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Mass Communication Campaigns for Environmental Education in Developing Countries: Honduras Case Study

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ABSTRACT

The critical ecological situation we find in the developing world today can be addressed by a two-part program which protects resources now through preserves and in the future through education.

This thesis reviews some basic principles and theories which apply to the successful execution of media campaigns and then offers a proposal for a comprehensive environmental education campaign for developing countries. The components of this proposal were developed by the author over a three-year period in Honduras, Central America. The lessons learned and some of the materials developed during this time were used for this thesis in ten randomly selected schools in and around Tegucigalpa, the capitol city of Honduras. Two experiments were done over a one year period to evaluate the effects that combining media and formal education have on attitudes and knowledge about environmental topics. The schools used were located in urban, semi-urban, and rural areas.

The two experiments performed for this thesis support as a major finding the concept that although general media use has no effect on attitudes and knowledge related to environmental topics, a media program coordinated with formal education shows potential for effective environmental education in developing countries.

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I Introduction

Environmental problems in the Third World are nearly as numerous as they are in the United States. Solutions to them are just as varied. They run from high-tech fixes to low-tech simplicity, from political reform to supply and demand economics. However, there is one approach to the problem that is seldom discussed, and that is environmental education. It is not presented here as the ultimate solution, but rather as a necessary component of any program which hopes to improve the environmental condition and thereby the quality of life in the Third World. Also, the term is not restricted to the formal sense of education in the classroom, but includes media campaigns in support of education as well as programs to reach those individuals who have not been fortunate enough to receive a formal education. A coordinated education campaign is the only way to reach all the decision makers of developing countries. Whether those decisions are made through Congress for the country or at the dining table for a single plot of land, the decision makers need to have an understanding of how they may be affecting the environment. Population has grown to the point where environments are subtley changed by individual actions whose cumulative effect brings suffering to civilization.

The education campaigns employed by this thesis were conducted in cooperation with the Ministry of Education in

Honduras, Central America. The review of environmental problems, however, is not limited to specific problems in Honduras. The analysis accurately portrays the character of Honduran environmental problems while showing that these same problems are known to countries within the region and also on other continents. The scope of the analysis is limited to the basic organic resources on which all economies and civilizations ultimately depend: soils and forests. With the exception of population growth, which magnifies all environmental degradation, no other resources are affected by so many individuals, so ignored in national plans, and so important to the continuance of civilization.

II The Problems of Environmental Mining

The Environment and Civilization

When we think of modern civilization, it is often the tendency to speak in economic terms and to look for economic answers to problems. Most economies are based on oil, a traded commodity, and planners at all levels often consider the oil market when drawing up future management or development plans (World Watch Institute, 1984). Oil, however, is only the obvious economic resource. Little concern is given to our basic resources which have traditionally been considered renewable. These resources, soils and forests, support our agriculture, clean our water, purify our air, and supply us with products that sustain us and, hence, civilization. But as population increases and world demand for food increases, most countries are moving from farming their soils to mining them. As Lester R. Brown has noted, "As the demand for products of the basic biological systems has exceeded their sustainable yield, the productive resource bases themselves are being consumed. In economic terms the world is beginning to consume its capital along with the interest" (World Watch Institute, 1984, p. 14).

Demand out pacing the renewability of a resource is not a new phenomenon. In recent history, we can examine the collapse of the Peruvian fisheries in the early 1970s. After a study undertaken by the United Nations Food and

Agriculture Organization, which established the sustainable yield of these fisheries at 9.5 million tons, the Peruvian government permitted a harvest of almost 13 million tons. The fisheries soon collapsed to a yield of 3 million tons per year where they remain today (World Watch Institute, 1984). Closer to home, we have the abandoned cannery row in Monterey which stands as a monument to the collapse of the California fisheries. In the early 1900s we had the thousands of misplaced refugees who fled the dust bowl in America's heartland. Each of these examples represent a single resource and a limited area of impact and, as a civilization, we survived them. But, what is the impact of environmental mining - exploitation of a renewable resource beyond its replenishment level - and what are the consequences when it touches all facets of a civilization?

The downfalls of the Greek and Roman empires may help to answer these questions. Both civilizations experienced similar environmental problems so here we will refer to them jointly. The Northern Mediterranean civilizations are remembered in part for their extensive aqueduct systems which carried water to both fields and towns. Their irrigation systems supported extensive agriculture which cleared the forest from the valleys. In addition, farmers maintained grazing animals which have been identified as one of the principal causes of deforestation in Greece and Rome (Hughes & Thirgood, 1982). It's not that grazing actually destroys forests. What it does is block forest

regeneration, maintaining the damage of forest clearing previously caused by man. Another cause of deforestation was the mining of precious metals. The operation of these mining centers could require as much as a million acres of forest for support timbers in tunnels and fuel wood for smelting. The resulting deforestation is still seen today in some of the most barren areas of the Northern Mediterranean (Hughes & Thirgood, 1982).

The economic gains from intensive agriculture and mining fueled an urban expansion that replaced more forests with roads and urban sprawl. But even as forests were converted to alternative uses, the people continued to depend on them to support their lifestyles. Not only did the trees serve as a commodity by supplying lumber, firewood, and charcoal, they also provided the raw materials for many products. Examples of these are dyes from bark, flowers, and forest insects; resins for varnish and preservatives; spices and drugs from trees and shrubs; food items; and raw materials for military weapons (Hughes & Thirgood, 1982). For the Greeks and Romans, wood represented energy; then, as now, energy represented power. So important in fact was wood for energy to both cultures that they used the same words for it and matter: in Greek Hyle and in Latin Materia (Hughes & Thirgood, 1982).

Although forests were important to the Greeks and Romans, for lack of knowledge and management, they both

started down the ecological slide of deforestation, soil erosion, and agricultural decline (Osborn, 1953). As resources declined, outlying forested areas were made military targets to maintain the supply of much needed forest related products (Hughes & Thirgood, 1982). As their empires expanded, their environmental practices remained the same and soils once protected by forests were now left exposed to extreme erosion. High sediment loads forced streams from their banks over the lowlands and coastal areas where they deposited silt scoured from fields and deforested hillsides. Without the forests to act as biological sponges to moderate stream flow and hold the soil, the ecological base of ancient civilization slowly slipped away. But not without notice, as Plato observed, "What now remains compared with what then existed is like the skeleton of a sick man, all the fat and soft earth having wasted away and only the bare framework of the land being left" (Hughes & Thirgood, 1982, p. 72).

Evidence seems to indicate that the Northern Mediterranean civilizations were not alone in the practice of environmental mining which, if not the principal reason, was at least a major factor leading to their downfall. The Mayan culture of Central America had also developed extensive agriculture, a system of commerce, and an advanced civilization. It also suffered from environmental mismanagement. By A.D. 250 the mounting pressures on croplands and deforestation led to the loss of topsoil and

a gradual decline in productivity (Brown, 1982). Structures from this period show signs of hasty construction with a loss in detail and order and the mixing of stones taken from abandoned projects. This may indicate the need to keep residents occupied in work in order to prevent them from thinking about their hunger caused by agricultural decline. At a cultural, agricultural, and architectural peak, the Mayan civilization suddenly collapsed. Within only a few generations, the population fell to less than one-tenth of what it had been. The areas around Mayan ruins show signs of once lush forests, but in many cases the forests themselves had lost their vigor.

Other examples of civilizations which may have fallen victim to environmental degradation are found both in Mesopotamia, which was once the fertile crescent but now makes up the arid regions of Iraq and Iran, and Lebanon, where once plentiful cedars have been replaced by relatively treeless landscapes. The fact that ruins of ancient civilizations are surrounded by deforested and eroded landscapes does not appear to be merely a coincidence (Hughes & Thirgood, 1982). These civilizations found it impossible to stop the ecological slide that started in deforestation, erosion, and agricultural decline and ended in crop failures, famine, and water-borne diseases, and finally population decline.

The situation today is aggravated by an average world population growth of 2% and, for many Third World countries, a growth rate of more than 3%. Continued growth at this rate would double the population in some of the world's poorest countries in 20-25 years (Brown, 1983). If environmental stresses undermined earlier civilizations in which population doubling times were measured in centuries, what will be their impact now that population doubling time is measured in decades (Brown, 1982)? We continue to mine the environment today, but on a global level. Resource degradation in the Third World countries increases their dependence on developed countries and increases their foreign debt. At the same time, the loss of marketable resources decreases their ability to pay. With banks overextended in the Third World and developing countries less able to pay, industrial countries may go down with the Third World unless joint responsibility and action are taken. The problems we face in the future are ecological in nature. As Osborn noted, "While the great edifice of civilization has been built upon the development and use of a vast number of natural resources that are inanimate and nonreplenishable . . . the organic resources obtained from the soils, the forests and from the sea are those that are of essential importance" (1953, p. 6).

Therefore, we must learn to understand our relationship not only to individual resources but also to the cultural and biological environments in which they

exist. We must begin to see civilization not as being based on those environmental systems but as an integral part of them, because the failure of the environment ultimately means the failure of civilization. To aid in our understanding, we will examine some of the cultural and biological interrelationships as they pertain to soils and forests, two of our essential natural resources.

Soils

As the industrial world continues to expand its consumption of resources, it reaches deeper into the developing world to meet that need. Whether by military action, political pressure, or market forces, the end result is the same: a growing dependence of the industrial world on Third World resources. For this reason, this thesis will treat the state of the two principal ecological resources, soils and forests, primarily as they exist in Third World countries.

When we speak of soils, what immediately comes to mind is agriculture. We seldom consider land lost to growing urban centers. However, in India part of the housing space for the 14 million annual increase in population is met at the loss of surrounding agricultural land (Norman, 1982), and in Central America where some urban areas double in population in little more than ten years, housing construction fills valleys and carpets foothills in a matter of months. As cities expand, they pave over

agricultural lands which are then lost forever. Each year urban sprawl, village expansion, energy production, and highway construction claim several million acres of prime agricultural land on a worldwide basis while land-hungry farmers push cultivation onto ever more fragile soils (Norman, 1982). Even farmers who might be aware of soil conservation practices are given no time and little incentive to apply them as they are pushed out of the valleys and onto the fragile soils of surrounding forests.

The traditional systems of shifting agriculture which had a cropping cycle of several years are now breaking down. Population pressures have shortened the cropping cycle, thereby depleting the soils and causing yields to fall with the result that more land is worked but no higher yields are achieved (World Watch Institute, 1984). As farmers move from the valleys, they cut deeper into the forests in the surrounding hills as they compete for new agricultural land. These soils, once protected by forests, are now subjected to severe erosion. This is soil loss in addition to that eroded naturally. Sheldon Judson estimates that before agriculture and grazing, river-borne soil sediment amounted to about 9 billion tons a year. After the introduction of agriculture and grazing, this increased to about 24 billion tons a year on a global level (World Watch Institute, 1984). This amounts to more than doubling the rate of natural erosion. As more soils are

lost, productivity declines until the cost of working the land is not sustained by the earnings gained by the crop produced (World Watch Institute, 1984). At this point, the farmer moves on to clear more forests for crops, leaving behind exhausted soil that will grow little more than weak grasses and small shrubs.

Often the farmer, to continue using the land, will turn out grazing animals in abandoned fields, thereby maintaining a potential income from his land. However, as in the time of the Greeks and Romans, grazing animals serve to perpetuate the damage already inflicted on the land. Forests are converted to croplands which are soon exhausted through poor management. Then grazing animals maintain the fields open and vulnerable to heavy erosion while the farmer moves deeper into the forest to clear more fields. According to Lester R. Brown, "as much as half of the world's croplands are being managed in such a way that soils cannot recover between croppings and soil loss outstrips annual soil production. The end result is a mining of soils which converts them from a renewable resource to a non-renewable resource" (World Watch Institute, 1984, p.62).

This soil is lost for agriculture and also degrades other resources. About one-fourth of all eroded soils reaches the oceans. The other three-fourths settle out and cause additional problems. This soil is deposited in flood plains, reservoirs and river channels causing siltation of

hydroelectric and irrigation projects and additional flooding because of stream bed siltation and course alteration (World Watch Institute, 1984). The silting-in of expensive public works projects puts an added burden on local economies. Often the silting-in of a reservoir behind an artificial dam can take as little as 25 years (Miller, 1975). And once silted-in there is a double loss; first, the silt that is lost to agriculture; and second, the capacity for production of electricity and the potential for irrigation water which is displaced by the silt.

Often erosion is not clearly perceived as a major problem by national planners, because it is a process rather than an event. Although many countries operate with a food deficit, few notice the washing away of their agricultural lands and fewer still relate soil erosion and mud loaded rivers to higher food costs (World Watch Institute, 1984). Those farmers with economic resources can mask the degradation of soil through the application of petrochemical products in the form of fertilizers, but their costs will be reflected in the price of their product. As prices for soil additives go up, so will the price of the products which depend on them. Another consideration for the economies of developing countries is that, as oil prices increase, they will have to depend more on renewable energy sources and fuels derived from wood or

agricultural products. Without good agricultural lands maintained in a productive state, these countries will not have this option open to them.

Many countries choose to continue the practice of environmental mining in the hopes of accomplishing a miraculous short-term development, but what they experience is the loss of potential solutions to development problems. The ideal would be that each generation take on the obligation to manage the land so as to avoid imposing unreasonable costs on future generations (World Watch Institute, 1984). Until recently, however, the world has had a poor record in soil conservation. Whereas there are many examples of continued desertification and soil erosion, there are no national successes in soil conservation; there are no models that other countries can emulate. There are, however, positive trends. In some countries development agencies are paying financial incentives for each foot of terrace constructed, and in Central America there are projects to teach terraced gardening and appropriate irrigation techniques to farmers so that they may slow soil loss and maintain soil fertility.

Appropriate land management programs and zoning would help to conserve soil resources, but the missing elements for success in many new programs are political will and awareness (World Watch Institute, 1984). Leaders need an education in the resources they manage before they lose the

potential for recovery because, with the growing global interdependence, an excessive loss of soil anywhere will ultimately affect food prices everywhere (World Watch Institute, 1984). This forces the industrial countries to share part of the responsibility for development in the Third World because of their dependence on Third World agricultural products and ultimately their soil resources.

The problems related to soil cannot clearly be understood, however, without examining their relationship to other resources, principal among them being the forests.

Forests

As discussed earlier, deforestation is the beginning of an ecological slide which terminates in poverty and starvation. But is it a cause of poverty as suggested by John Lee and Ronald A. Taylor (1986) or the result of poverty as suggested by the World Resources Institute (1985)? Soil degradation and economic need at once both result from and promote continued deforestation.

In Central America, one of the major economic pressures which encourages deforestation is a short-term chance to reduce international debts through the exportation of beef. In 1978 six of the seven Central American countries exported 85 to 90% of their beef to the United States (World Watch Institute, 1984). This demand for low grade beef in the United States is led by the fast food industry which offers low priced hamburgers by using

beef raised by low cost labor on converted forest land of Central America (World Watch Institute, 1984). Essentially, the purchase of Central American beef is an example of environmental degradation by American concerns. Deforestation in parts of Central America has been reported at an alarming rate of 3.2% per year, caused primarily by cattle ranching (Buschbacher, 1986). This amounts to more than 8,000 square miles annually to meet the United States market demand for low cost beef (Lee & Taylor, 1986).

