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ECOLOGICAL ASPECTS OF
INTERNATIONAL DEVELOPMENT

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ECOLOGICAL ASPECTS OF AGRICULTURE, SHIFTING CULTIVATION
AND ROAD DEVELOPMENT IN THE HUMID TROPICS OF THE AMERICAS

by

F. C. LEHMANN V.

Valle State Museum of Natural History, Cali, Colombia.

INTRODUCTION

In this paper I will try to describe the influence of agriculture, shifting cultivation and road development in most of the tropical countries in Latin America.

Due to economic reasons, it was not possible for me to travel as I would have liked, to visit areas that have received tremendous impact in recent years from new aspects of development and modern methods of road building and tree cutting, after I received the invitation to participate in the Conference, to obtain more photographs of some areas to illustrate my contribution.

Most of this change has taken place within the last thirty years, but chiefly after the Second World War, more or less during the last twenty years.

A very large role in the change that has and is affecting conservation of natural areas, and contributing to the rapid destruction of nature in general, is played by the demographic explosion that is affecting these countries, which should be considered seriously in planning, both conservation, and future developments.

The last part, Road Development is a consequence of need to open new horizons for the encreasing number of inhabitants, with which in turn transform more and more forests in open countries.

Large Scale Agriculture in Relation to Ecological Changes:

Within the last 20 or 25 years most of the agricultural areas of the Neotropical countries have experimented a radical change in their management. From primitive horse or oxen driven plows, that worked relatively small areas, to powerful tractors, and large scale irrigation, and the use of pesticides, in very large areas, we can easily understand the impact these changes have brought to these areas. The change ~~from~~ in many cases has followed this pattern: From original forests, - in extreme cases - to grazing fields, and more recently ~~from~~ grass lands to ~~xxx~~ mecanized agriculture. In Colombia we have three main examples. Probably the area that received the most rapid transformation was the plateau of the Cauca Valley, here large areas were covered by forests, of which only very very small remnants can be seen today. Similar treatment in more recent years is receiving a greater part of the Magdalena basin. The third is the Eastern Llanos - grass lands - where the gallery forests along the rivers are giving way to rice and other plantations.

While these tremendous changes in the ecological aspects of the tractable valleys are taking place, the need for water for irrigation, city use and hydroelectric power is becoming quite critical, because the destruction of the forest goes parallel in the mountains along the Andes. The rivers lose their volume of water, in many cases become mere creeks or empty river beds that during the torrential downpours become dangerous waterways loaded with soil, mud, etc. that flood the valleys, destroying in many cases, plantations and dwellings. This is the high price paid for lack of control and planning in the use of the steep mountainsides, which in many cases are changing from the original beautiful and luxurious forests to eroded or degraded soils, and in no few cases in bare rocks.

The effect of this practise goes along the rivers, and in many instances the navigable rivers are being filled with the silt and sand that comes from the mountains, which make them unsuitable for navigation, cases like this we have in the upper Cauca, the Magdalena, and to some extent the Meta rivers.

The transformation of the original forests into agricultural fields is so drastic a change, that with the forests are gone the other forms of life associated with the humid tropical forest in the valleys, ^{as well as in the mountains.} At the beginning, in some places, the change was gradual, patches of forest were cut for pasture, ^{or agriculture} but still enough forest remained to preserve some of the original habitat for many species, and though the ecological aspect began to change, still many vegetal varieties subsisted, as well and most of the fauna. This was the case for the Cauca Valley Plateau, the Magdalena and the Llanos in Colombia, ^{50 years ago,} but as the destruction of the forest advanced, less and less woods could be seen, and consequently the fauna also dwindled, until the patches of forest became so small, as to be unable to continue their normal living, the trees ~~that~~ degenerate, and finally die, for lack of humidity, shade, and other ecological factors that can not subsist in these small areas. In this way we have seen disappear little by little many beautiful forests and their inhabitants. The animals are easier prey for predators and hunters in these small areas, which has contributed in no small degree, to the extermination of most of the original fauna in many places.

In the less developed areas, like some of the Magdalena basin, the upper Cauca and Patía rivers basins, and mostly in the Llanos, peasants resort to fire, as a means of cleaning land for agriculture or grazing, at small cost to them, but at a very high price for the future of the country, with all its consequences. Fire as a means to clean land is illegal in Colombia, but either, the local authorities do not enforce the law, or just ignore it, and in that way vast areas of the country, both in the valleys, as well as in the mountains suffer the scourge of fire every dry season. This custom is so extended, that at the end of the dry season even aviation has very serious problems for lack of visibility due to the heavy layer of smoke that covers the country.

