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Can Humans Solve All Global Environmental Problems Simultaneously?

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Jun Kobayashi*[1], Keiichi Ikeda[2]

[1]Faculty of Nutrition, University of Kochi, 2751-1 Kochi, Kochi 781-8515, Japan;

[2]Faculty of Pharmaceutical Sciences, Hokuriku University, 3 Ho, Kanagawa-machi, Kanazawa, Ishikawa 920-1181, Japan.

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ABSTRACT

Global environmental problems are a type of environmental problem whose implications are widespread and global. Although in each of the problems potential solutions are usually present or can be determined, these often have implications other than those intended, possibly causing problems. This study deals primarily with five environmental problems: global warming, acid rain, desertification, marine pollution, and wildlife species reduction. The relationship (whether problems occur in a chain) between these problems is also indicated. Additionally, we consider other issues such as salt damage, food problems, and alien species invasion, determining whether their solutions may exacerbate other environmental problems or cause new ones. It is concluded that the simultaneous solution to all or many global environmental problems is difficult.

INTRODUCTION

Environmental problems are a general term for problems caused by changes in the environment resulting from human activities. These problems are expanding and becoming more severe because nature cannot cleanly self-repair environmental changes caused primarily by the increasing influence of human activities[1]. A global environmental problem is a type of environmental problem with a wide range of sources and damages globally[2]. The spread of these problems across national borders is also an obstacle to their solution. Even if environmental protection legislation is promoted in one country, environmental damage may occur due to environmental destruction in another. Therefore, global environmental problems require measures within an international framework.

Possible solutions for these problems exist, including those that cannot be implemented immediately and those whose feasibility remains unknown[2,3]. Even if one problem can be solved using such methods, it may aggravate other problems or cause new ones[3,4]. In this paper, we discuss typical environmental problems and describe their causes, interrelationships, and possible solutions. Also, we provide an example of one being resolved while leading to more serious situations.

Examples and solutions of typical global environmental problems

Here, we outline five typical problems: global warming, acid rain, desertification, marine pollution, and reduction of wildlife species[5-7]. Table 1 provides a summary of the results. As its name suggests, global is a phenomenon in which the average temperature of the atmosphere on the Earth's surface rises. With human production activities, the amount of carbon dioxide and methane in the atmosphere is increasing yearly, hindering heat dissipation and raising the average temperature of the Earth. These gases, which absorb infrared rays emitted from the Earth and warm its surface, are called greenhouse gases. There is concern that polar ice will melt, sea levels will rise, and that areas with low altitudes will be submerged over a wide area due to global warming. Besides, there are concerns about the impact on food production due to the disruption of water resources and plant ecosystems and the damage to human health due to the expansion of the distribution area of infectious diseases transmitted by animals such as malaria. Coal and oil consumption increased exhaust gas in automobiles, and deforestation is the primary cause of increased carbon dioxide in the atmosphere. However, carbon dioxide emission regulation is difficult to implement because it

directly affects industrial activities. Although each country continues to devise emission regulation efforts, reduction target values are not easily achieved. In developed countries, various efforts are recommended in parallel with mitigation measures, including technological improvement for energy saving, energy supply efficiency improvement, and the utilization of renewable energy such as solar power and wind power.

Second, acid rain, as the name implies, is the fall of acidic water. Acid rain occurs when sulfur dioxide gas and nitrogen oxides, which are air pollutants, drift in the atmosphere for a long time and then oxidize to become sulfuric acid and nitric acid, falling with the rain. It has been reported that this rain causes pain in the eyes and throat, acidifies lakes and river waters, reduces fish populations, and causes the large-scale withering of forests, resulting in damage to ecosystems. There are also concerns about damage to archeological sites or world-class buildings made of acid-soluble marble. Wind-carrying polluted air has caused damage to other countries thousands of kilometers away from its source and has become an international problem.

Thirdly, marine pollution is sea pollution. The ocean occupies 3/4 of the Earth's total surface area and has greater purification power (decomposing and regenerating substances) than rivers and lakes. In recent years, the detection of heavy metals and persistent chemical substances and the expansion of oily sea areas have become problematic. It is difficult to improve the quality of marine water because domestic wastewater and industrial wastewater are discharged from various countries to the sea area and because air pollutants fall with the rain. International treaties regulate the dumping of land-based waste from ships to the sea and the discharge of oil and harmful liquid substances from ships; the structure, maintenance, and bottom paint of ships are also strictly regulated. Despite these regulations, the dumping of plastic scraps and construction waste can contaminate coastal fishing grounds, cause large tankers to become stranded, and cause accidents in offshore oil fields. This causes significant damage to the ecology of fish and mammals in the sea, as well as seabirds.