Grazing has not changed in its impact since the day of the Greeks and Romans. It freezes the recuperative process of the forests and leaves the soil exposed to erosion. Within five to ten years pasture becomes severely degraded and weed infested (Buschbacher, 1986). A Friends of the Earth report quoted by John Lee and Robert A. Taylor (1986) estimates that virtually all ranches established in Amazonia prior to 1978 have already been abandoned. So what is gained by short-term use of tropical forests is a further slip toward poverty.

But forest clearing and grazing are not alone in their ability to clear large tracts of forests. The need for energy from firewood, land for agriculture, and logging for international companies also greatly reduces standing forests in the Third World. It is estimated that the annual rate of destruction of tropical forests is more than 11 million hectares (Tangley, 1986). The hunger for land

and timber has erased more than 40% of the world's original rain forests in the past 30 years (Lee & Taylor, 1986). Both mechanized and subsistence farming have gained land through the cutting and selling of timber and conversion of forests to cropland. Sandra Postal terms this conversion the leading direct cause of deforestation (World Watch Institute, 1984).

This conversion is also probably the most difficult aspect of deforestation to deal with. Families must be supported through manipulation of available resources. In the past, this was done through the practice of shifting agriculture. The land requirement for such systems is about 10 to 29 acres for each person. With lower population levels, this type of agriculture was sustainable, but today with ever increasing populations and the added pressures of expanding cities and disproportionate land tenure, rural farmers do not have the necessary land available to work. So, when yields decline after two to five years, the farmer has the choice of remaining to work his depleted soils or to move farther into the forests and open more land. The resulting impact from shifting agriculture is estimated by the United Nations Food and Agriculture Organization to be about 45% of all forest clearing (World Watch Institute, 1984).

The need for energy exerts another pressure on tropical forests. However, the gathering of firewood, like soil erosion, is a process which continues almost

unnoticed. Unlike the loss of forests to agriculture, wood gathering by rural peasants and urban fringe dwellers has the effect of first clearing the land and then maintaining it clear, much as grazing would. As wood becomes more scarce, more time and energy are expended in gathering it. In some countries the time used in firewood collection is lost from activities such as education. The lack of firewood causes people to stop boiling water, thereby increasing the incidence of waterborne diseases. In more extreme cases, families will switch from their healthful traditional foods in favor of others like roots that don't require cooking. This change in diet often results in malnutrition (Tangley, 1986). So in addition to the loss of trees, soil degradation, and a decline in agricultural yield, firewood shortage can also lead to malnutrition, disease, and a lack of education. In many of the urban areas of Honduras, residents still use wood for cooking, creating an urban demand for firewood that is met by men who drive more than three hours from the capital to fell trees. In some other Central American cities a family may spend up to 25% of its earnings on fuel wood, a proportion comparable to what a family in an affluent society might spend on housing (World Watch Institute, 1984). With population climbing in some of these countries at rates that exceed 3% annually, demand for agricultural land and firewood will also increase. Many countries may find they

are managing systems which lead to degradation of forest to savanah, increased soil erosion, drought, flooding, degradation of water quality, falling agricultural productivity, loss of cultural and biological diversity, and ultimately greater poverty (Buschbacher, 1986; Tangley, 1986).

The burden placed on national governments which ultimately must confront these problems is obvious, but what is not so obvious is the loss to civilization caused by the ruination of tropical forest habitats. The species which make these forests their homes, once extinct, are lost forever. The tragedy is that we don't even know what it is that we are losing. The potential for loss becomes more apparent when we realize the tropical rain forests represent 80% of the world's vegetation and as many as four million varieties of life forms, many of whose benefits are still unknown (Lee & Taylor, 1986). Robert J. Buschbacher estimates that of the five to ten million species that inhabit the earth (only 1.7 million of which have been classified), one million could become extinct by the end of this century (1986). He goes on to say that between 1900 and 1960 there was an average of one extinction a year. The current rate of extinction as estimated by Friends of Earth, is one a day (Lee & Taylor, 1986). What we are losing as a civilization is survivability. A large gene pool to draw on to develop agricultural plants resistant to environmental stress or crop disease would enable us to

adapt our crops to changes in the environment whether caused by humanity or by natural processes. This pool can help us to stabilize our ability to feed our population and avoid the fate of earlier civilizations.

Diversity also increases the probability of developing cures for human diseases. One-fourth of the ingredients for prescription drugs on the market today comes from the plants and animals of the tropical rain forests (Lee & Taylor, 1986). Some of these drugs have meant great advances to humanity. For example, quinine from the bark of the Cinchona tree in Peru made large areas of the tropics accessible by curing malaria. Many tranquilizers have as their base reserpine, which is derived from the snake root plant in India, and the treatment of schizophrenia would not be the same without scopolamine extracted from the corkwood tree of Central Austria (Lee & Taylor, 1986). If there is anything that could be termed a gene warehouse, it would be the tropical rain forests with their diversity and potential to offer new products and real hope as a civilization. But as Peter Ravan of Missouri's Botanical Gardens observed, "man is cutting back on the number of choices available to improve the quality of life in the future (Lee & Taylor, 1986, p. 61)."

Environmental Education

So what are some of the choices we have available to improve the quality of life in the developing world and

specifically Central America? Current populations are easily large enough to wipe out Central America's remaining rainforest (Raloff, 1986). With demographics similar to those in Honduras, where more than half the population is under fifteen years of age, populations will probably continue to grow at nearly the same rate for at least the next 24 years, even if family size were limited to replacement levels. That increase will give us double the population dependent on the same resource base by the year 2010. The quality and size of that base will determine the survivability of the people dependent upon it.

One possible approach to the problem is a two-part program which treats environmental degradation with both a short-term and long-term perspective. First, developing countries need to establish well organized park systems and designate as many national parks and preserves as possible. As Jane Roloff (1986) notes, "this is the only way to be sure that there will still be something left to conserve in thirty years" (p.14). Land management and zoning need to be included in local, regional, and national planning. Governments must also share in costs to individuals because of hardships resulting from such land use and protection measures. Without such sharing there would be little incentive for farmers to respect park boundaries when their immediate survival is in question (Brown, 1982).

The second part of the program and the subject of this thesis is environmental education. This will give

individuals the knowledge they need to manage their environment effectively and to solve environmental problems as they present themselves. However, to educate a society is a slow process as B. B. Vohra tells us: "An informed public opinion cannot. . .be wished into existence over night. A great deal of painstaking and patient work will have to be done to wipe out the backlog of ignorance, inertia, and complacency" (World Watch Institute, 1984, p. 56). This patient work should be directed toward all levels of society, from the poorest to the richest and the youngest to the oldest. A public information campaign such as that described later in this thesis represents one way of reaching all those who have an impact on the land, whether through direct contact or through political or market influence.

As R. Neil Sampson has said, "if land and land use are to be a battleground, then facts, trends, and ideas must be the major weapons. The new land ethic must be a product of education and social evolution" (Brown, 1982, p. 122).

Before presenting a specific proposal, however the next chapter will discuss some of the functional components and elements that go into a successful public communication campaign.

III Media Campaigns in Education and Persuasion

Media Campaign Theory

Campaign in Spanish is Campana. Bell in Spanish is Campana. The similarity of the words may indicate a common origin. If we wander back through our impressions of history, we will most probably find a town crier, bell in hand, informing the general population of the desires of the King. This may have been the beginning of the public information campaign. But in modern times, campaigns have come a long way from simple bell ringing and shouting out. Along the way they have passed though many stages, from limited or no effects (Hyman & Sheatsley, 1947) to positive or aided effects (Mendelsohn, 1973). Both perspectives have their favorite examples to support their points of view. For failures one is directed to studies such as the United Nations Information Campaign (Hyman & Sheatsley, 1947) and for successes one is led down a path bedecked with projects like the Stanford Heart Disease Prevention Study (Maccoby & Solomon, 1981).

What are the key components that differentiate a campaign that has a good chance of success from one that is doomed to failure? Public information campaigns are often started with a quite optimistic goal of reaching and causing an attitude change in more than 90% of the target population (Solomon, 1981). Perhaps we would do better to set more realistic goals. Even marketing firms spending

millions of dollars don't expect such a high impact on their audience. Solomon (1981) offers a model for calculating the expected impact of a campaign. If given three stages -- exposure to the messages, attitude change, and behavior change - and a 50% probability for success at each stage, then the chance that an individual will adopt a change at all three levels is .5 x .5 x .5 or .125. This gives one a base against which to reasonably evaluate campaign impact. Obviously, there are many variables involved in public campaigns. And a successful campaign may reach much higher than the calculated base, just as a failure may fall far below.

Another component to be evaluated is the campaign audience. Hyman and Sheatsley (1947) show how surveys can provide an audience profile. With this information, the campaign planners can modify the campaign to fit the audience. This idea is further developed in a later study, in which the idea of adapting the campaign format to a target culture shows a significant improvement in cognition in regular viewers over non-viewers of a popular educational television program (Palmer, Chen & Lesser, 1976).

The importance of using the appropriate channel of communication described in Laswell's paradigm "who says what to whom in what channel with what effect" (1948) should not be viewed as a restriction to an information campaign, but rather as a creative challenge. Many

Westerners think of the media as print, television and radio because of their dominance in the developed world. Yet in other cultures traditional forms of communication such as the "Cantadores" (Singing Poets) of Brazil, the "Ludrak" (Theatre Play) of East Java or the "Bhavai" (Folk Theatre) of India can prove to be more effective in reaching a mass audience (Taplin, 1981). The customary communication channels within a target group as well as attitudes held by that group are important in planning a successful campaign.

Atkin (1981) further develops this relationship in his reference to the four basics of a campaign; the source, the message, the channel and the receiver. The first three are within the control of the campaign organizer, but the lack of an audience profile can render the entire campaign ineffective. Larson (1979) also recognizes the importance of the audience profile in a successful campaign. He notes that the audience will discuss among themselves the overt message received from a communicator. This message, along with other information and symbols, will be combined by association within the minds of the audience members. An effective campaign will use these symbols in the planning and utilization of its message.

Larson (1979) refers to the two-step flow of information in his description of message manipulation by the audience. In doing so he is touching on a basic model

for the spread of information within a mass audience. The components of these are: agenda setting, salience and the two-step flow.

In his communication/persuasion model McGuire (1981) lists "exposure to the communication" as the first element of 12 that form a process of total adoption of an idea. Maccoby and Solomon (1981) later reinforce exposure by naming agenda setting as their first campaign element. It's logical that in a public communication campaign audience members must have information about the theme before they can begin to process it. This has been supported in some information campaigns which have demonstrated that the mass media have been effective in increasing knowledge about family planning (Taplin, 1981). Setting the agenda, however, is not as simple as just placing a topic in the public eye. All information is filtered and, if it is not deemed salient to the individual or group, it can be ignored. This was illustrated in May, 1975 when runner Steve Prefontaine died. In the following week 310 people were interviewed. Among those who were runners, more than 90% were aware of the event; in the general population, only 52% of the people had knowledge of his death. Those to whom the news was important turned to the media and personal contacts for more information (Gantz, Trenholm & Pittman, 1976).

Public campaigns, however, rarely treat topics with such potential overt public impact as the death of a

celebrity. In fact, often a campaign theme may seem quite distant from the audience. In this situation it is up to the campaign organizer to covertly support an idea to increase its public salience and then overtly propose a specific program (Larson, 1979). This can be done by utilizing various channels of the mass media to show increased media salience in the topic. In turn, increased media attention influences the salience of a topic among the audience (Shaw, McCombs, Maxwell, Becker & Lee, 1977). Newspapers have been shown to be significantly more effective in influencing salience and setting the agenda than television, but this is most probably because of the limitations of the television medium. Nixon's trip to China is an example in which television offered more than just headline announcements of events and proved itself in this case to be quite effective in influencing salience and setting the agenda (McClure & Patterson, 1976). Up to this point, what exists is a one-step flow from media to audience. For an effective spread of information to occur, a topic must be discussed between individuals (Troldahl, 1976). The two-step flow of information refers to a path followed by information from media to opinion leaders to audience. In public campaigns, however, the position of opinion leaders is probably not as strong as this implies, since, as already stated, the information will be discussed and recombined with symbols already held by the audience.

Still there is an active pursuit within the audience for information pertaining to salient topics (Troldahl, 1967; Gantz et al., 1976).

The effectiveness of the two-step flow was illustrated by Rahudkar in India in 1958 (Rogers, 1962). He showed that illiterate and poorly educated people learned agricultural innovations contained in printed media. A study done in 1970 replicated these results by showing that illiterate farmers had access to printed information from literate friends or household members (Brown, 1970). Both of these studies illustrate the functioning of the two-step flow. Further, a study on mental retardation awareness conducted in Wisconsin adds support (Douglas, Westley & Chaffee, 1970). In the summary, the authors noted that the media set the agenda and the information was relayed through interpersonal contacts to the secondary audience.

These three components of information dissemination, agenda setting, salience and the two-step flow, are inseparable, complementary and, in the planning of public communications campaigns, indispensable.

The goal of public communication campaigns is to influence public opinion and ultimately public behavior. According to Hyman and Sheatsley (1947), accomplishment of these goals is a rarity. It must be acknowledged that, to realize a change, a campaign must be well planned and well managed, but success is possible. In the above mentioned mental retardation awareness campaign, the authors report a

positive correlation between information gain and attitude change. A study utilizing a local newspaper in Boston showed belief change resulting directly from the media (Troldahl, 1967). A study of Sesame Street (Cook & Conner, 1976) found that, although there was an increase in learning among children who simply attended to the show, there was a significant positive difference between these children and those who received encouragement and support while watching the show. Liebert (1976) found in a study of the same television program that his experimental group showed an increase in knowledge gain with no difference between boys and girls, blacks and whites, or different I.Q. levels when families were encouraged to watch with their children and were supplied with promotional support material. While non-encouraged families showed a gain in knowledge, it was not as great. Liebert (1976) discusses the differential growth in knowledge between social classes, noting that the knowledge gap directly affects the disadvantaged and they lose out as the knowledge gap grows.

The experience with Plaza Sesamo in Mexico reiterates this problem in its failure to reach rural children (Diaz-Guerrero, Reyes-Lagunes, Witzke & Holtman, 1976). To avoid widening of the knowledge gap, the authors suggest related forms of stimulation and reinforcement. But the importance of interpersonal contact in reinforcing media messages is not related only to children's television. The blending of

mass media with interpersonal communication techniques promises a higher likelihood of effectiveness and impact (Flay & Cook, 1981). The Sesame Street Studies (Cook & Conner, 1976; Diaz-Guerrero et al., 1976; Liebert, 1976) as well as a study done with a Boston newspaper (Troldahl, 1967) all recognize a degree of learning from a one-step flow of information from the media source to the receiver, but they also recognize the influence of interpersonal communication among audience members. Successful campaigns like the Stanford Heart Disease Prevention Study actively utilize personal contact to interpret the campaign. This added component highly increased the positive results of the campaign (Maccoby & Solomon, 1981).

By including practical components derived from the two-step flow of information in the design of the campaign the organizers brought a primary element for campaign success under their control rather than leaving it to chance. One cannot depend on only the increased availability of information to increase salience or be effective in spreading a message (Hyman & Sheatsley, 1947).

Interpersonal communication with extension workers, health workers and peers makes a campaign more effective in attitude change and the continued use of adopted innovations (McGuire, 1981). Douglas (1970) shows us that under certain circumstances even those referred to as the chronic know-nothings can be reached through the combination of media and interpersonal communication. This

is an important point considering that those who most need to be affected by a campaign are probably those who are least touched by it. His study suggests that they can, in part, be reached by interpersonal contact.