^{disappearance}
The ~~disappearance~~ of forests has brought as consequence also the change of climate to many places, and diminution in the rainfall rate.

One of the most serious problems to contend with in the humid and rainy tropics, due to the practice of deforestation is the degradation of the soil, specially in steep hillsides of the Andes, where the soil is rapidly taken away by the rains. Not always is taken into consideration the quality of the soil before cutting the forest, and where this is lateritic, or of some other easily erodable nature the top soil is washed away very quickly, so rapid in instances, that only one crop can be harvested before the soil becomes so poor that will not produce again. Then, the area or patch is abandoned and another destroyed in the same manner. Examples of this ~~funest~~ regrettable practice can be seen in many places, mostly in mountainous country, but when the soil is lateritic, even in not very steep terrain, this can and do occur. Some other soils are even more affected, and not only are washed away, but very rapidly, after one or two crops are taken, or even earlier, these soils slide down the mountain-side. On occasion these land slides become true avalanches that block creeks or small rivers, and when the dam thus formed lets go, occur the flooding of the valleys below, and in no rare occasions destruction in urban areas, with loss of lives and property.

Exhaustive studies of the soils should be done before any authorization to cut a forest could be granted, in order to save what is left of the forest in the Andes. Already very vast areas in this chain of mountains have been deforested, Some are devoted to agriculture to produce cold or temperate climate crops, or in no small degree to grazing land. Happily in the southern end of the Central Andes in Cauca and Nariño Departments (States) where potatoes and akin crops are planted the soil is of such kind that can stand the rains, otherwise these areas should have been abandoned long ago. In the Quindío area at the subtropical level the lateritic soil is still producing, because it is devoted to coffee culture, which in Colombia has been done with the soft variety -Coffee arabica-, which need shade to grow. Several species of shade trees are used, and

these form in combination with the coffee shrubs an artificial forest that in some way protect the soil from the rain and both hydraulic and eolic erosion. Unhappily in recent years another variety of coffee called locally "caturra", which does not need shade, has been introduced, and if it is not carefully planted following contours, and even more carefully cultivated, it may show deleterious effects on these poor soils.

In places like the Rio Mira (Mira River) valley, vast expanses of forests, were initially cut to plant banana trees. Forgetting the tropical storms that are frequent here, planters did not leave trees to act as windbreakers, and in many instances they lost their efforts, because their plantations were destroyed by the storms. Quite a few abandoned the banana culture, and converted their properties to cattle grazing ~~pastures~~ fields. What is worst, when these forests were originally cut, the wood and lumber were not used, but let to rot on the ground, even though there was a railway at short distance from these fields. Valuable woods, more precious than the crops that were sought after there, after rot there. A severe loss for the prosperity of the country.

In the Urabá region, in extreme northwestern Colombia, new and large plantations of banana are being made. Here too every rainy season we learn that the plantations are destroyed by storms, but I can not understand, after so many cases, why the planters have not learned to devise a system of wind breakers to protect their plantations, or just leave rows of the original forest that usually is cut, to protect the banana crops, until new trees that can survive the new ambient are grown to protect the plantation. ~~It is a~~ Large figures in losses every year are recorded from this problem alone.

exhaustive
I think that /research is needed in new areas of development, before exploitation ~~xxx~~ permits are granted, or new colonizations are planned, in order to avoid future failures, and useless destruction of forests that could be

used more profitably as such, by rational utilization of the forest products without destroying it, as is the most common practice today.

Lumbering industry is taking a rapid step, both on the Pacific, as well as in the Amazon drainages, but in most cases there is not enough control, to see that ~~that~~ the valuable species are not depleted completely, and fine wood is an expensive luxury today, because the lumberers work in a very primitive way, and out of government control, as to the way they practice their craft. The custom is that two or three of these men roam through the forests in ~~search~~ quest for fine trees - mahogany, walnut, red cedar, and many more,- and when they find a suitable tree, they get their "machetes" - wood knives out, and cut or clean all vegetation under the tree that they are going to use in an area of 80 or 100 feet across, killing in that way all the new or young trees of the same kind as the one they are going to use. This practice, I think, should be stopped if we wish to save the valuable species. This system is in practice by private lumberers that work on their own in the national or private owned forests. Large lumbering mills have been established in many places of both drainages as stated above, and these cut everything that can be used by their modern power machines.