The fourth is the decline in wildlife species. With the destruction of tropical forests and industrial progress in developing countries, the decline of wildlife species has become increasingly serious. When one type of plant becomes extinct in a tropical forest, the ecosystem becomes unbalanced, and dozens of animal species can eventually become extinct. Due to human activities, animals and plants move to areas where they are not naturally distributed, increasing the opportunities for them to be eliminated by alien species (invading

organisms). Under the Convention on the Control and Protection of Endangered Wild Fauna and Flora (Washington Convention, established in 1973) and the Convention on Biological Diversity (Convention on Biological Diversity, established in 1993), international measures are underway. However, thousands of species of flora and fauna are still endangered.

The fifth aspect is desertification. In forest areas, thick branches and leaves soften strong winds and heavy rains to prevent soil erosion. Rain accumulated in the undergrowth and fallen leaves soak into the soil and is stored, playing a significant role in the water cycle. In the second half of the 20th century, forests were burned in developing countries to convert their land to farms and ranches. Tropical forests have also been lost as significant amounts of timber is cut down as a raw material for houses, furniture, and paper. Due to the rapid disappearance of such forest resources, landslides occur during the rainy season, and water holding capacities decline, resulting in floods downstream, while the land is dry and desertification progresses upstream. Desertification is a particular problem in the steppe areas of Asia and Africa (grassland areas in semi-arid climates). Based on the United Nations Convention to Combat Desertification (effective in 1996), assistance is being provided to each country to mitigate the effects of drought.

Problem interrelationship

Fig. 1 shows a correlation diagram indicating how the five global environmental problems, explained in the previous section, can be exacerbated by human activities. However, they have a cause-effect (upstream-downstream or pre-post) relationship, indicating a chain in which when one problem worsens, others do as well. Taking global warming as an example, its aggravation is one of the principal causes of desertification[8]. Also, accelerated warming reduces or moves the area where some species can live, resulting in a decrease in their population or extinction.

Acid rain causes minerals in the soil to flow out, aiding the desertification progress where plants cannot grow. Also, acid rain kills plants, leading to a decrease in plant species and herbivore food shortages, causing a decrease in species. Moreover, acid rain falls directly onto the sea and moves desert minerals to the ocean, causing marine pollution. The ecosystem balance is then lost due to changes in the seawater composition, causing microorganisms such as plankton to overgrow and resulting in the death of larger fish due to lack of oxygen. As a result, fish spoilage contaminates seawater further with organic matter.

If volatile acidic substances are contained in seawater pollutants, acid rain may be caused by marine pollution.

We have already shown that global warming, acid rain, and marine pollution are related. However, desertification may also cause some organisms' ecosystems to become uninhabitable. If we consider that the existence of plants can stop desertification, the decline in wildlife species will likely promote desertification.

Creation of new environmental problems

Global environmental problems range widely in topic and subject however, if we consider other problems in addition to the five problems mentioned so far, we can take a different perspective to find new solutions. For example, if one wants to suppress the generation of methane gas, a causative substance of global warming, it is better to landfill swamps, which is another source of this gas. However, this implies the destruction of nature by humans[3]. Here, we will consider the problems of salt damage, food problems, and the invasion of alien species in addition to the above problems[7]. Salt damage is a situation in which the growth of agricultural products is hindered by the high concentration of minerals in a field. In the natural world, sea-salt particles are transported to land by the wind. Considering their relevance to the problems explained thus far, the temperature rises due to global warming raise the salinity of water in the environment and living organisms. As a result of salt damage, crop yields may be affected, leading to a reduction in wildlife. On the other hand, adding salt to soil is thought to be a way to prevent the spread of desertification damage.

Food problems are affected by global warming, the depletion of wildlife species (mainly plants), acid rain, and marine pollution (mainly fish and shellfish). Overfishing of food organisms (especially marine organisms) may contribute to the reduction of wildlife species. The invasion of alien species may also be due to migration to regions with suitable growth climates as a result of climate change, including global warming. If they are wild species, they may be captured or slaughtered to reduce alien species. Considering the whole Earth, there is an aspect of promoting the decrease of species to prevent species invasion and its consequences.

CONCLUSION

If the deterioration of the environment is caused by human behavior, humans must solve this problem. However, if it occurs naturally, there is no need to stop it, even if it results in human disadvantage[3]. However, human behavior exacerbates global environmental problems. Notwithstanding, cases exist where the actions are taken to solve the problem become problematic.