Encouragement and support are not limited to just a medium and personal contact. As is the case in selecting the primary channel for communicating a message the design of encouragement and support programs also presents a creative challenge. The Stanford Heart Disease Prevention Study (Maccoby and Solomon, 1981) utilized a variety of channels to reach its audiences. Community groups, health professionals, and school education programs, as well as the mass media, were used to support the message. The use of various channels of communication provided multiple opportunities for individuals to receive the information.

Each medium has its own set of characteristics that make it appropriate for a given message or audience or a given function within the overall campaign plan. Television, for example, is effective in increasing awareness of a topic in the public arena but, because of its nature, it can only offer headlines, and details are soon forgotten. Newspapers, however, offer better discussion on topics and, therefore, are capable of bringing about deeper understanding (Wade & Shramm, 1969; McClure & Patterson, 1976). In summarizing the previous

discussion we can say that a public communication campaign which utilizes various channels of communication and support materials, plus interpersonal contact and encouragement, has a better chance of reaching the desired public with the desired message, thus achieving the desired effect.

The Successful Campaign

> (We have) uncertain theory being used to design information campaigns that are transmitted to groups or persons who, for the most part, hardly pay attention to them and are not at risk from the behaviors to be prevented.
>
> (Flay & Cook, 1981, p. 249)

Many campaign planners start with familiar media sources and plan how to reach their target group through these channels. Often these channels are limited to newspaper, radio and television. Planners with these restrictions have severely limited their potential impact on their target group. They have precluded the use of such culturally unique channels as the "Cantadores" or the "bhavai" mentioned earlier. Often subgroups or localities even within the United States have special channels of communication that are unique. When considering communication of a mass message to a specific group, one must remember that most persuasion takes place as a result of multiple message inputs over various channels and as a product of a campaign or movement and not simply a limited message contact (Larson, 1979).

A public communication campaign is a dynamic, developing entity that must adapt to a changing audience to survive. It must also influence the audience members in a way that aligns their attitudes with the goals of the campaign and involves them in self-persuasion (Larson, 1979). Hyman and Sheatsley (1947) tell us that it is not sufficient simply to increase exposure to information flow if that flow is in the same direction. Exposure awareness is determined by the individual and interpretation of information is dependent on prior attitudes and experiences of the individual. A campaign, then, should be concerned with the audience process of interpretive filtering and the need to present information that is salient to the audience.

The message presentation becomes important because it must maintain the interest of the audience long enough to be seen or heard. To do this the campaign should be designed as a complete series of episodes which relate to one another yet are capable of standing on their own. It should not merely present a collection of messages; rather it should be as a serial with a beginning, middle and end. This format allows for a dramatic presentation which pits good against evil in an appropriate setting. The tendency of the serial will be more toward success because the ideology is acted out rather than preached at the audience (Larson, 1979). Larson continues by telling us that

humor, editorial comment and dramatizing all have the potential to better reach the audience. In writing on campaign effectiveness, Atkin (1981) also tells us that pains should be taken to avoid dullness. The content should be appealing in a novel and entertaining manner and the message should be repeated in a variety of vehicles. Some family planning studies (Taplin, 1981) assume a message retention time of eight to ten weeks and maintain a rotation of messages throughout the year. Finally, we are told to aim messages at opinion leaders to take advantage of the two-step flow (Larson, 1979), but as discussed earlier, opinion leaders are not necessarily the most appropriate target group. A modified approach to this would be to design messages that encourage discussion.

The source is a key component in a successful campaign. A credible source in tune with the times can transpose the humdrum to exciting (Larson, 1979). Excitement and credibility then make the message more palatable. Research shows that public communication can be more effective if the source is made more salient in terms of credibility (Lynn, 1974). Three basic characteristics of a credible source are trustworthiness, expertise/competence, dynamism/attractiveness. It has been demonstrated that a source with two or more of these characteristics is more successful in communicating a message (Atkin, 1981). Larson (1979) takes us one step further with the source in discussing idea campaigns. He

says that two things are necessary for them to flourish: a leader and attention to times. He notes that the anti-war campaigns of the sixties had no definable leader and, therefore, were somewhat weak. The opposite, he says, was true for Jesse Jackson, a good leader at the wrong time. Although these examples are of social movements, the principle is equally applicable to public campaigns. Finally, concerning both the message and the source, we are warned not to preach to an audience but rather to draw from their own experiences.

In searching for style elements which may indicate whether a public communication campaign can expect failure or success, we are able to create two opposing lists of characteristics. Campaigns that have failed offer a scarcity of salient information, present the information at a poor level of quality, lack coordinating links or promote vague messages. Those that have succeeded manage a pervasive message in an engaging manner, deal with straight facts, offer a quality presentation and have a carefully targeted audience (Atkin, 1981). Atkin reinforces the idea of source credibility and message appeal, as well as the careful selection of communication channels, as mentioned earlier in his discussion of campaign style.

Recalling the dynamic entity, which is the campaign, we can outline five elements of its development (Larson, 1979):

1. Identity - This is the process of developing a symbol by which the campaign is identified or an activity to which it can be linked for purposes of identity. The development of a jingle, a special greeting or a slogan all serve to identify the campaign.

2. Legitimacy - This is the act of demonstrating power or credibility. It can be done through alliance with already credible groups, by demonstration of a large following or a show of ability through gaining an objective or winning in a confrontation.

3. Participation - The third stage involves a spread of legitimacy. People are invited to join the cause, fly a banner or wear a button, in essence to be identified with the campaign. By participation the campaign is strengthened and legitimacy is improved.

4. Penetration - Stage four could be called the integration stage. This is when the campaign goes beyond its followers and touches the masses. Terms related to this stage are "grass roots," "ground swell," and "the silent majority."

5. Distribution - This final stage is marked by the institutionalization of the campaign. At this stage the campaign must begin to fulfill promises and to share its acquired power. With these five stages of development condensed from Larson (1979), let's look at a successful campaign to see how well it has fared and what activities and developments mark each stage.

The Smokey Bear Campaign (McNamara, 1981) started in 1945 after one year of using Disney characters on a prevention poster. The idea of using an animal was desirable, but the U. S. Forest Service wanted one that could be drawn upright in order that he might demonstrate fire prevention practices. The character was employed on posters carrying the plea "Smokey says - care will prevent 9 out of 10 forest fires." In June of 1950 a bear cub was rescued after surviving a wild fire in New Mexico. He went on to become the living symbol of Smokey Bear. In 1981 the Smokey Bear campaign was budgeted $476,000 plus the donations from the Advertising Council, and it is credited with saving $17 billion over the last 30 years through fire prevention awareness. How does Smokey Bear fit Larson's model?

1. Identity - The Smokey Bear symbol has been easily identifiable since its creation, more so since the rescue of Smokey in New Mexico and supplying him with a home in the National Zoo in Washington D. C. The original Smokey Bear was retired in 1975 and a new Smokey was chosen on May 2 of that year. Smokey now has his own theme song "The Ballad of Smokey the Bear."

2. Legitimacy - In the 82nd Congress both houses unanimously passed Public Law 359, dubbed the Smokey Bear Act of 1952. The act:

1. Prohibits the unlawful use of any image of Smokey Bear without the express permission of the Forest Service.

2. Permits the Forest Service to license the use of Smokey Bear and collect royalties.

3. Allows the Forest Service to keep those monies and put them into a revolving account that could be used to further promote the program.

3. Participation - The Smokey Bear Junior Ranger Program, which started in 1953, supplies fire prevention kits to boys and girls upon written request. Smokey received about 500 letters a day and in 1965, he was given his own zip code. This program has enlisted over six million young people in the cause of forest fire prevention.

4. Penetration - The mass media are utilized in fire prevention advertising through the three main channels -- radio, television and newspapers. An illustrated campaign guide is prepared each year and offers support items, many at cost, to state and federal agencies. More than $1 million worth of campaign items were produced in 1979, including posters, pamphlets, bookmarks, calendars, coloring sheets, comic books and Junior Ranger Books, and in 1984 media support for Smokey was more than $43 million.

5. Distribution - In 1956 the U. S. Forest Service signed a special agreement with the Canadian Forest Association to establish international cooperation in forest fire prevention. The Canadian Forest Association receives the Smokey Bear Campaign materials. In 1958 the

first four Smokey Bear statuettes were awarded in a ceremony on the White House lawn and, by 1979, more than 180 people, agencies and organizations had received them. In 1970 the first Smokey Bear workshop was held in Atlantic City.

A 1976 attitude study shows that, in aided recall, 98% of the subjects were aware of the Smokey Bear campaign (Rice & Paisley, 1981). This campaign successfully used the basic communication theory developed earlier. It also employs the many other processes discussed, such as interpersonal encouragement, adaptation to the specific culture (The Smokey Bear Southern Campaign), drawing from audience experience, multi-channel communication and source credibility. The Smokey Bear Campaign is enormous in both size and impact and presents a good model to follow for successful public communication campaigns.

An alternative to this approach, where a campaign is designed as education, is offered by Solomon (1981) in what he calls social marketing. This involves selling social change as one sells a product. First the idea or service is established as a product and a price, which includes the social, personal and monetary costs, is set. Then the audience and channels of communication to be used are defined. Finally the actual dissemmination of information is planned along with a method of monitoring and modification of the campaign. Solomon notes that many people are already aware of a problem and what they need

are the skills to treat it. This fits into his social marketing model of campaigns designed to offer social improvement as a product to a target audience.

In planning messages, the direction of the message has been shown to be important. Prevention campaigns often take a negative or fear approach rather than a positive approach. Flay and Cook (1981) believe that prevention campaigns are not salient to the public. Research (Evans et al., 1973) has shown that positive motivation or recommendations are as good or better than fear motivation. Larson (1979) tells us that a campaign should express a "you're O.K." philosophy and that some sort of personal reward or benefit should be implied or expressed to the audience. In developing countries, if the media present a positive view of development, then those with a higher media exposure will have a higher level of achievement motivation, and media exposure will have a positive correlation with innovation (Brown, 1979).

Therefore, the study proposed in the following pages will test two hypotheses:

1. General media use increases the knowledge gain and attitude change from a formal education program beyond the effect of the program alone.
2. A media program coordinated with formal education increases knowledge gain and attitude change beyond general media use.

IV Proposed Media Program

Overview

Honduras, considered the second poorest country in Latin America, finds itself in a race toward development as development goals advance even further into the future. The over-exploitation of resources diminishes the capacity of the Honduran economy to reach development goals. The mistake is often made that economic structures are free from an ecological base. As once stated by a government planner in Honduras, "Honduras has to develop now; we can afford neither the time nor the money to invest in environmental safeguards." Environmental problems are development problems (Campanella et al., 1982). Failure to recognize the ecological base of an economic system can lead to further degradation of the environment and an eventual weakening or collapse of the economy.

The common belief that the responsibility for rampant environmental degradation lies with the poor rural farmer tries to separate the problem from the socio-economic characteristics of the nation (Glick, 1980). All sectors of the population affect the state of the environment, either by direct ownership, personal lifestyle or participation in the economic system locally, nationally or internationally. The Phase II Environmental Education

Program - Honduras Ecological Association, (1982), prepared with the aid of R. A. R. E. Incorporated Washington D. C., states as a goal the "dissemination of information to rural populations and the general public regarding the proper role of resource management technologies and conservation practices in sustaining the long-term stability of the country's economy" (p. 5). Environmental education then becomes not only an environmental safeguard, but an economic safeguard as well, and a comprehensive program in environmental education must deal with both the natural environment and the cultural environment (Dodd, 1984). Environmental education is everything that results in an improvement of the management of resources and gives a better understanding of the relationships between man, his culture and the biophysical environment (Lieberman, 1983). To ensure the effectiveness of such a program, a national strategy should be defined and focused on four target groups: decision makers, students, the general public and the rural population (Campanella et al., 1982).

A multi-media program with both formal and non-formal education components could be designed to cover all of these target groups and, if such a program were coordinated around a central theme or figure, each component would support the others. The following is an example of a program designed by the author to meet the above criteria. It is currently in partial use in Honduras, and if funding

and support increase, it has the potential to be the first comprehensive program of its kind in the developing world.

1. Formal Education

   A teacher's manual of a curriculum plan designed for the fifth-grade. Lecture and activity time is allotted to ecological principles and cultural-ecological relationships. The evaluation of the manual includes suggestions for future manuals to be written for other grade levels in primary education.

2. Non-Formal Education

   Newspaper, radio, and television campaign (ECOEDUCANDO). Since February, 1984 the major national newspaper, La Prensa, has carried two pages weekly of environmental education material centered around a mascot. In May of that year an initial contact was made with the national radio station to produce radio spots. In the following June interest was shown from a private television producer to use the mascot and its environmental message to host a children's show.

3. Inter-Agency Newsletter

   In November, 1983 the first issue of an inter-agency newsletter was well received by representatives of both government and non-government development agencies. Lack of a

permanent coordinator stalled the project and, to date, it has not been revived.

4. Literacy Campaign

In February and March, 1984 interest in using the mascot from the newspaper program as a central figure in some material to be used in the literacy campaign was expressed by the Ministry of Education and some informal meetings were held. Lack of personnel stalled the project and, to date, no further meetings have been held.

5. Work Education

In February, 1984 the first draft for the creation of a Honduran conservation corps was drawn up by members of the U. S. Mission in Honduras. Cooperation and technical assistance through the California Conservation Corps was approved but changes in personnel temporarily stalled the project. In December of 1985 and January of 1986 a scaled down version of the project was run with high school students. The trial project met with success and plans were made to continue at that level while building experience and support before expanding further.

Formal Education

Curriculum Plan:

In response to the worsening environmental problems in Honduras, the General Directorate of Renewable Natural Resources, in collaboration with Peace Corps/Honduras and with the support of the Ministry of Education, began the development of a curriculum plan for primary education in environmental studies. The project began in February, 1983. The development portion of this project consisted of the creation and evaluation of classroom and outdoor activities appropriate for primary school children. Three schools were used during the development stage to evaluate the activities:

Casa del Nino: a semi-private semi-public school for middle-class children and orphans. This school is partially funded by the Catholic Church and many of the families whose children attend are quite active in the school programs.

Camara Junior: a lower-middle-class public school. Families whose children attend this school are generally of the working class. There appeared to be a mix of motivated and apathetic teachers on the staff and low family participation in school programs.

Escuela Mixta Toribio Bustillo: this school is located in a barrio known as Las Cajas (The Boxes). It is a poor area which absorbs migrant families from the

rural areas. The houses are of wood construction and cover 12 to 20 square meters of floor space. Few have electricity; fewer have water or sewage. School starts at 8 a. m. and runs until 10 a. m., at which time there is a one-hour break so that students can go home for breakfast. Many families work in the morning to buy the food for the day. There is high teacher apathy.

The original project covered the school year from February to November, 1983 at which time results from testing, comments from teachers and experiences from the program were used to re-write the activities and lectures into a teacher's manual and present it to the Ministry of Education. The manual was approved in September, 1984 for use at the fifth-grade level in a one-year trial involving 500 schools for the 1985 school year beginning in February. That number was later reduced to nine. An experiment evaluated the effectiveness of the manual in teaching basic environmental concepts at the fifth-grade level. A summary of the content of the program is found in Appendix A.