⑥ / These ignorant peasants sell the lumber at rather low prices to people that buy it, either at the lumbering spot, or at the nearest road where they can transport it by truck to the market centers. These people are the ones that are making the good business, and the poor peasant that sweats out himself sawing by hand the wood is always poor, and more so every year, because he finds less and less suitable trees to cut, and these are farther and farther away each time. These poor people by ignorance, and lack of control, are destroying our fine wood heritage, with no ways of obtaining a better living, but impoverishing the natural resources of the country and themselves.

These need also a better control from the part of the authorities concerned, to see that they leave enough seed trees to preserve the forest.

In many places, the lack of forests ~~is~~ has reached alarming levels.
human
Cities do not have enough water for ~~their~~ use, for electric power, and other/ today.
Watersheds have been destroyed, and are still being destroyed inexplicably/
uses. Reafforestations are in order, but these are carried out generally very
slowly, if it is done at all, or in the better cases, it is resorted to commer-
cial plantations of exotic species, mainly conifers and eucaliptus, with an
aim to use the wood in short time. I want to make it clear here, that I am not
against commercial plantation of whatever is necessary for the paper industry,
but I think that we should have also programs of reforestation for the seek
of preserving ~~water~~ ^{indigenous flora, the} the soil, the water, the fauna, the climate and the lands-
scape. In many places we need permanent woods for the purposes above mentioned,
and where it is not advisable to spend money and effort in planting exotic spe-
cies at a high cost, when the native, indigenous species are cheaper to repro-
duce only by fencing the areas and controlling the fires. This last danger is
even greater with the woods of conifers that are more prone to take fire than
the local species, and strict measures should be taken to protect the invest-
ment in these plantations from fire hazards quite frequent in ~~any~~ ^{the} dry seasons
as stated before; otherwise we will have to regret sooner or later for not
doing it. Vast programs of conifer and eucaliptus plantations are under way
~~in many areas of the~~
in several regions of Colombia, and I understand in other tropical Latin-Amer-
ican countries as well, sponsored by the paper industry, as well as the govern-
ments concerned. Let us hope these will save some of the original or native
existing
woods. Unhappily in some places native woods have been cut to plant the conifers.
We must not forget the drastic ecological changes that these new forests intro-
duce in the natural community. The uniformity of these woods may attract insect
pests, that will not be controlled by the local fauna, that in general do not
inhabit these woods. I have already seen examples of this problem in the water-
shed of Manizales, where the patches of conifers had many trees affected by in-
sects, while the ~~native~~ patches of native trees were healthy and abounded in
bird life absent from the other areas.

Reservoirs for hydroelectric programs are, and have been built in several places. While in some cases these have been constructed in well forested areas, and far sighted laws reserved the necessary areas to protect the watershed, in practice this has not been done. One well known case is the Anchicayá Hydroelectric Company, a government agency controlled undertaking, in the Pacific drainage of the Cauca Valley State-Departamento del Valle del Cauca-, which was built on the Anchicayá river. Lack of strict control of the watershed has endangered this power source. Squatters ~~have~~ invaded the watershed area, producing large quantity of silt and all sort of debris that have filled the reservoir. Some years ago the problem was envisaged, but instead of getting the squatters out, a typical engineer's view of the problem adopted to buy a dredge. The amount of silt getting into the reservoir was calculated, and the capacity of the machine to be bought to ~~take~~^{dredge} it out too. But after the machine started to operate, more squatters came to establish themselves in the watershed with the consequent increase in silt and debris going to the river. The dredge was not powerful enough to contend with the new situation and the reservoir is now completely filled, while the dredge working at all capacity tries to keep the water running at least. This power plant as can be guessed, is not operating at its normal rate, but curtailed in its power production, but what is worst, probably ~~doomed~~^{doomed} to stop working, if drastic and costly measures are not taken immediately. Another reservoir to help the one mentioned, is at this moment being built in the main tributary of this watershed, and it is hoped that the experience acquired from the first case will decide the authorities to frown squatters from getting into the new river basin. Some think that with the money invested in buying the dredge, when it was done, there was enough money to have ~~been~~ moved, the then existing squatters, to other less dangerous location.

More hydroelectric projects, as well as waterworks for several cities are endangered in the same way. The Anchicayá, is an extreme case but other may develop in the future, and ^{some} are ~~being~~ experimenting serious problems from siltation, water shortage, etc.

