the contents to settle.
- 5. Record your observations of the water and of the dirt.

1.19 What happened to the soil after shaking? _____

1.20 Why did all the soil not settle to the bottom immediately? _____

Δ1.21 How long did all the soil take to settle to the bottom? _____

1.22 How did your shaking the jar affect the environment within the jar? _____



Write true or false.

1.23 _____ The degree of cloudiness of the water would be affected by the amounts of water and soil in the jar.

1.24 _____ If more soil were added to the water, more time would be required for it to settle out.