Non-Formal Education

Newspaper:

In Honduras only 28% of students finish the 6th grade and the literacy rate on a national level is only 45% (Campanella et al., 1982). A public education program

which depends solely on the school system for its audience would be leaving a large portion of the population untouched by its messages. Another problem in the school system is availability of appropriate material in environmental education which treats salient problems in an understandable format. ECOEDUCANDO was designed to attack both of these problems. First, it utilizes the national circulation coverage supplied by a major newspaper, La Prensa, and presents educational material in an easy to understand conversational language.

Accompanying the main articles are drawings which emphasize the theme of that week and a simple word game that asks questions about the article, thereby reinforcing it. Also included are classroom activities, information on national flora and fauna and a "letters from the readers" section (letters to the Eagle, the program mascot).

ECOEDUCANDO is multi-institutional in that it depends on input from many sources. The coordinating group works within the Honduran Ecological Association (A. H. E.). They are the program's designers, writers and the artist. This group works with the ecology and biology classes in the University to develop information appropriate to the environmental situation in Honduras. The text and drawings are prepared from this information. Letters to the Eagle are answered by an A. H. E. member and these, along with the text and drawings for the week, are sent to La Prensa. Layout is done at the newspaper's offices and every Sunday

ECOEDUCANDO presents its mascot, The Harpy Eagle, an endangered species in Honduras, with its message to a national audience. The Ministry of Education promotes the use of the program by teachers through area supervisors.

ECOEDUCANDO is based on 52 weekly themes which follow a basic yearly theme. The theme for 1984 was the monthly precipitation table. Weekly themes corresponded to problems experienced because of a lack of/or over-abundance of water throughout the year. Articles always give suggestions for working with the environment to improve the national or one's own personal situation.

ECOEDUCANDO is written at close to fifth-grade level to make it usable for teachers and appropriate for the general educational level. It is also written and presented in an entertaining fashion to attract the largest number of readers possible.

Future plans for ECOEDUCANDO include expansion into radio spots and possibly into a children's television show.

Inter-Agency Newsletter

The developing world is full of agencies, both public and private, that have stated as their main objective the improvement of a standard of living or economic base. Many of these agencies support programs in Honduras. As stated earlier, environmental problems are development problems. Therefore, any agency or institution working in development programs is, by definition, affecting the environment of

the country, yet communication between these agencies is very limited. The reasons for this lack of communication may range from territorialism and mistrust to simply not having considered inter-agency communication as having too much importance. The results of maintaining closed doors between agencies can be extremely costly in both economic and environmental terms. The objective is to create a channel of communication that is non-threatening and comfortable and also offers a forum for dissemination of environmental information appropriate to development projects at the level of the agency, as well as the level of the individual.

The Honduran project was developed over a five month period from September, 1981 to February, 1982 in the form of a newsletter printed in a combination of offset and mimeograph. Development agencies were asked to submit articles about development issues. These were printed in the first portion of the newsletter while the second portion was prepared by the A. H. E. and presented ideas for environmentally sound and "Honduran appropriate" development projects for either an agency or individual. The newsletter was designed to be self-supporting, paid for by subscriptions from the agencies themselves. The first edition carried introductions from ten agencies and was enthusiastically accepted by several others. Before cancellation of the project in late February, 1983, 20

groups had expressed interest in buying a subscription and participating in the project. The project was cancelled because of the lack of a full-time coordinator. The first issue was distributed in early 1983. Also, at this time, a new group was developing that would serve as a representatives' council to facilitate cooperation between development agencies. That group continues to operate.

Literacy Campaign

The most common level of completed education in Honduras is the sixth grade and the national literacy rate is 45%. To counter the negative effects of this situation the Ministry of Education sponsors a Literacy Program in which students from public schools give night classes in different communities where residents would not normally have the opportunity to study. These programs use manuals that depend heavily on drawings to support the language teaching units. The Ministry of Health cooperates in the development of materials to be used in these manuals in an effort to promote good health practices and disseminate information about basic treatment for diarrhea. The mascot used in ECOEDUCANDO could be employed in the literacy campaign with similar drawings and simpler text to teach environmental material.

Realizing this potential media source for reaching a specific group, the A. H. E. in May, 1984 had an informal meeting with the coordinator of the Office of Materials

Development for the Literacy Campaign in the Ministry of Education. There was interest shown in cooperating with the A. H. E. in the incorporation of environmental education materials into the Literacy Program. This portion of the integrated media program was seen to have two potential audiences: those people learning to read and those secondary students teaching in the program. It was decided by the A. H. E. to establish ECOEDUCANDO on a good base before expanding the program to the Literacy Campaign, to concentrate resources according to priority and potential impact.

Work and Learn

The previously described components of this integrated media program reach most sectors of the population: curriculum plan-- primary school students; ECOEDUCANDO -- students, teachers and general public; newsletter -- development agencies; literacy campaign -- illiterate population. The final major group that must be reached to approach complete coverage of the population with environmental information is the unemployed. A major concern of this group is survival; almost all else is secondary.

The most effective way to reach this group is by supplying jobs. This could be done through the creation of a work-and-learn program where workers are expected to participate in learning activities as well as complete a

specific job for which they would be paid. The learning activities would supply the participant with needed skills and knowledge which could later be applied in his community.

In early 1984 U. S.A.I.D./Honduras made the initial information inquiries and held a meeting to discuss the feasibility of the program. A working group was established out of this meeting and in February, 1984 the preliminary draft proposal was completed. Subsequent meetings were held in which members of U.S.A.I.D., Peace Corps and the A. H. E. refined the proposal. A similar program in California, the California Conservation Corps (C. C. C.), was contacted and agreed to assist in the planning of the program, including sending the sub-director and an assistant to visit Honduras and also to host a visit of the Honduran planning group.

A high level of interest was shown by both C. C. C. and the A. H. E., which was the sponsoring agency in Honduras. In 1984 the author visited the C. C. C. office in Sacramento and it still showed support for the proposal. As mentioned earlier, the work-and-learn program has been scaled down to help build support within Honduran agencies before looking for international support.

V Methodology

Between March, 1983 and January, 1984 a curriculum for environmental education was developed in Honduras as an appropriate program for teaching environmental topics in the fifth grade of that country. The program was evaluated and revised in relation to the level of understanding displayed by the students in three experimental schools. The final copy was evaluated by a didactic commission from the Ministry of Education, which then approved the curriculum for use in public schools. Because environmental education is a subject not generally included in primary education in Honduras, it can be assumed that students participating in the experiment had not had much exposure to the topic. Therefore, knowledge gain and attitude change throughout the course of the experiment can be primarily attributed to media exposure or the curriculum program, El Ambiente y Yo.

El Ambiente y Yo was used by this thesis as a base from which to conduct an evaluation of two specific hypotheses which relate to education and media. They are:

1. General media use increases the knowledge gain and attitude change from a formal education program beyond the effect of the program alone, and
2. A media program coordinated with formal education increases knowledge gain and attitude change beyond general media use.

Two experiments were conducted to evaluate the above hypotheses.

Experimental Group

A list of 50 schools was compiled by the supervisor from Supervision Departmental de Francisco Morazan. From this list, the author drew ten schools at random to be used in the experiments. Of the ten schools chosen, six were urban schools, three were semi-urban and one was rural. Of the two schools drawn from this group as the control group, one was urban and one was semi-urban. The remaining eight schools formed the experimental group. Four schools were then randomly drawn from the experimental group to form two sub-groups of four schools each. One of these sub-groups was formed by three urban schools and one rural school. The other sub-group was formed by two urban schools and two semi-urban schools.

A minimum amount of stratifying was done in group selection to ensure representation from each of three demographic groups; urban, semi-urban, rural. During the course of the experiment, one school (semi-urban) dropped out because of problems in maintaining a fifth-grade teacher. This left 207 subjects for the first experiment, 152 in the experimental group and 55 in the control group. Experiment 2 included 152 subjects, 96 in the experimental group and 56 in the control group. All participants were fifth-grade-daytime students. Figure 1 is a graphic representation of the groups used in both experiments.

GRAPHIC REPRESENTATION OF EXPERIMENTAL GROUPS

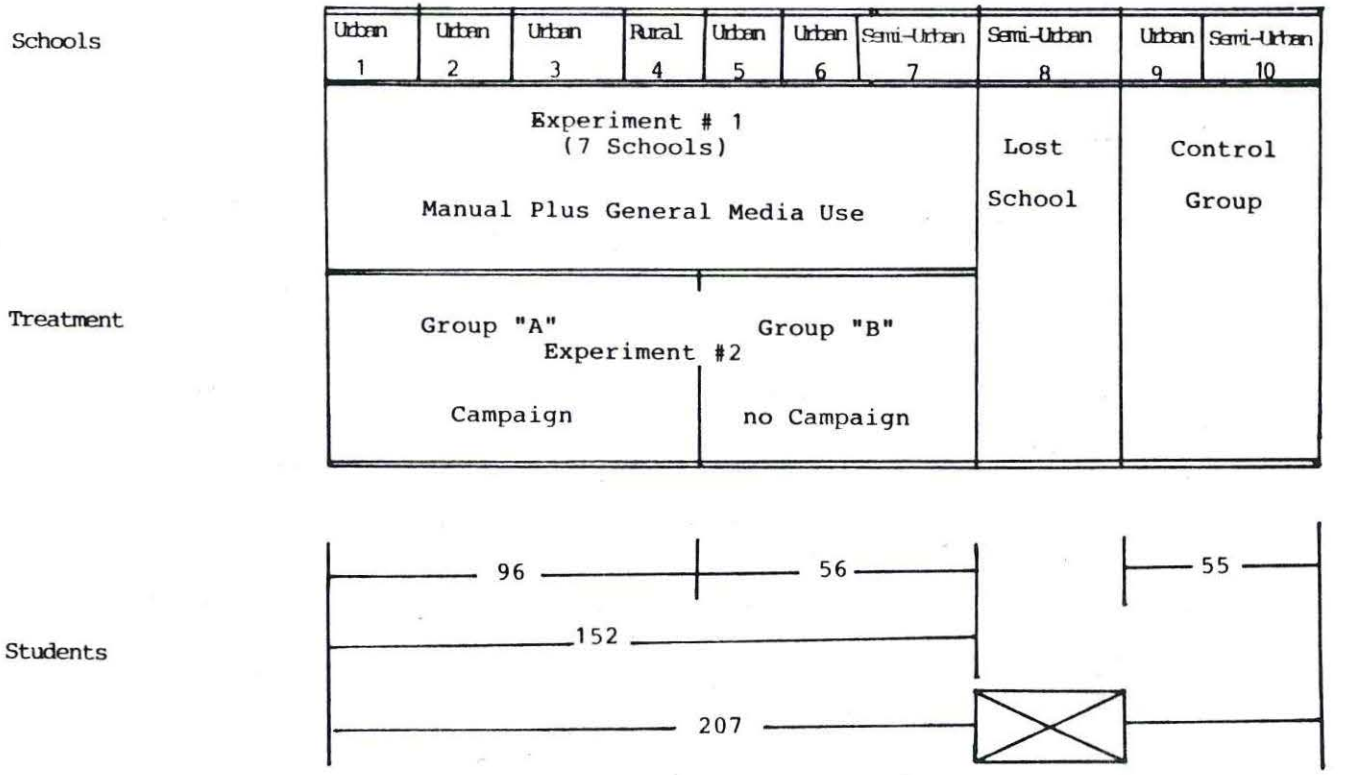


Figure 1: Graphic representation of groups used in Experiments 1 and 2, location of school, treatment received and number of students.

Experiment 1: General Media Use Plus Curriculum Plan

The first experiment, a before and after design, employed the curriculum plan El Ambiente y Yo (Appendix A), in the eight schools chosen as the experimental group.

The fifth-grade students were given a questionnaire which was completed in the classroom setting at the beginning of the school year. This questionnaire (Appendix B) determined the attitudes and level of knowledge related to the environment, as well as media exposure and socio-economic level for each student.

Their instructors were then given a copy of the teacher's manual El Ambiente y Yo and a brief introduction on how to use it. They also received information about the program, its goals and the importance of their participation.

Instructors were left on their own to teach the weekly topics from the manual throughout the year. At the end of the school year, each student was again tested. These scores were compared to the scores from the pre-test to determine media exposure, attitude change and knowledge gain. The pre- and post-tests were essentially the same.

The students from the two schools chosen as a control group received the same pre- and post-tests as the experimental group and at the same times. Their instructors were introduced to the goals of the experiment and asked to follow the traditional fifth-grade curriculum

which does not include topics specifically related to the environment. These scores were used as the baseline against which the knowledge and attitude scores of the experimental group were compared.

Experiment 2: Media Support vs. No Support Within a Formal Curriculum Plan

The second experiment, an after-only design, used a formal education unit designed on the same format as those contained in El Ambiente y Yo. A series of radio commercials and a newspaper article with a graphic were developed which served as support material for the education unit. This unit and support material, along with the test is found in Appendix C.

The experimental group was divided into two groups of four schools each. The first group received the formal education unit in late July after the National Campaign for Tree Week and International Earth Day had ended. There was no media support for the education unit for this group. At the end of the week, the students were tested on knowledge and attitude change relating specifically to the topic of the education unit. They were also asked if they had heard radio commercials, read articles in the newspaper, or had seen programs on television which related to the topic. During this portion of the experiment, one school dropped out of the formal education group.

The week after the first group was tested, treatment began on the second group with the newspaper article being distributed in two national newspapers. One of these was the Thursday edition of a daily paper in which the article appeared alone. The other was a weekly paper which came out on Sunday; here the article appeared, accompanied by the graphic. Beginning on the same Thursday as the newspaper article, the three radio commercials were aired, eight to ten times a day on four radio stations. Two of these stations use a popular music format and two use an information/music format. The media campaign lasted nine days and ended on a Friday.