These problems can be traced to several causes: a- Economic reasons. Sometimes the projects are decided upon because of the cheaper initial cost of building near the towns they are going to serve, where roads exist or need little building, available man power, and small cost of transmission lines. Towns then need little power. But ^{there} ~~it~~ is not planning for the future development of the country, and fast growing towns. b- Lack of far sightedness in the future of the enterprises and no control measures to protect the watersheds, or simply by building these projects where already exist the erosion problem. Cases of this last condition can be seen almost everywhere. c- Probably the most difficult to solve is human population explosion. Not all the areas of the Latin-American countries are suitable or adequate for human living or agriculture. Thus the urban centers and even the rural dwellings are concentrated in the areas where conditions are more favorable, but it is a well know factor now that rate of growt of the human species is reaching dangerous levels, for the social problems involved, the human pressure on the natural resources, and ~~a~~ degraded soils, and the reduction of the ⁵ earth to support more and more crops, agravated by the multiplication of both rural and urban dwellings, and the necessary roads to keep pace with the economical development of the countries, and all other things that this problem pose, like trash accumulation or disposal, ~~sewage~~ water pollution by ⁵ sewage or trash, or factories's wastes.

The social problems that these countries have to contend ~~with~~ with, mainly in the mountains, are as big as the Andes themselves. But still is time to do every possible effort to save some important areas of these mountains and valleys. Action has to be taken rapidly and with energy. Otherwise in a few years more there will not be an area large enough for a national park or a nature reserve.

SHIFTING CULTIVATION.-

While I have mentioned above the problem of squatters in relation to reservoir watersheds, this ^{is} a vast and very serious problem, and a difficult one to solve. Squatters, or "colonos" as they are called in Spanish, are spread almost everywhere in these countries. They not only take the national lands, but even private land in no few cases. Their activities are more dangerous to the future of the countries, when they establish themselves on the steep sided mountains, where they destroy the forest to make, in many cases, plantations of corn or other crops. Sometimes valuable woods are cut and burnt in place, utilizing only a very small quantity of it for ~~their~~ home needs, because the lack of roads precludes any commerce of the wood. In most instances the value of the forest destroyed alone, not to mention the loss of the soil and future use of the land, is worth more than the crop harvested. In cold climates in Colombia is planted a variety of corn that needs 10 to 11 months until it is seasoned for harvesting, while in the tropical climates two and more crops of corn per year can be obtained. I wonder if, for the economy ^{sake} of the country, it would not be wiser to sell ^{cheaply,} or even give to these poor peasants tropically produced corn, that to let ~~them~~ continue ~~continue~~ with their shifting cultivation, because in these steep hillsides the soil is washed away rapidly and they have to start over again in ^{an} other patch, time after time, year after year, and in that way we have seen many a forest disappear completely, and replaced either by pasture in the best ~~case~~, or just useless ordinary grass land that is burned almost every dry season to have fresh grass for a few grazing heads, a practice that we consider destroy more and more fertility everytime. Quite often these squatters establish themselves along the rivers, rivulets, creeks, and head waters of important watersheds, endangering the future of these, and making future development of the valleys below difficult, very costly, or impossible. Examples of this can be seen in too many places to be mentioned here. Nevertheless, the Cauca Valley Plateau, can be one good example again. Here agriculture has reached a very high level, but today the rivers

that formerly irrigated this plateau, have lost most of their water, or the smaller ones have dried completely. Farmers have had to resort to drill deep wells to obtain the necessary water for their crops, at a very high cost of building and operation. But this is not the best or final solution, since the water table is sinking lower, and new and deeper wells have to be drilled at higher costs, to keep the top soil wet. This sinking of the water table is not due only to the use of the under surface water, but ^{also} to the continued destruction of the forests on the mountains as well, which produce both surface and undersurface water.

Another crop used in subtropical and tropical climates, and in many instances, not to say almost every time, planted on hilly country is the "yuca" or manioc or yucca or cassava, ^{which culture} ~~whose cultivation~~, especially in lateritic and hilly country ends with the soil in one crop. Large craters are left when the large roots of the plant are pulled out in harvesting. Rain or wind take a rapid toll of the ~~xxx~~ loose soil. Woods or brush covered land is cleared for this culture.

A program of soil conservation has to be devised. In some cases reforestation can be done. There are indigenous species of plants and trees that can be used to begin this work. In many instances ^{what} ~~all that~~ is needed to save these areas is simply fence them from cattle, goats, sheep, horses, or whatever grass or vegetable eating large animals may be, and establish a body of trained wardens to protect these from fire and squatters. In some extreme cases where only the bare rocks remain is almost impossible to do anything.

Some far sighted land owners used to keep some of their property covered with forest, to preserve springs, rivulets, creeks and headwaters of rivers, but now it is no longer possible to keep these forested areas in private ownership, because the agrarian reform law ^{for which we are socially prepared, but} imposed in order to obtain external aids, consider that not cultivated land can revert to the ownership of the country, and thus can be given to another person who can or wishes to do some kind of ^{nt} planning in it. This provision has played to the destruction of many tracts of forests by the same people who were keeping them to save them from being confiscated. Also

prepared,
not technically

Su carne que tiene sabor a pescado, se vende como tal algunas veces bajo el nombre de salmón. Negociantes venezolanos pidieron permiso para matar 300.000 capibaras al año en Colombia. Siguiendo mi sugerencia como consejero del Ministerio, el Ministro de Agricultura rechazó la propuesta.