In this paper, we present the outline and causes of environmental problems, including their mutual relationships. We show that one problem can cause other problems and that the solution of one problem can lead to the exacerbation of other problems. Unfortunately, even if we solve environmental problems through human measures, it is challenging to consider all the effects, and new problems will likely arise. In many cases, the solution only produces human benefits. In other words, it is difficult to solve all problems simultaneously. Therefore, even if humans think carefully and take sufficient measures, it may be better to avoid those that have an immediate effect and have a strong influence. This provides an opportunity to review the methods in question while verifying the effects of these measures. It is necessary to stop the progress, observe the situation, and consider whether to make changes instead of perpetuating measures once they are started. Traditionally, environmental assessments (survey and evaluation of the maintenance of the natural environment before development) have been carried out. Their content is currently in line with the idea of environmental management or environmental auditing, which implies continuously monitoring the natural environment centered on the industrial world[5]. This may lead to keeping the Earth healthy for the future and maybe a bold opinion, but the idea that humans should disappear to solve such environmental problems also exists. Even if humans do what they want, the consideration of other living organisms and the environment may be biased. Many humans consider preserving the natural environment, albeit in a way that leaves or expands it in a convenient way for humans, not accepting nature as it is. Unfortunately, humans may have forgotten that the Earth's environment is finite and fragile[2].

In Japan, there is a natural environment called Satoyama (the outskirts of the country) that is not left in the wild but implies the coexistence of humans and nature, such as the fields on mountain slopes and trees growing on paved roadsides[3)]. It is an artificial nature created by humans for convenience. As has been long said, human beings are just one kind of living organism on Earth. It may be necessary to consider the perspective of other living organisms

and make efforts to protect the environment even if it is inconvenient for humans, rather than thinking that everything will be used or remade for the convenience of human beings.

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Table 1 Examples and overview of global environmental problems

Name	Overview and ancillary matters	Cause	Solution	Problem
Global warming	The world's average temperature rises, resulting in the spread of endemic diseases in the tropics and rising sea levels due to the melting of polar ice.	Increased concentration of greenhouse gases (carbon dioxide, methane, etc.) in the air.	Directly reducing greenhouse gases; The main focus is on reducing carbon dioxide emissions from burning things.	Manufacturing goods is indispensable for economic development and industrial expansion, involving the emissions of carbon dioxide. If we the emission of methane gas, we will suppress the growth of microorganisms under anaerobic conditions, leading to environmental destruction, such as the inability to ferment in compost production and waste disposal and the elimination of lakes and marshes. Alternative chlorofluorocarbons currently used in place of chlorofluorocarbons have a greenhouse effect.

Acid rain (snow, fog)	The fall or occurrence of acidified rain (snow or fog).	Sulfuric acid and nitric acid are generated when SOx and NOx dissolve in water, such as when clouds and emissions in the atmosphere react.	To suppress the generation of SOx and NOx, it is conceivable to burn a compound containing sulfur or nitrogen and combine it with oxygen, or to decompose the produced compound with a catalyst device.	SOx and NOx are substances easily generated by the combustion of fossil fuels, and not generating them leads to difficulty in expanding various global industries. Catalytic technology is costly to use. Suppressing the generation of NOx is difficult as long as there is nitrogen in the air.
Marine pollution	Seawater is polluted	Direct human origin includes dumping of garbage into the ocean. In addition, as a result of soil erosion, substances that were on land may be washed away into rivers and the sea.	Controlling ocean dumping is the most effective solution. It can also suppress the production of plastic products. Regarding the inflow of substances from the land, acid rain causes metal corrosion and the outflow of nutrients	Garbage cannot be completely eliminated and may cross boundaries due to ocean currents. As a result of marine pollution, it threatens fish and seabirds' habitats.

			such as phosphorus and potassium in fields.	
Wildlife species decline	Decrease in wildlife populations and species	If you cannot live in the same area due to global warming or desertification, or if you are forced to live in the same area due to development, ovehunting for stuffed animals and pets occurs.	Maintaining the current state of the global environment (keeping the current state of global warming, acid rain, marine pollution, ozone layer depletion, desertification, *etc.*), preventing overfishing by treaties, and not develop unnecessarily based on environmental assessments.	Some animals and plants adapt to changes in the environment, and if the current environment is to be changed back to previous states, that will also be a burden on wildlife, potentially causing their decrease. Assessments are not always based solely on scientific knowledge, and development may proceed due to interests. In particular, animals may be brought in and sold by smuggling.
Desertification	Desertification of green spaces	Moisture may evaporate as a result of the temperature rising due to global	Plants may increase due to tree planting, *etc.* Moisturizers may be	As returning the desert to greenery can be very difficult, measures are often taken to prevent further expansion of

		warming. As a result of acid rain or similar phenomena, the water-moisturizing ability of the soil may be lost, and the soil may dry out. It is also thought that human progress may reduce the number of plants being planted.	artificially mixed to increase the moisturizing ability of the soil.	deserted areas. Some creatures settle in the desert, therefore, changing desert areas affects the growth of the creatures that live there.