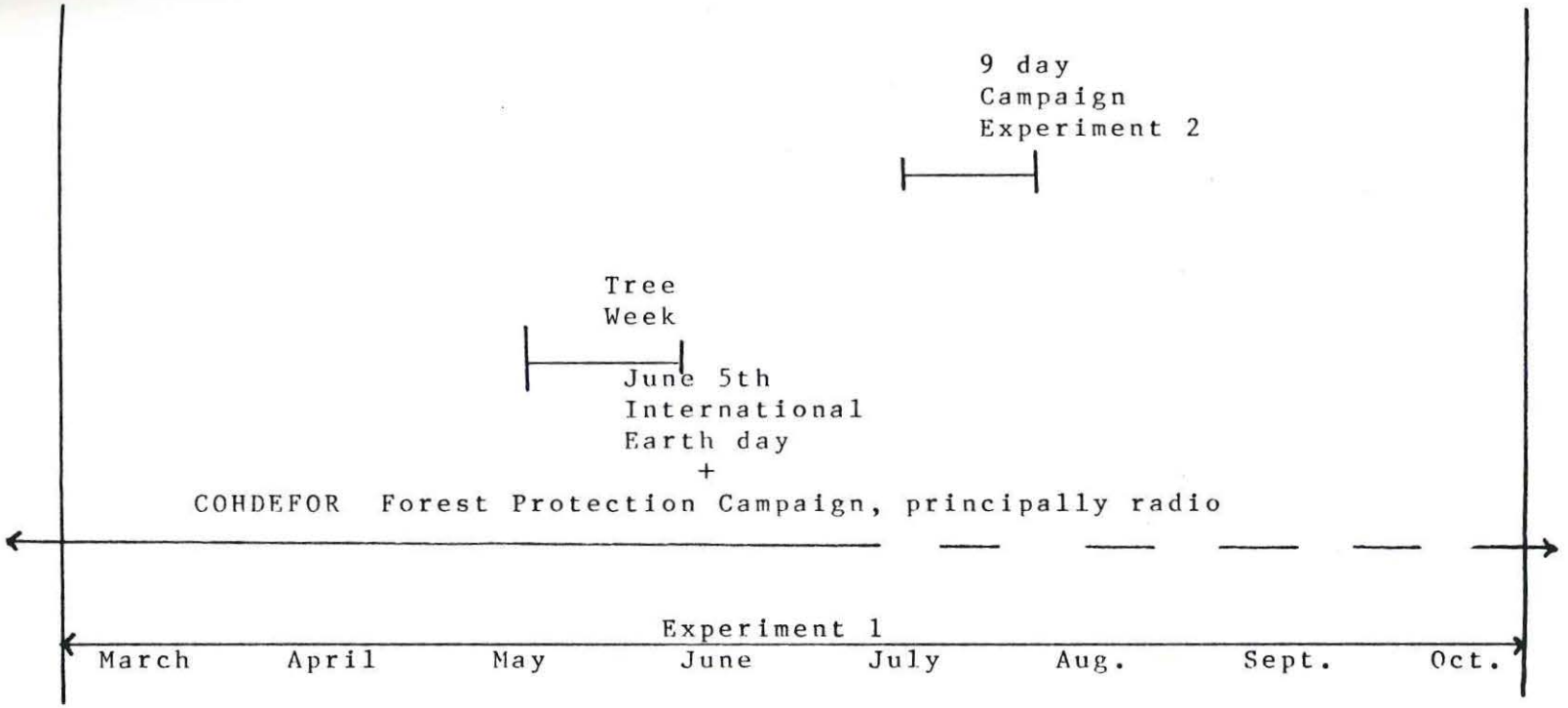
In the classroom during the same time period, students were given the formal education unit. At the end of the week they were given the same test covering knowledge gain, attitude change, and specific media exposure as the previous three schools from the first group were given. The scores from the seven schools for this test were compared to determine if there was a difference between knowledge gain and attitude change in a media-supported education unit and an education unit alone without media support. The two schools in the control group from the first experiment did not participate in the second experiment.

VI Results

The main research hypotheses of this thesis were: 1) General media use increases the knowledge gain and attitude change from a formal education program beyond the effect of the program alone and 2) a media program coordinated with formal education increases knowledge gain and attitude change beyond general media use. These two hypotheses were tested in two separate experiments with the same ten schools. An analysis of variance was used to test the relationships in attitude change and knowledge gain between groups. Figure 2 shows a timeline which represents environmentally related events or programs during the course of the experiments. There were no environmentally related events or programs near any of the testing dates other than the radio commercials from the Honduran Forest Development Agency (COHDEFOR) and media messages directly related to the experiments.

An analysis of variance comparing group division and socio-economic status is represented by Tables 1 and 2. It was found that the groups for Experiment 1 showed no significant difference in socio-economic status ($F = 2.20$ $(1,206)$, $p = .14$) while the groups for Experiment 2 showed highly significant differences ($F = 12.22$ $(1,151)$, $p = .001$). Because of the nature of the experiment, it was decided to control for socio-economic status throughout the analysis in both experiments.

Time Line For Experiment 1 and 2



Experiment 1

Figure 2: Time Line for Experiments 1 and 2. The Honduran Forest Development Agency's (COHDEFOR) campaign is greatly reduced from late June through October because of lower incidence of forest fires due to more rain.

Table 1

Socio-Economic Status: Experiment 1

Group	N	M	SD	df	F	p
Experimental	152	14.67	4.12	1,206	2.20	.14
Control	55	13.73	3.83			

Note. Socio-economic status was calculated by summing education, occupation, and possession variables. The final variable ranges from 6 to 23 with 23 being high socio economic status.

Table 2

Socio-Economic Status: Experiment 2

Group	N	M	SD	df	F	p
Experimental	96	15.53	4.15	1,151	12.22	.001
Control	56	13.19	3.64			

Note. Socio-economic status was calculated by summing education, occupation and possession variables. The final variable ranges from 6 to 23 being high socio-economic status.

Experiment 1

Experiment 1 was a pre/post design with the pretest in February at the start of the school year and the posttest in October near the end of the school year. The tests were essentially the same and designed to establish general media use as well as knowledge and attitudes concerning environmental topics. The treatment was based on the teacher's manual, El Ambiente Y Yo, which has weekly lessons presented by the participating fifth-grade instructors. The tests were analyzed through an analysis of variance to determine whether there were significant differences.

The number of information questions correct in the posttest was analyzed using the number of information questions correct in the pretest as a covariate. Table 3 shows a significant difference in this score in the experimental group over that of the control group ($F = 14.79$ (1,206), $p = .001$). When this knowledge was analyzed by general media use in the three principal channels evaluated--newspapers, radio and television--the analysis showed no significant relationships.

To test attitude change, items from the Likert scales on the posttest were combined and tested for internal reliability with Cronbach's Alpha and Pearson Correlation. The results of this test are shown in Table 4. The

Table 3

Difference in Number Correct Between the Experimental and Control Groups: Experiment 1

Group	N	M	SD	df	F	p
Experimental	152	5.26	1.96	1,206	14.79	.001
Control	55	3.87	1.65			

Note. Possible correct ranged from 0 to 10 with 10 being the high score.

variable "water quality" showed a very low level of reliability and so was not utilized in the analysis. The variables "no impact," "no tree" and "forest value" show low correlation in a Pearson correlation. For this reason, they were also dropped from the analysis. This left the variables "forest condition" and "pro resources" with values high enough so that the indexes could be used. In a between groups analysis, controlling for the value in the pretest, both variables showed significant differences between groups at the .05 level: forest condition ($F = 4.90$ (1,206), $p = .03$), and pro resources ($F = 11.42$ (1,206), $p = .001$) (Table 5). Like the knowledge variable, no attitude variable showed significant values or values approaching significance when analyzed by media channels. In Experiment 1 the results indicate that general media use does not significantly influence the effects of formal education.

Experiment 2

Experiment 2 was an after-only design. The control group received a formal education unit followed by a test. The test evaluated attitudes, knowledge, and media exposure directly related to the formal education unit topic. The experimental group received the same formal education unit and test during the following week when it was supported by radio commercials and newspaper articles. The tests were analyzed through an analysis of variance to determine any

Table 4

Internal Reliability Within Attitude Variables

Variable	Reliability
Forest Condition	.57
1. Healthy forests are important for a better life	
2. We should plant a new tree for everyone we cut	
3. If we protect the forests, we won't have so many problems with water in the city	
Forest Value	.004
1. Forests and corn fields are equally important to all Hondurans	
2. If we destroy the forests close to our homes, we will make our families poorer	
Water Quality	.33
1. We cannot do anything to improve the quality of water	
2. The quality of water in Honduras is excellent	
3. It is not necessary to change the quality of water	
No Tree	.001
1. We need more firewood, not more trees	
2. There are so many trees in Honduras that we do not need to plant new ones	
Pro Resources	.49
1. The protection of Lake Yojoa is not important for my country	
2. It is my responsibility to help in protecting nature	
3. National parks are important for the protection of natural resources in Honduras	
No Impact	-.004
1. We cannot do much to improve our lives	
2. My level of life depends completely on me personally	

Note. Cronbach's Alpha was used to check reliability in variables made up of three questions. Pearson Correlation was used to check reliability in variables made up of two questions.

Table 5

Attitude Differences Between Groups

Variable	N	M	SD	df	F	p
Forest Condition						
Experimental	152	4.40	1.96	1,206	4.90	.03
Control	55	5.16	1.75			
Pro Resources						
Experimental	152	6.15	2.66	1,206	11.42	.001
Control	55	7.65	2.67			

Note. The range of scores for "forest condition" and "pro resources" was from 3 to 15 with 3 being strong agreement and 15 being strong disagreement.

Table 6

Percent Correct From Knowledge Question From Experiment 2

Variable		OA	EG	CG
9.	For each tree that we cut we should plant: A. nothing B. one more tree C. two more trees D. three more trees	28.9	39.6	10.7
10.	Forests detain water A. in rivers, reservoirs, and small lakes B. in the wind C. in organic material plants and the air in and above the forest D. in reality they do not detain water	38.2	27.1	57.1
11.	Organic material feels A. Sandy B. Spongy C. Hard D. Slick	73.0	75.0	69.6
12.	Forests capture and hold water, letting it go a little at a time so that we have water A. in the rainy season B. in the dry season C. in the summer D. all year	32.2	46.9	7.1
13.	Water A. evaporates from the leaves of plants B. stays in the plants forever C. only passes through the roots and nothing more D. does not enter the plants	69.7	71.9	66.1
14.	Forests capture and detain which of the things in the following list, so that it can be used throughout the year: A. soil b. water C. plants D. air	44.1	46.9	39.3
15.	The quantity of water that evaporates from the leaves of plants A. is insignificant B. disappears in the forest C. falls to the ground D. can cause clouds and rain	33.6	31.3	37.5
16.	Forests detain water A. in the soil B. in the soil and plants C. in the soil, plants and air D. in the soil, plants, air and wind	12.2	13.5	10.7

Note: OA = Overall, EG = Experimental Group, CG = Control Group

significant differences. The number correct for each subject was analyzed and no significant difference was found ($F = 2.85$ (1,131), $p = .09$).

The percent correct overall within the experimental group and within the control group for each variable is listed in Table 6 to see if any variables showed large discrepancies between groups. For variable 10 the percent right within the control group was more than double the percent right in the experimental group. This relationship is not repeated in any of the other variables. Variable 16 as a group shows lower percentages than the other variables. The test was re-examined to determine if these differences could be explained. It was found that there was a printing error on the questionnaire which made reading the correct answer for variable 10 difficult. Variable 10 was dropped from further analysis. Variable 16 had a different problem. Each possible choice consisted of a list of items made up of the previous choice plus an additional item. The choice most often selected was D which has the longest list. The correct choice, however, is C. Several teachers were independently consulted and agreed that the question was misleading. Therefore, variable 16 was dropped from further analysis. A new knowledge index was then created by combining variables 9 and 11 thru 15. Table 7 shows a significant difference for this new knowledge index between the experimental and control groups ($F = 11.74$ (1,130), $p = .001$).

Table 7

New Variable for Number Correct Between Groups

Group	N	M	SD	df	F	p
Experimental	83	3.60	1.18	1,130	11.74	.001
Control	48	2.68	1.15			

Note. The range of scores for the number correct was from 0 to 6 with 6 being the most correct.

This variable was then analyzed by recalled exposure to the formal education unit topic from newspapers, radio, or television. No significance was shown between the recalled media exposure and the number correct on the test.

Of the attitudes tested in this experiment, only two showed significant differences between the experimental group and the control group. They were variable 1--"we need healthy forests in order to have water" ($F = 17.35$ $(1,135)$, $p = .001$)--and variable 4--"we do not have the responsibility to plant two trees when we cut one" ($F = 10.16$ $(1,135)$, $p = .002$) (Table 8). Tables 9 and 10 show that of these two, variable 1 ($F = 2.03$ $(4,135)$, $p = .09$) and variable 4 ($F = 2.60$ $(4,135)$, $p = .04$) only one was significantly related to media exposure.

The grouping of attitude variables was attempted but no reliability was found in any of the possible groupings. None of the variables other than 1 and 4 approached significance. Experiment 1, intended to test the influence of general media use on the effects of formal education, did not support the first hypothesis. However, experiment 2, intended to show that a coordinated media campaign combined with formal education influences attitudes and knowledge beyond the impact of general media use, provided partial support for the second hypothesis.

Table 8

Attitude Variables 1 and 4 Between Groups

Group	N	M	SD	df	F	p
Variable 1: We need healthy forests in order to have water.						
Experimental	87	1.16	.50	1,135	17.35	.001
Control	49	1.96	1.47			
Variable 4: We do not have the responsibility to plant two trees when we cut one.						
Experimental	87	1.95	1.19	1,135	10.16	.002
Control	49	2.94	1.49			

Note. The range of scores for attitude variables was 1 to 5 with one being strong agreement and 5 being strong disagreement.

Table 9

Attitude Variable 1 by Media Exposure:

We Need Healthy Forests to Have Water

Media Exposure	N	M	SD	df	F	p
0	4	2.5	1.9			
3	12	1.42	1.17			
4	26	1.27	.87			
5	61	1.30	.78			
6	33	1.76	1.30			
				5,135	2.03	.09

Note: The range for attitude variables was 1 to 5 with 1 being strong agreement and 5 being strong disagreement.

Table 10

Attitude Variable 4 by Media Exposure:
We Do Not Have the responsibility to Plant Two Trees When We Cut One

Media Exposure	N	M	SD	df	F	p
0	4	2.0	.82			
3	11	2.33	1.50			
4	26	1.77	1.14			
5	61	2.25	1.30			
6	33	2.88	1.58			
				5,135	2,60	.04

Note. The range of values for attitude variables was 1 to 5 with 1 being strong agreement and 5 being strong disagreement.

VI Conclusions and Recommendations

Two hypotheses were proposed for this thesis, but the experiments only supported one.

Although students in the experimental group in Experiment 1 performed much better than those in the control group, their performance was not related to general media use. This is not to say that performance in formal education is definitely not related to general media use, however. Calculating the variables relating to media use proved to be difficult. Because of difficulties experienced by the students in evaluating their exposure to media and personal sensitivity regarding questions concerning family members, the questions relating to the number of hours a radio or television was used and the percent of literate family members in each household were dropped from the pretest. These questions were redesigned for the posttest and the students found them easier to answer. Only the questions from the posttest were used to determine media exposure. Even without the difficulties experienced, the posttest better represents individual media use since the test was given near the end of the school year rather than near the end of vacation.

The questions even in the posttest form seemed difficult for some. However, students were assisted in this part of the survey and the results represent media use fairly well. This indicates that, if there is a

relationship between general media use and education, that relationship is very weak, and in this study proved insignificant.

Of the five attitudes used in the analysis, two showed a strong difference between the experimental and control groups. These were questions which emphasized the relationship between healthy forests and the quality of responsibility of one's life (forest condition), and questions which emphasized the importance of protecting natural resources (pro resources). These variables treat attitudes addressed during National Tree Week and International Earth Day in May and June. During this time a media and in-class awareness campaign is supported by the National Forest Development Agency (COHDEFOR) and the General Directorate of Renewable Natural Resources (RENARE). The media campaign consists mostly of increased frequency of the COHDEFOR commercials and some television commercials sponsored by private industry. The in-class component involves a large percentage of RENARE employees in classroom visits, slide show presentations, and guest speaking engagements in many of the schools in the capital. This comes at a time when the students who follow with their teacher El Ambiente Y Yo should have been beginning the lessons over ecosystems. In these lessons the quality and importance of forests as well as other natural resources is mentioned in the form of examples and explanations.

The added information from the awareness campaign may have reinforced the lessons being taught at the time and, for this reason, these attitudes showed more change. Upon closer analysis of the variables which show significance, the questions for the variables "forest condition" and "pro resources" treated directly themes that emerged from the National Tree Week and International Earth Day campaign.

During this short campaign, most formal class time was dedicated to environmental topics or preparation for the parade and fair on the June 5 Earth Day. Because of the week's intensity, it became a memorable event and some of its lessons, if reinforced, might also have become memorable. This one-week campaign in May and June was not included in the survey, but it is the only event outside of the media that could have had an effect on environmental knowledge or attitudes other than the effect of the teacher's manual itself.