Los venezolanos ejercieron alguna presión sobre otro ministro y este les concedió un permiso por 50.000 al año y con un poco más de presión la cuota fue aumentada a 20.000 más. Pero no hay control de ninguna clase.

Los animales se llevaban a encerrar en corrales y sacrificados para aprovechar la carne. Sus pieles valiosas son desechadas y botadas. Esta no es una forma racional de utilizar este recurso natural.

El negocio de pieles es más difícil de suspender que el negocio de animales vivos porque algunas agencias oficiales lo fomentan para obtener divisas extranjeras. Países importadores como los Estados Unidos, Inglaterra, Holanda, Bélgica y Alemania podrían ayudar mucho para reducir el mercado de animales vivos o quizás suspenderlo definitivamente si pudieran reducir o prohibir la importación de animales "pets" y conceder licencias exclusivamente a unos pocos Jardines Zoológicos bien establecidos.

Los Conservacionistas en Colombia estamos tratando de establecer parque nacionales y reservas naturales pero necesitamos ayuda para convencer al gobierno y persuadirlo en este sentido. Tres reservas se han establecido recientemente en el norte por la C. V. M., una entidad oficial del gobierno para el desarrollo de los valles del Magdalena y del Sinú; la Sierra de la Macarena, una extensión de 11.000 kilómetros cuadrados, se ha convertido en una reserva natural. Lo mismo un pequeño parque nacional, la Cueva de los Guácharos para protegerlos, ambos necesitan organización y supervisión.

Dos regiones también han sido escogidas con este fin en los departamentos del Valle y del Cauca; los Farallones de Cali en el Valle y Puracé en el Cauca, en la cordillera central. Desgraciadamente ninguno de estos últimos ha sido aprobado por el Gobierno Central y continúa la destrucción de la fauna y de la flora. Deberían ser protegidos antes de que la destrucción sea tal que no puedan convertirse en parque naturales .

aguanos pueden escapar esta destrucción, y las ciudades grandes y pequeñas están sufriendo por escasez de agua y de fuerza hidroeléctrica mientras que a los valles les falta el agua necesaria para los cultivos.

Las cacerías continuas sin limitaciones, o temporadas, ni reglamentación acerca de la matanza de las hembras constituyen otro problema. Otro aspecto muy serio es la comercialización de la fauna salvaje, de la cual hay dos formas: el negocio con animales vivos y el negocio de las pieles.

Cada año miles de animales vivos se exportan de Colombia y por cada ejemplar que llega vivo a su destino, muchos mueren en el camino debido a falta de cuidados o alimento inadecuado. Esto es definitivamente cierto en relación con los quetzales, gallitos de las rocas, muchas tógaras y especies pescadoras. Miles de tógaras mueren en las jaulas de los coleccionistas antes de ser exportadas.

Con respecto a los quetzales y gallitos de las rocas creo que 50 ejemplares mueren por cada uno que sobreviva. Nuevos sistemas de captura hacen que sea muy fácil coger los pájaros con el resultado de que grandes poblaciones han sido exterminadas en algunos ríos; en un año un solo exportador exportó 300.000 ejemplares. Los papagayos se exportan por millares mensualmente a México y luego introducidos de contrabando a los Estados Unidos. No se escapan ni los reptiles ni los peces, centenares de miles se exportan vivos. Los huevos de tortuga se recogen en gran número, principalmente en los ríos Magdalena Meta y Caquetá, poniendo en peligro la supervivencia de las especies. Los datos que se incluyen han sido recopilados por inspectores oficiales en Cali y Leticia y denunciados por una revista deportiva de Barranquilla.

En realidad los números correspondientes a Cali y Barranquilla están por debajo de lo correcto; muchos ejemplares salen fraudulentamente del país, mientras que los datos correspondientes a Leticia incluyen pieles. Algo debe hacerse para controlar, o suspender completamente, este negocio internacional de animales, además muchos animales se sacrifican por sus pieles tales como saínos, jaguares, ocelotes, nutrias amazónicas; yo tengo los comprobantes de una persona que exportó 480.000 pieles en un año, otros animales tales como la capibara se sacrifican a millares por su carne siendo esta matanza uno de los peores casos.

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