The underline shows where it is possible related to other problems.

Based on the contents of references 5–7).

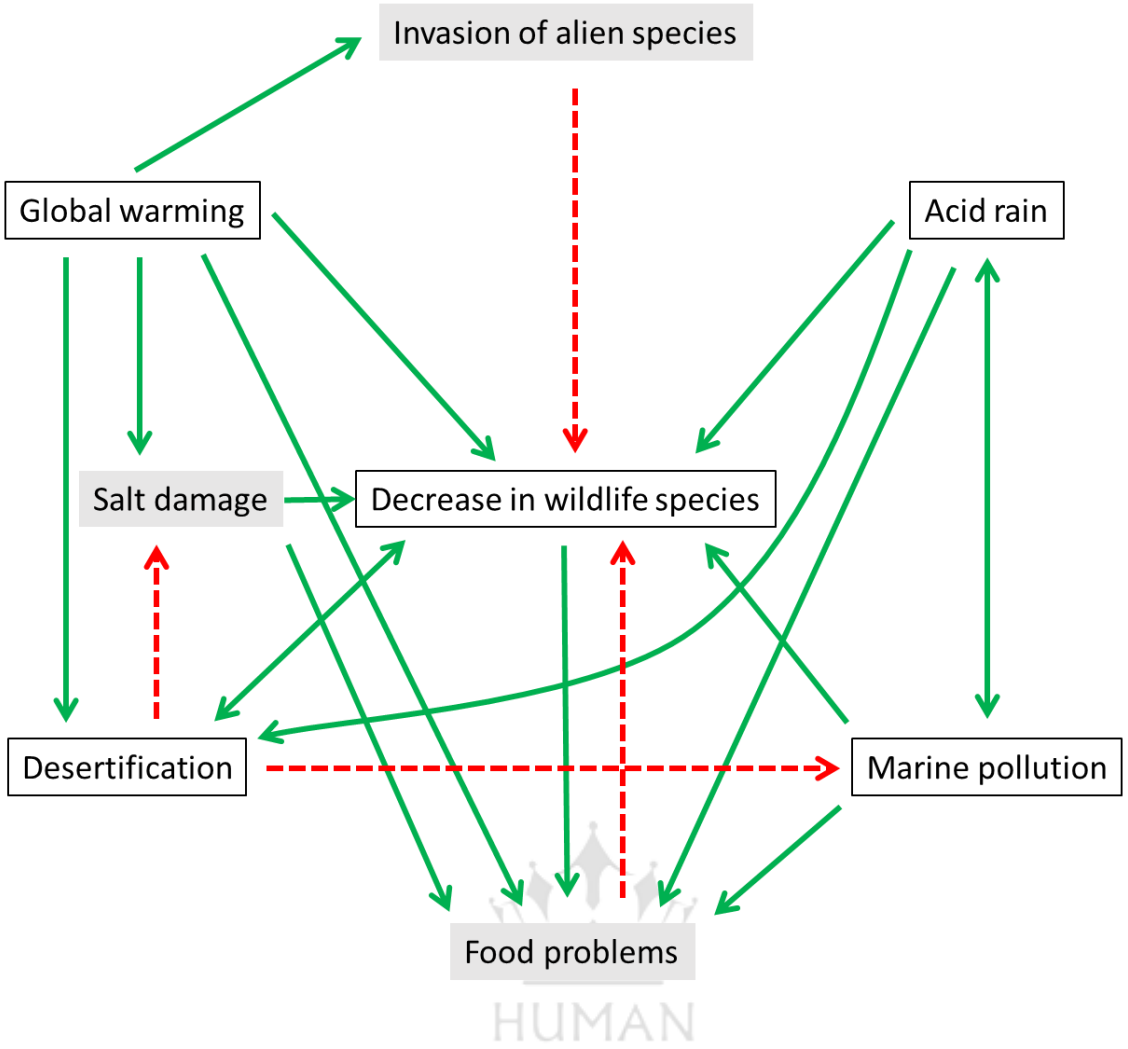

Fig. 1 Interrelationship of global environmental problems

The arrow indicates the (cause) → (effect) relationship.

The green solid arrow indicates that it occurs in a chain, and the red dotted arrow indicates that preventive measures cause later content.

Double-headed arrows indicate that both can be both cause and effect.

The figure is not constructed with particular consideration given to the positional relationship, such as up, down, left, or right, and the distance between items.