In Experiment 1 the lessons from the teacher's manual changed some attitudes while failing to change others. General media use failed to show a relationship to any attitude or knowledge change. Other than the possible effect from National Tree Week, all of the differences between the experimental group and the control group in Experiment 1 in both attitudes and knowledge are the result of the lessons from the teacher's manual, <u>El Ambiente Y Yo.</u>

In Experiment 2, on the other hand, media showed some influence on both attitudes and knowledge. The education unit was planned as the base for a small education campaign. Adding the media messages to the formal education expanded the educational information to include more information channels and passed related and supportive messages through those channels.

While Experiment 1 shows a significant positive change from a formal education program designed within the limitations of a specific group represented here by ten Honduran public schools, it fails to show that general media use is related to that change. It does, however, leave open the possibility that the campaign for National Tree Week and International Earth Day had an effect on attitude change because of its coincidence with the topics in the teacher's manual. If this is true, it supports the findings of Experiment 2 which take the same formal education format and add a minor media campaign to support the formal education topic. Media in this role show some influence on performance in formal education. This finding is consistent with the Sesame Street and Plaza Sesamo studies (Cook & Conner, 1976; Diaz-Guerrero et al., 1976; Liebert, 1975) mentioned earlier. However, where these studies incorporated interpersonal communication as well as support material to increase the impact of a media program, the present study utilizes a media program to increase the impact of formal education and more specifically shows how

a media campaign can increase the impact of formal education. This underscores the need for cooperation between formal educational entities and their non-formal educational counterparts, the mass media. Through a cooperative program, media and education could coordinate a series of topics that both could follow throughout the year.

This study endorses the use of media to support formal education, and it also shows that theory generated in a controlled setting also works in the field. In this study most of the problems encountered were the result of the dynamics of a school setting and teachers managing an unsupervised course of study which served as the base for the experiments. This loose control of the treatment led to the situation where some teachers advanced through the series of lessons faster than others. Some teachers found themselves obligated to give less coverage to later topics in the manual which may have limited significant findings in those attitudes. The study, however, represents a realistic situation and the only problem worth mentioning is the difficulty fifth-grade students have in relating their use of media through survey style questions. Sensitive data collection about media exposure needs to be done almost on a one-to-one basis, which can be extremely time consuming. For this study, the problem was overcome by verbally asking each student specific questions from the

test after it was turned in. This verbal answer was compared to the answer on the test. This procedure was needed to check understanding and validity of the responses from each student. Data collected in the pretest dealing with radio and television exposure, family literacy, and occupation of parents' were disregarded as a result of this difficulty in understanding. These questions were reworded and, in the case of the questions on parents occupation, repositioned in the test to increase reliability. Only the data from the posttest for these questions were used in the analysis.

Several doors leading to other experiments were opened by this study. All would help environmental education through media in developing countries. Examples of these would be to add a group to the design for Experiment 2. This group would receive media alone to see if a well-planned and executed media campaign can approach formal education in influencing knowledge and attitudes. Along with this, one could test if media campaigns not coordinated with formal education, can, nevertheless influence education in general or specific topics. One final study relating to formal education with importance to developing countries would be to test if media can effectively deliver formal education units as part of an education campaign.

Both of the experiments in this study combined media or a media campaign with formal education. However, as

mentioned in Chapter II, everyone needs to be reached by environmental education. The proposed media campaign from Chapter IV suggests some possible ways to reach other groups whose members are not part of the formal education system. Each group would need to have a part of the campaign aimed directly at their own needs and interests. If campaign components were centered on the same idea or topic, then there would be re-enforcement between them since it has been shown that individuals, even if not exposed to campaign material, learn campaign information through the two-step flow of information (Brown, 1970; Rogers, 1962). This could be tested by adding one more group to the design of Experiment 2. This group would consist of the school's community members. Testing parents, relatives, friends, and strangers on their awareness of the campaign topics would give an indication of how far into the community campaign information can flow.

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Appendix A

List of objectives from *El Ambiente y Yo*

List of Objectives from El Ambiente y Yo

Following is the list of 40 objectives contained in the curriculum plan El Ambiente y Yo. This plan has been approved by a curriculum committee established by the Ministry of Education in Honduras and was utilized by this experiment during the 1985 school year which began February 20, 1985, as the formal education component.

1. That students begin to see a relationship between a flower that grew thousands of years ago and a bus in the city today?
2. That students put themselves in contact with their environment.
3. That students develop a definition for environment.
4. That students learn the basics of the water cycle.
5. That students see a water cycle in action.
6. That students see the movement of water in a plant.
7. That the students learn specifics over the transportation of minerals by water.
8. That students receive an introduction to the importance of air in the environment.
9. That students have a better understanding of the production of oxygen and sugar in plants.
10. That students see the production of oxygen by the plant.
11. That students learn specifics about soil construction.

12. That students have an idea about how soil is made and the importance this has in the environment.
13. That students learn how to protect soil against erosion.
14. That students have a better idea about the position of living things in the ecosystem and their relation in the food pyramid.
15. That students learn the relations in the food pyramid.
16. That students can identify physical adaptations in animals.
17. That students experience their own dependence on sight and personal adaptation of the other senses to better understand adaptations in nature.
18. That students comprehend the most important difference between energy and minerals.
19. That students see the effect of different energy contents in light of various intensities.
20. That students can describe the path of energy as it passes through our earth's system.
21. That students understand what is an ecosystem.
22. That students learn and see various components and processes of an ecosystem through the use of an artificial ecosystem.
23. That students discuss their observations of the artificial ecosystem.
24. That students recognize problems in the ecosystems which make up the natural environment.

25. That students know the steps of development of an ecosystem.
26. That students know the principal ecosystems of Honduras.
27. That students express their feelings about the environment with poems and drawings.
28. That students recognize the relationship and dependency of man on the ecosystem.
29. That students see the dependency that exists between members of the cultural web.
30. That students learn the destination, origin, and social costs of the things they use in daily life.
31. That students better understand the relationship between environmental planning and the frequency and severity of environmental problems and disasters.
32. That students realize a graphic illustration which shows the accumulative effects of environmentally unsound practices compared to those of environmentally sound practices.
33. That students learn what is environmental pollution.
34. That students learn how contaminants disperse in the environment.
35. That students define what is garbage and understand their relationship to it.
36. That students construct a compost pile and observe the difference between organic waste and inorganic waste.

37. That students experience the difficulty in providing basic needs for today while conserving resources for tomorrow.
38. That students analyze their lifestyles and name themselves as "wasters" or "savers" and realize what this means for the environment.
39. That students experience different population densities and their relation to natural resources.
40. That students see their personal values and how they relate to the world and the environment.

Appendix B

Test for Experiment 1:

English and Spanish

QUESTIONS OVER YOUR ENVIRONMENT

School _____

Student _____

Teacher _____

INSTRUCTIONS: Fill in the space the answer that applies:

1. I am ___ years old.
2. What does your father do _____
3. What does your mother do_____
4. I listen to the radio how many hours each day?

Sat	Sun	Mon	Tues	Wed	Thurs	Fri
_____	_____	_____	_____	_____	_____	_____

5. I watch T.V. the number of hours indicated below;

Sat	Sun	Mon	Tues	Wed	Thurs	Fri
_____	_____	_____	_____	_____	_____	_____

6. How many people in your family can read the newspaper? ____
7. How many people are there in your family? _____

INSTRUCTIONS: Circle the letter that is the correct answer for you.

8. I read the newspaper:
   a. Less than once a week.
   b. One or two times a week.
   c. Three times a week.
   d. Four or five times a week.
   e. Six or more times a week.

9. My family listens to the radio:
   a. Never.
   b. Sometimes.
   c. Frequently.
   d. Always.
10. My family watches television:
   a. Never.
   b. Sometimes.
   c. Frequently.
   d. Always.
11. Someone in my family reads the newspaper:
   a. Less than once a week.
   b. Once or twice a week.
   c. Three times a week.
   d. Four or five times a week.
   e. Six or more times a week.
12. I talk about what I read in the newspaper with my family and friends:
   a. Never.
   b. Sometimes.
   c. Frequently.
   d. Always.
13. I talk about what I hear on the radio with my family and friends:
   a. Never.

b. Sometimes.

c. Frequently.

d. Always.

14. I talk about what I see on television with my family and friends:

a. Never.

b. Sometimes.

c. Frequently.

d. Always.

15. My father:

a. Never went to school.

b. Went only until the third grade.

c. Went only until the sixth grade.

d. Finished high school.

e. Studied at the University.

16. My mother:

a. Never went to school.

b. Went only until the third grade.

c. Went only until the sixth grade.

d. Finished high school.

e. Studied at the University.

17. Does your family have a radio? Yes ___ No ___

18. Does your family have a televion? Yes ___ No ___

19. Does your family have a car? Yes ___ No ___

INSTRUCTIONS: According to the following table of values, put an "X" beside the number that corresponds to your opinion:

1. Strongly Agree.
2. Agree.
3. No opinion.
4. Disagree.
5. Strongly disagree.

20. Healthy forests are important for a better life:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

21. We need more firewood not more trees:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

22. We can't do anything to improve the quality of water:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

23. Forests and corn fields are equally important to all Hondurans:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

24. The quality of water in Honduras is excellent:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

25. Agriculture is more important than forests:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

26. It isn't necessary to change the quality of water:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

27. We should plant a new tree for every one that we cut:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

28. If we protect the forests, we won't have so many problems with water in the city:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

29. There are so many trees in Honduras that we don't need to plant new ones:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

30. If we destroy the forests close to our homes, we will make our families poorer:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

INSTRUCTIONS: Circle the answer you believe is correct.

31. The responsibility to protect the soil, water, plants, animals, and to keep Honduras clean, belongs to:

    a. The poor.

    b. The rich.

    c. Everybody.

    d. The Government.

32. The environment is:

    a. The plants and animals.

    b. The city.

    c. Everything that surrounds us.

    d. The natural resources.

33. The air, water, soil, plants, animals, and energy are:

    a. Products of mans work.

    b. Natural resources.

    c. Products of the culture.

    d. Non-natural resources.

34. The ecosystem is:

    a. Plants, animals and soil.

    b. Air, water and energy.

    c. Includes everything except energy.

    d. Includes air, water, plants and animals, soil and energy.

35. Ecosystems supply us with:

    a. Clean water.

    b. Oxygen.

    c. Our natural resources.

    d. All of the above.

    e. None of the above.

36. Everything we use:

    a. Is man made.

    b. Is bought in stores.

    c. Comes from ecosystems.

    d. Comes from the soil.

37. Natural disasters:

    a. Can be less dangerous if we plan against them.

b. Can be more dangerous if we plan against them.

c. Are not important.

d. Don't happen anymore.

38. Non-organic garbage:

a. Doesn't damage nature.

b. Is not important.

c. Damages nature.

d. Exists only in rivers.

39. The economy:

a. Depends on natural resources as a base.

b. Depends on banks.

c. Depends on the cities.

d. Is independent of everything.

40. Over population:

a. Helps the economy.

b. Uses many resources.

c. Is good for agriculture.

d. Uses few resources.

41. Organic garbage:

a. Has no value.

b. Can be used for compost.

c. Doesn't cause any problem.

d. Doesn't decompose in the soil.

INSTRUCTIONS: According to the following table of values, put an "X" beside the number that corresponds to your opinion:

1. Strongle Agree.
2. Agree.
3. No opinion.
4. Disagree.
5. Strongly disagree.

42. The protection of Lake Yojoa is not important for my country:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

43. We cannot do much to improve our lives:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

44. Natural resources are abundant:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

45. I prefer to do things like I always have instead of change with new ideas:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

46. It is my responsibility to help in protecting nature.

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

47. There are no limits for the restoration of natural resources:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

48. If we are not careful with our natural resources, we can deplete them:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

49. Tree planting is the responsibility of the Government:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

50. My level of life depends completely on me personally:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

51. National parks are important for the protection of the natural resources of Honduras:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

PREGUNTAS SOBRE SU AMBIENTE

Nombre Escuela _____

Nombre Alumno _____

Nombre Profesor _____

INSTRUCCIONES: Llene el espacio en blanco con la respuesta de acuerdo a la realidad:

1. Tengo ___ años.
2. Escucho la radio en las horas indicadas abajo, de acuerdo a los días escritos:

____	_____	_____	_____	_____	____	_____
Sab	Domin	Lunes	Mrts	Mierc	Juev	Viernes

3. Veo televisión en las horas indicadas abajo, de acuerdo a los dias escritos:

___	_____	_____	____	_____	____	_____
Sab	Domin	Lunes	Mrts	Mierc	Juev	Viernes

4. ¿Cuántas personas en su familia pueden leer el periódico? _____
5. ¿Cuántas personas en su familia tienen 6 años o más de 6 años? _____

INSTRUCCIONES: Encierre en un círculo, la letra que contenga la respuesta adecuada para usted:

6.- Leo los periódicos:

a. Menos que una vez a la semana.

b. Una o dos veces a la semana.

c. Tres veces a la semana.

d. Cuatro o cinco veces a la semana.

e. Seis o más veces a la semana.

7.- Mi familia escucha la radio:

a. Nunca.

b. A veces.

c. Frecuentemente.

d. Siempre.

8.- Mi familia ve televisión:

a. Nunca.

b. A veces.

c. Frecuentemente.

d. Siempre.

9.- Alguien en mi familia lee los periódicos:

a. Menos que una vez a la semana.

b. Una o dos veces a la semana.

c. Tres veces a la semana.

d. Cuatro o cinco veces a la semana.

e. Seis o más veces a la semana.

10.- Comento lo que leo en el periódico con mi familia y mis amigos:

a. Nunca.

b. Ocasionalmente.

c. Frecuentemente.

d. Siempre.

11.- Hablo con mi familia o amigos sobre lo que oigo en la radio:

a. Nunca.

b. Ocasionalmente.

c. Frecuentemente.

d. Siempre.

12.- Hablo con mi familia o amigos sobre lo que veo en la televisión:

a. Nunca.

b. Ocasionalmente

c. Frecuentemente.

d. Siempre.

13.- Mi padre:

a. Nunca fué a la escuela.

b. Sólo fué hasta el III Grado (Tercer Grado)

c. Sólo fué hasta el VI Grado (Sexto Grado).

d. Terminó el Ciclo Común.

e. Terminó estudios en la Universidad.

14.- Mi Mamá:

a. Nunca fué a la escuela.

b. Sólo fué hasta el III Grado (Tercer Grado).

c. Sólo fué hasta el VI Grado (Sexto Grado):

d. Terminó el Ciclo Común.

e. Terminó estudios en la Universidad.

15.- ¿Cuál es el trabajo de su papá? _____

16. ¿Cuál es el trabajo de su mamá? _____

17.- ¿Tiene su familia un radio? Sí ___ No ___

18.- Tiene su familia un televisor? Sí ___ No ___

19.- Alguien en su familia tiene carro? Si ___ No ___

INSTRUCCIONES: De acuerdo con la siguiente tabla de valores, coloque una "X" en el número que corresponde, según su opinión:

1. Estoy totalmente de acuerdo.
2. De acuerdo.
3. No tengo opinión.
4. No estoy de acuerdo.
5. Totalmente en contra.

20. La buena salud de los bosques, es importante para que nuestras vidas sean mejores:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

21. Necesitamos más leña, no más árboles:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

22. No podemos hacer nada para mejorar la calidad del agua:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

23. Los bosques y las siembras de maiz son igual en importancia para todos los Hondurenos:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

24. La calidad del agua en Honduras es excelente:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

25. La agricultura es más importante que los bosques:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

26. No es necesario hacer cambios en la calidad del agua:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

27. Debemos sustituir cada arbol, plantando uno nuevo:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ____

28. Si cuidamos los bosques, no tendremos tantas problemas con el agua de la ciudad:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

29. Hay tantas arboles en Honduras que no necesitamos plantar nuevos:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

30. Si destruimos los bosques cercanas a nuestras casas, haremos nuestras familias mas pobres:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

INSTRUCCIONES: Encierre en un círculo, la respuesta que considere correcta:

31. La responsabilidad de proteger el suelo, agua, planta, animales y mantener a Honduras limpia, es de:

a. Los pobres.

b. Los ricos.

c. Todos.

d. El Gobierno.

32. El ambiente es:

a. Las plantas y los animales.

b. La ciudad.

c. Todo lo que nos rodea.

d. Los recursos naturales.

33. El aire, agua, suelo, plantas, animales y energía, son:

a. Productos del trabajo del hombre.

b. Recursos Naturales.

c. Productos de la cultura.

d. Recursos no naturales.

34. El Ecosistema es:

a. Plantas, animales y suelo.

b. El aire, agua y energía.

c. Incluye todo, menos la energía.

d. Incluye aire, agua, seres vivos, suelo y energía.

35. El ecosistema nos abastece de:

a. Agua limpia.

b. Oxigeno.

c. Nuestros recursos naturales.

d. Todo lo anterior.

e. Nada de lo anterior.

36. Todo lo que usamos:

a. Es hecho por el hombre.

b. Es comprado en tiendas.

c. Viene del ecosistema.

d. Viene del suelo.

37. Los desastres naturales:

a. Pueden ser menos peligrosos, si planificamos contra ellos.

b. Pueden ser más peligrosos, si planificamos contra ellos.

c. No son importantes.

d. No ocurren más.

38. La basura no orgánica:

a. No daña a la natualeza.

b. No tiene importancia.

c. Daña a la naturaleza.

d. Existe solamente en los ríos.

39. La economía:

a. Depende de los recursos naturales como base.

b. Depende de los bancos.

c. Depende de las ciudades.

d. Es independiente de todo.

40. La sobrepoblación:

    a. Ayuda a la Economía.

    b. Usa muchos recursos.

    c. Es bueno para la agricultura.

    d. Usa pocos recursos.

41. La basura orgánica:

    a. No tiene valor.

    b. Puede ser utilizada para hacer abono.

    c. No causa ningún problema.

    d. No se deshace en el suelo.

INSTRUCCIONES: De acuerdo con la siguiente tabla de valores, coloque una "X" en el número que corresponde, segun su opinión:

1. Estoy totalmente de acuerdo con todo.
2. De acuerdo.
3. No tengo opinión.
4. No estoy de acuerdo.
5. Totalmente en contra.

42. La protección del Lago de Yojoa no es importante para mi pais:

    1. ___ 2. ___ 3. ___ 4. ___ 5.___

43. No podemos hacer mucho para mejorar nuestras vidas:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

44. Los recursos naturales son abundantes:

    1. ___ 2. ___ 3. ___ 4. ___ 5. ___

45. Prefiero hacer las cosas como las he hecho siempre, en lugar de cambiar con las ideas nuevas.

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

46. No es mi responsibilidad ayudar a proteger la naturaleza:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

47. No hay límites para la restauración de los recursos naturales.

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

48. Si no tenemos mucho cuidado con el uso de nuestros recursos naturales, terminamos con ellos:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

49. Es responsabilidad del Gobierno la siembra de los arboles:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

50. Mi nivel de vida depende únicamente de mi persona.

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

51. Los parques nacionales son importantes para la proteccion de los recursos naturales en Honduras:

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

Appendix C

Campaign Materials and Test for Experiment 2: English and Spanish

RADIO COMMERCIAL

Jaime: Jorge, let's cut this tree down for firewood.

Jorge: O.K., I'll get a couple of trees to plant in its place.

Jaime: What for? All we need is the firewood.

Jorge: Don't you know how important the forest is? If we protect the forest and plant more trees when we cut, we will be protecting our water supply. That way we guarantee water and firewood for our children. Let's work together to protect the forests.

Rosa: Roger, do you know where our water comes from?

Roger: No, but I know it tastes good on a hot day.

Rosa: If you like water so much, then you should know that the forests capture it, then they hold it in the soil and plants so we can use it in the dry season.

Roger: Then a healthy forest means clean drinking water, right?

Rosa: That's right, Roger. Let's all work together to protect our forests and water.

Papa: Carmen, do you know what this is?

Carmen: That's just dirt, Papa.

Papa: No Carmen, this is called organic material. We find it on the forest floor. It is made from leaves and plant parts that fall from the trees and decompose. Feel it.

Carmen: Ooh, it feels soft and spongy.

Papa: That's right. That's one way that a forest stores water for us.

Carmen: Then it's pretty important to protect the forest, isn't it, Papa?

Papa: Yes, Carmen. If we work together to protect the forest, we will also be protecting the water.

ANUNCIOS RADIALES

Jaime: Mire este arbol, esta buena para lena!

Jorge: Vaya pues. Voy a traer un par de arboles para sembrar en su lugar.

Jaime: Para que? Solo necesitamos la lena!

Jorge: Que no sabes lo importante que es el bosque? Si lo protegemos y sembramos nuevos arboles cuando los cortamos, estaremos protegiendo nuestras fuentes de agua y asi garantizamos agua y lena para nuesrtros hijos. Debemos de trabajar juntos para proteger nuestras bosques!

Rosa: Roger, sabes de donde viene el agua que tomamos?

Roger: No, pero que bueno es cuando tenemos calor.

Rosa: Si tanto te gusta el agua, deberias de saber que cuando llueve, los bosques ayudan a retener el agua en el suelo y las plantas y la deja suelta poco a poco, para que tengamos agua todo el ano.

Roger: Entonces los bosques sanos se necesitan para tener agua limpia, verdad?

Rosa: Asi es, Roger, y entre todos podemos proteger nuestos bosques y el agua.

Papa: Carmen, sabes que es esto?

Carmen: Es tierra, Papa, nada mas.

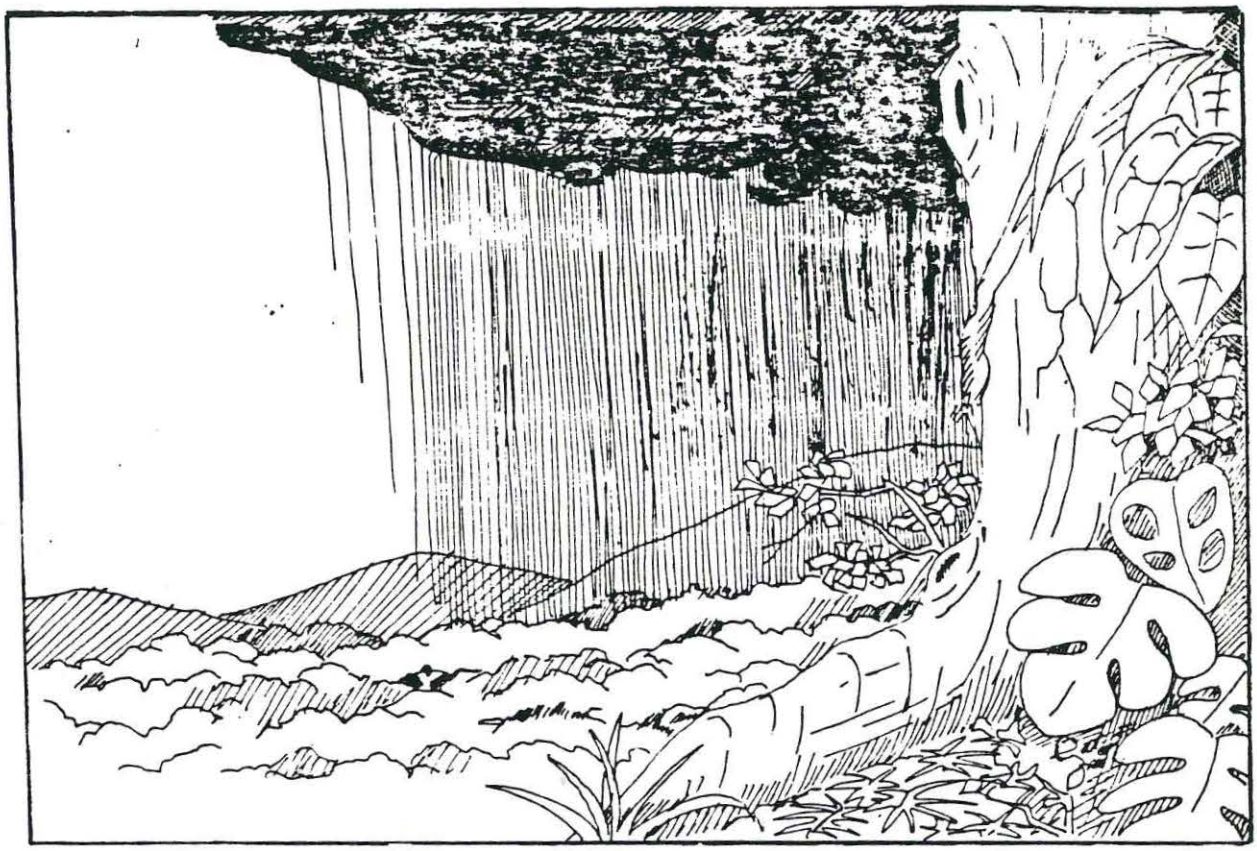
Papa: No Carmen, Esto se llama materia organica y la puedes encontrar en el suelo de los bosques. Esta materia viene de las hojas y ramas que caen de los arboles y se descomponen. Tocala.

Carmen: Ooh, se sienta suave y esponjosa, Papa.

Papa: Asi es. Es una de las formas en que el bosque retiene el agua para nosotros.

Carmen: Entonces Papa, es muy importante proteger los bosques, verdad?

Papa: Claro. Entre todos podemos proteger los bosques y asi tambien estaremos protegiendo el agua.



Newspaper Graphic

NEWSPAPER ARTICLE

Giant Sponge Saves Water for Tegucigalpa

Every year Honduras has a rainy season and a dry season. The heaviest rains come in June and the driest months are March and April. Because of several months without rain, April is when Tegucigalpa has most of its water problems. But even in April the rivers aren't completely dry. Where does the water come from if it hasn't rained in several months? The answer is from the forest. A forest is one of nature's marvels. More than just a bunch of trees, a forest is a system that works to capture water when it rains and release it slowly during the dry season. You might ask yourself how a forest can capture and hold water.

Throughout the year leaves fall from the trees. These leaves fall to the ground and begin to decompose. Decomposition releases the minerals used in the plant when it was growing. This decomposing plant material forms a soft spongy layer of mineral-rich organic material. When the rain falls, the water is absorbed by the organic material and held from running rapidly down the mountain. Instead, it dissolves some of the minerals in the organic material and is absorbed by the plants.

The plants use the water to move minerals and chemicals from the roots to the leaves and from the leaves to the roots, much like our bodies use blood to carry chemicals

from one part to another. Much of the water in the plant escapes or evaporates from the leaves. This water fills the air in and above the forest with water vapor. Sometimes, this vapor will form clouds and may even rain on the forests, so we have three ways in which a forest captures and holds water for us to use during the dry season. First, in the organic material on the ground; second, inside the plants; and third, in the air in and above the forest. If we cut our forests we will lose this system that holds water and we will lose the water that we use in the dry season.

In the Directorate of Renewable Natural Resources we are fortunate enough to have people who understand the importance of forests for supplying our water. In 1979 they established La Tigra National Park to protect the forest that supplies almost half of the water for Tegucigalpa. But still today, there are people who continue to cut or burn the forests without ever thinking of planting new trees. Many educated people say that for every tree we cut, we should plant two. This will help to guarantee that we will have large forests in the future and, because we have forests, we will have water. So, let's everybody work together to help protect the giant sponge that gives water to Tegucigalpa. Plant a tree and protect it while it grows.

ARTICULO PARA EL PERIODICO

Una Esponja Guarda el Agua de Tegucigalpa

Cada ano Honduras tiene su epoca de lluvia y su epoca seca. Las lluvias mas fuertes llegan en Junio y los meses mas secos son Marzo y Abril. Por haber pasado varios meses sin lluvia, Abril es cuando Tegucigalpa tiene mas problemas con el agua. Aun en Abril, los rios no estan completamente secos. De donde viene el agua si no ha llovido por varios meses? La respuesta es de los bosques.

Un bosque es una maravia natural, mas que solo una coleccion de arboles, un bosque es un sistema que captura el agua de la epoca lluviosa y la deja suelta en la epoco seca. Tal vez te preguntastes a ti mismo, como es que un bosque puede capturar y detener el agua? A traves del ano las hojas, ramas, y ramitas se caen de los arboles. Estas hojas y ramitas caen al suelo y empiezan a descomponerse. El proceso de descomposicion deja sueltos los minerales utilizados por la planta durante su crecimiento. Estas plantas en vias de descomposicion, forman una capa de materia suave, esponjosa, y rica en minerales. Esta materia se llama materia organica. Cuando viene la lluvia, el agua es absorvida por la materia organica y detenida en su rapida corrida hacia abajo de la montana. A la vez se van disolviendo los minerales de la materia organica para ser re-absorvida por las plantas. Las plantas utilizan el agua

para transportar minerales y quimicos desde las raices hasta las hojas y desde las hojas hasta las raices, en forma muy paracida a la forma en que nuestros cuerpos usan la sangre para transportar quimicos de una parte a otro. Una gran parte del agua se escapa o se evapora de las hojas. Esta agua llena el aire adentro y arriba del bosque con vapor. A veces, este vapor forma nubes o hasta lluvias en el bosque. Entonces tenemos tres formas en que los bosques captura y detiene el agua para que nosotros la podemos utilizar en la epoca seca: En la materia organica en el suelo, dentro de las plantas, en el aire dentro y arriba del bosque en las nubes y en la lluvia. Si cortamos nuestros bosques perderiamos el sistema que detiene el agua y tambien perderiamos el agua que usamos durante las epocas secas.

En la Direccion General de Recursos Naturales Renovables somos afortunados al tener gente que entiende la importancia de los bosques y su relacion con el abastecimiento de agua. En 1979, ellos establecieron el Parque Nacional "La Tigra" para proteger el bosque que abastece de casi la mitad del agua a Tegucigalpa, pero aun hoy, algunas personas siguen cortando y quemando los bosques sin pensar en sembrar nuevos arboles.

Muchas personas que conocen dicen que por cada arbol que cortamos debemos de sembrar dos mas. Esto nos ayudaria a garantizar que tendremos bosques grandes en el futuro y por los bosques tendriamos agua. Entonces, integremonos a todas

las personas que trabajan juntos ayudando a proteger esa esponja grande que abastece el agua de Tegucigalpa.

Sembremos arboles y protejamoslos mientras crezcan.

FORMAL EDUCATION UNIT

Forests and Water

Objective: That the student better understand the relationship between the forests and the water available to him throughout the year.

Lecture: We've heard before that the water throughout the year is directly related to forests. How is it related? What would happen to our water supply if we cut the forests?

The water we use in our homes is collected in natural areas called watersheds. These areas work in two different ways. One is like a funnel, the ridges in the mountains are like the top of the funnel and where the river comes out is like the bottom of the funnel. The rain falls on all parts of the watershed and, in the same way that the water runs down to the center of the funnel so that it all comes out at the same place, the drops of rain water in our watershed run downhill joining with other drops to form first rivulets, then creeks, and finally streams and rivers. If there were no plants in our watershed, the water would run down the hillsides to the streams and rivers and flow away very fast. Soon after the rain stopped, the rivers would be dry again and the whole watershed would

soon dry under the hot sun. But if our watershed is full of plants and trees, something else happens. This forest acts like a large sponge to capture the water from the rain and keep it from flowing away so fast. This is the second way in which our watershed works.

* Where do you think the forest holds the water?
* If you have plants in your house, what does your mother have to give them so that they live?
* What do the plants do with the water?
* What do you always find under a tree in the forest?
* What happens to these leaves?

A forest acts like a sponge in three ways. First, when leaves fall on the ground, they begin to decompose. This leaves a layer of organic material on the ground. Organic material is made up of the minerals that were in the leaves when they fell from the trees. When the leaves decompose, these minerals can be used as food by new plants. Leaves are always falling off the trees in the forest and new plants are always using the organic material. So, on the ground in the forest, called the forest floor, we always

have a layer of organic material covered with dry leaves. This layer is very soft and actually functions like a giant sponge to capture the rain water and keep it from flowing away. Second, we have all the new plants that are going to use the minerals in the organic material.

* How do you think plants bring the minerals from the organic material into their systems?

The water that is held by the spongy forest floor dissolves the minerals in the organic material. This water, with small amounts of minerals, is trapped by the roots of the plants and absorbed into the plant. The water carries the minerals up the plant where it is used in growing and then the water evaporates from the green leaves. The water that evaporates from the plant helps to cool the air and sometimes it will even form clouds and rain on the forest again. So, we have three areas where a forest stores water. They are: the organic material on the forest floor, the water being used inside the plants, and the air in and above the forest. The water captured by the forest escapes to the rivers little by little, so that even after the rains stop there will be water in the rivers for us to use in our towns. Without healthy forests to

capture the water, the rivers would flood when it rains and dry up when the sun shines. So it is important to protect the forests, because they capture water from the rain and let it out a little at a time so that we have water all year

Organic Material

Objective: That the students see how organic material acts like a sponge by holding water.

Material: Two cups or glasses of the same size (any two small containers of the same size will work; e.g., two empty cans with the ends removed. Be sure that there are no sharp edges).
Some dry organic material (gather the soft surface soil found below plants and trees. In it you should find mostly leaves, small twigs and other plant parts in decomposition.)

Activity: START THIS ACTIVITY BEFORE GIVING THE LECTURE
Spread the organic material on an open page of newspaper and have the students come up to examine it.

* What does it have in it?
* What does it feel like?
* What does it smell like?

Make a list of the students' answers on the board. Now fill the first container with the organic material and the second with water. Fill them to the top. Poor water from the second container into the first until it fills to the top. Now you have one container with organic material and water to the top and another with some left over

water. Set the two containers on the shelf and give the lecture while you wait.

When you finish with the lecture, bring the containers back. Pour the water from the first can back into the second can. Be sure to hold the organic material from falling out with your fingers. Remember that when you started, the second can was full to the top with water.

* Is it full now?
* Where is the rest of the water from the second can?

Have the students touch the organic material in the first container.

* How is it different from before?

(The next step is messy so you should move outside or put newspaper or a trash can under your hands to avoid a mess). Take some of the organic material from the first container and squeeze it as you would a sponge to see if you can squeeze some of the water from it.

The forest floor is covered with organic material like that used in the experiment. When it rains, this organic material absorbs the water and lets it out a little at a time.

* If we did not have the forests, would we still have the organic material on the ground to capture the water?
* Why not?

Organic material comes from leaves, twigs and other parts of forest plants.

UNIDAD FORMAL

Bosques y Agua

Objectivo: Que el estudiante entiende mejor la relacion entre los bosques y el agua disponible a el durante el ano.

Charla: Hemos oido muchas veces que el agua durante el ano, tiene una relacion directa con los bosques.

* Como es esta relacion?
* Que pasaria con nuestra suministro de agua si cortamos los bosques?

El agua que usamos en nuestros hogares es recogida en areas naturales que se llaman cuencas. Estas areas funcionan en dos formas differentes: una es como embudo, las cimas de las montanas representan la parte de arriba del embudo y donde salen los rios representa la parte de abajo del embudo. La lluvia cae en todas partes de la cuenca y en la misma forma en que el agua corre al centro del embudo para que pueda salir en el mismo punto, las gotas de lluvia en nuestra cuenca corren hacia abajo, juntandose con otras gotas y formando riachuelas, rios pequenos y finalmente, rios grandes. Si no hubieron las plantas en las cuencas, el agua correria hacia abajo en los rios y se iria saliendo de la cuenca con rapidez. Muy pronto despues de la lluvia,

los rios estarian secos otra vez y toda la cuenca se secaria pronto abajo del sol; pero si nuesta cuenca esta llena de plantas y arboles, pasaria otra cosa.

El bosque funciona como una esponja grande, capturando el agua de la lluvia y deteniendola en su rapida corrida de la cuenca. Esta es la segunda forma en que funciona nuestra cuenca.

* Donde piensa usted que el bosque detiene el agua?
* Si tiene plants en su casa, cuales son los cuidados que su mama tiene que darles para que vivan?
* Que hacen las plantas con el agua?
* Que es lo que siempre se encuentra abajo de un arbol en el bosque?
* Que pasa con estas hojas?

Un bosque funciona como una esponja en tres formas diferentes. Primero, cuando caen las hojas al suelo, empiezan a descomponerse. Esto deja una capa de materia organica en el suelo. Esta materia organica es compuesto de los minerales que estaban en las hojas cuando se cayeron del arbol. Cuando se descomponen las hojas, estos minerales pueden ser utilizados como comida por las plantas nuevas. Las hojas siempre

se estan cayendo de los arboles en el bosque y las plantas siempre estan utilizando la materia organica. Entonces, en el suelo del bosque, llamado el terreno boscoso, siempre se encuentra una capa de materia organica tapado por las hojas secas. Esta capa es suave y en realidad funciona como una esponja gigantesca, capturando el agua de la lluvia y deteniendola en su rapida corrida. Segundo, tenemos las plantas nuevas que van a utilizar los minerales contenidos en la materia organica.

* Como piensa que las plantas traen los minerales de la materia organica para ser utilizados en su sistema?

El agua detenido en el suelo esponjoso del bosque, disuelve los minerales de la materia organica. Esta agua, con sus pequenas cantidades de minerales, es capturada por medio de las raices de las plantas y absovida por las mismas. El agua lleva los minerales hacia arriba de la planta donde esta siendo utilizados para el crecimiento de la planta y donde el agua se evapora en las hojas verdes. El agua que se evapora de la planta, ayuda a enfriar el aire y a veces puede formar nubes o puede convertirse en lluvia en el bosque otra vez. Entonces, el aire es el tecer lugar donde el bosque guarda el agua.

Ahora tenemos tres areas donde el bosque guarda el agua. Ellos son: la materia organica en el suelo del bosque, el agua que esta siendo utilizada dentro de las plantas, y en el aire adentro y arriba del bosque. El agua capturada por los bosques se escapa poco a poco a los rios. Por lo que aun despues de que han parado las lluvias, siempre hay agua en los rios que puede ser utilizada por nosotros en nuestras casas. Sin los bosques sanos que capturan el agua, los rios se saldrian de sus bordes cuando cae la lluvia y se secarian cuando sale el sol. Entonces, es importante proteger los bosques porque capturan el agua de la lluvia y la deja suelta poco a poco para que tengamos agua todo el ano.

La Materia Organica

Objetivo: Que el estudiante vea como la materia organica funciona como una esponja deteniendo el agua.

Materiales: Dos (2) envases de igual tamano; Ejem. tazas, vasos, latas con un extremo abierto (cuidado que no hayan orillas filosas).

Materia organica seca; (recoja del suelo suave en la superficie abajo de las plantas y arboles. Debe ser compuesto en su mayor parte de hojas, ramitas y otras partes de plantas que esten descomponiendose).

Actividad: EMPIECE ESTA ACTIVIDAD ANTES DE LA CHARLA.

Exhibe la materia orgganica en una pagina abierta de un periodico e invite a los estudiantes a examinarla.

* De que esta compuesta?
* Como la siente?
* Como huele?

Haga una lista de las respuestas de los estudiantes en la pizara. Ahora, llene el primer envase con materia organica y el segundo envase con agua. Llenalos hasta la orilla. Pase el agua del segundo envase al primero hasta que llegue el agua al orilla. Ahora, lo que tiene es un envase lleno de materia organica y agua hasta la orilla y otro envase con el agua que sobro. Guarde estos envases en algun lado, mientras

usted da la charla a los estudiantes. Cuando termina con la charla, traiga los envases otra vez. Regrese el agua del primer envase al segundo. Hagalo con cuidado deteniendo la materia organica con los dedos para que no caiga al segunda envase. Recuerda que cuando empezaron, el segundo envase estaba lleno hasta la orilla con agua.

* Esta llena ahora?
* Que paso con el agua que estaba en este envase?

Invite a los estudiantes a tocar la materia organica en el primer envase.

* Cual es la differencia ahora?

(En el sigente paso, coloque un periodico grueso o el basurero abajo de sus manos, para no ensuciar el piso o su escritorio)

Saque un poco de la materia organica del primer envase y aprietelo como lo haria con una esponja para ver si puede sacar parte del agua de elle. El suelo en el bosque esta totalmente cubierto con materia organica igual a lo que usamos en este experimento. Cuando cae la lluvia esta materia organica absorve el agua y la deja suelta poco a poco.

* Si no tuvieramos los bosques, tendriamos la materia organica en el suelo para capturar el agua?

* Por que no?

La materia organica viene de las hojas, ramitas y otras partes de las plantas y animales que se encuentran en el bosque.

EXAMINATION

School _____

Student _____

Teacher _____

INSTRUCTIONS: According to the following table of values, put an "X" beside the number that corresponds to your opinion:

1. Strongly Agree.
2. Agree.
3. No opinion.
4. Disagree.
5. Strongly disagree.

1. We need healthy forests in order to have water:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

2. Forests have no real relation to water supply:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

3. If we protect the forests we are protecting the water:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

4. We do not have the responsibility to plant two trees when we cut one:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

5. We can cut the forest without the danger of damaging the water supply:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

6. Forests work as a system for detaining water:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ____

7. Organic material would exist without the necessity of forests:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

8. To guarantee a future water supply we should plant trees and protect the forest:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

INSTRUCTIONS: Circle the answer that you think is correct

9. For each tree that we cut, we should plant:

   a. Nothing.

   b. One more tree.

   c. Two more trees.

   d. Three more trees.

10. Forests detain rain water:

   a. In rivers, reservoirs, and small lakes.

   b. In the wind.

   c. In organic material, plants, and the air in and above the forest.

   d. In reality, they don't detain water.

11. Organic material feels:
    a. Sandy.
    b. Spongy,
    c. Hard.
    d. Slick.
12. Forests capture and hold water, letting it go a little at a time so that we have water:
    a. In the rainy season.
    b. In the dry season.
    c. In the summer.
    d. All year.
13. Water:
    a. Evaporates from the leaves of plants
    b. Stays in the plants forever.
    c. Only passes through the roots and nothing more.
    d. Does not enter the plants.
14. Forests capture and detain which of the things in the following list, so that it can be used throughout the year:
    a. Soil.
    b. Water.
    c. Plants.
    d. Air.

15. The quantity of water that evaporates from the leaves of plants:

    a. Is insignificant.

    b. Disappears in the forest.

    c. Falls to the ground.

    d. Can cause clouds and rain.

16. Forests detain water:

    a. In the soil.

    b. In the soil and plants.

    c. In the soil, plants and air.

    d. In the soil, plants, air and wind.

INSTRUCTIONS: Answer Yes or No to the following questions:

17. In recent weeks I have read articles related to forests and water in a newspaper: YES ____ NO ____

18. In recent weeks I have heard in radio commercials the importance of protecting forests and water: YES ____ NO ____

19. In recent weeks I have seen commercials or programs in television that treated the subject of forests and water: YES ____ NO ____

EXAMEN

Nombre Escuela _____

Nombre Alumno _____

Nombre Profesor _____

INSTRUCCIONES: De acuerdo con la siguiente tabla de valores, coloque una "X" en el número que corresponde, según su opinión.

1. Estoy totalmente de acuerdo.
2. De acuerdo.
3. No tengo opinión.
4. No estoy de acuerdo.
5. Totalmente en contra.

1. Se necesitan bosques sanos para tener agua:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

2. Los bosques no tienen relación con el suministro de agua:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

3. Si protegemos los bosques, estamos protegiendo el agua:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

4. No tenemos el deber de sembrar dos árboles cuando cortamos uno:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

5. Podemos cortar los bosques, sin el peligro de dañar el suministro de agua.

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

6. Los bosques funcionan como sistema para detener el agua:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

7. La materia organica existiria sin la necesidad de los bosques:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

8. Para garantizar un suministro de agua en el futuro, debemos de sembrar árboles y proteger los árboles:

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

8. Para garantizar un suministro de agua en el futuro, debemos de sembrar árboles y proteger los bosques;

   1. ___ 2. ___ 3. ___ 4. ___ 5. ___

INSTRUCCIONES: Encierre en un círculo, la respuesta que considere correcta.

9. Por cada árbol que cortemos debemos de sembrar:

   a. Nada.

   b. Un árbol más.

   c. Dos árboles más.

   d. Tres árboles más.

10. El bosque detiene el agua de la lluvia:

    a. En los rios, las represas y las lagunas.

    b. En el viento.

    c. En la materia orgánica, las plantas y el aire adentro y arriba del bosque.

    d. En realidad no detiene el agua.

11. La materia orgánica se siente:

    a. Arenosa.

    b. Esponjosa.

    c. Dura.

    e. Lisa.

12. Los bosques capturan y detienen el agua y la dejan suelta poco a poco para que tengamos agua:

    a. En la época lluviosa.

    b. En la época seca.

    c. En el verano.

    d. Todo el año.

13. El agua:

    a. Se evapora en las hojas de las plantas.

    b. Se queda en las plantas para siempre.

    c. Sólo pasa por las raíces y nada más.

    d. No entra en las plantas.

14. Los bosques capturan y detienen, una de las cosas de la lista siguiente, para que sea utilizada a través del año.

a. El suelo.

b. El agua.

c. Las plantas.

d. El aire.

15. La cantidad de agua que se evapora en las hojas de las plantas:

a. Es insignificante.

b. Se desaparece en el bosque.

c. Cae al suelo.

d. Puede causar nubes o lluvia.

16. Los bosques detienen el agua:

a. En el suelo.

b. En el suelo y las plantas.

c. En el suelo, plantas y el aire.

d. En el suelo, las plantas, el aire y el viento.

INSTRUCCIONES: Conteste "SI" o "NO" a las siguientes preguntas:

17. ¿En las últimas semanas, ha leído un artículo en algún periódico relacionado con los bosques y el agua? Si __ No __

18. En las últimas semanas, ha oído anuncios radiales sobre la importancia de proteger los bosques y el agua? Si ___ No ___

19. En las últimas semanas, ha visto anuncios o programas en televisión que trata con los bosques y el agua? Si ___ No ___