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THE THRUST OF PRESENT AND FUTURE RESEARCH IN THE LOWLAND TROPICS OF MEXICO[1]

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The subject I wish to discuss has worried me for many years, and even though I am still very far from having all of the facts and answers, I think I will take a chance and try to foresee the problematic near future of botanical research in the lowland tropics of Mexico.

I have found a similarity in the problems of obtaining scientific knowledge of tropical plants by non-resident botanists from extra tropical countries with the problems we have had in Mexico to develop botanical knowledge of tropical lowland areas by botanists resident in the highlands in Mexico City. It seems to me that the comparison is so close, that some of our thinking about this problem could be useful in other tropical areas as well.

I hope also that our experiences in Mexico can help to identify the same problems in other places and that we can make a joint effort to look for practical solutions.

My thoughts will be related mainly to botanical sciences (floristics and plant ecology) but may be appliable to other natural sciences as well.

The vegetation of the lowland tropical areas of the world is a very complex mosaic of communities composed by an endless combination of species. It is in these areas where we find the greatest terrestrial diversity of species and also the richest floras and faunas. It is also true that the biota of these areas is very poorly known. Often has been stated that the most important concepts in organismal biology will come from the study of tropical organisms. On the other hand we know that tropical species are the ones that are in more danger of extinction, because of the delicate and highly specialized life cycles of very many of them.

It is my intention on this occasion to give you my opinion on some of the reasons for having such a poor knowledge, some ways that this can be corrected, and the role that botanists can play in this regard. In Mexico we have a con-

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siderable area of tropical lowlands, and the interest of our University in this region has been continuous for several decades since the pioneer work of Dr. Miranda and Prof. Matuda in southeastern Mexico. The rule of the poor knowledge of tropical lowland areas is still a valid one in Mexico, and a race against time is underway. The primary vegetation of these areas is being destroyed at a fantastic speed.

Why are these tropical lowland areas so problematic, and what can we do about it? I will try to answer these questions.

The first and most important answer is the almost total lack of development of botanical institutes in the tropical lowland areas.

Most of the botanists in the past and present are located in other regions. The reasons for this are complex; but, the result is that in the tropical lowlands of Mexico there were almost no botanical research centers, until very recently. No new local botanists were being trained, and even though there were persons interested in the lowlands, there was no future for them there, as there are no jobs available.

The general public is not aware of the importance of these types of activities and for that reason they do not care about them. There is almost no local support for research in these lines, and there are very few funds available for the very few persons interested in living and working there. I firmly believe that the lack of professionals living in these areas is one of the main reasons for the poor knowledge of the lowlands of the tropics, and this may be extended very well to other tropical areas of the world.

It seems to me obvious that any effort to create institutions for research in these areas should be encouraged, if these centers can open jobs for scientists who want to live and work there. It also seems evident to me that any research project that involves training of local personnel should also be encouraged.

Another great important problem of a different nature in these lowland areas is the scarcity of collections. If you followed some of the itineraries of many collectors in the past, they seem to stop at 800 m of altitude. There are several reasons for it; the difficulty of distinguishing one tree species from another, the difficulty of collecting specimens from a tree, liana, or epiphytes. In addition to this we have many other reasons: The unhospitable climate, mosquitoes, poisonous snakes, tropical diseases, and other reasons very well known in certain countries with political instability. In contrast with these facts we have the problems of the lack of interest for support of plant collectors in general in these areas. It has been stated that there are enough collections from tropical America already in herbaria which, if studied would give a good representation of the flora for these regions. As many of you know by personal experience, this is far from being the truth. As soon as you engage yourself in a study of a set of new collections from any lowland tropical area it is certain that you will find many new and interesting things.

The data from specimens from these areas are a good indicator of the poor knowledge of the regions and their environment. Data such as "in poor soils," "wet ravine," "shadowy places," "tropical jungle," etc. have very little meaning and reflect our poor knowledge of the areas and of the plants.

It is clear that the solution for this problem is rather simple: Promote scientific collecting activities in the lowland tropics as much as possible, and help any program that encourages this type of activity. A training period should be given to any person in order that they could provide good label data. It is surprising to know the number of scientific plant collectors that ignore the literature concerning the areas they are working.

Knowledge of the biology of tropical lowland plants in Mexico is almost nil, and the very little that is known has come mainly from sporadic visits of visiting botanists in a "hit or run" research basis. Of course the result is that there are so many superficial observations that one can hardly make use of them. There are very honorable exceptions, and it seems that in recent years this is changing rather rapidly for the better.

It is true that this lack of information of the biology of plants is rather general and extends to other regions and climates which also need to be studied. But I feel that there should be a high priority for tropical lowland plants, because of their diversity, their highly specialized life cycles, and the danger of their extinction.

How to solve this problem is more difficult because it involves more people, with different training and much more local facilities. So, there is a need to include in the curriculum for biologists a good deal of problem-oriented field research courses; also there is a need to have on-going research projects that may help to stimulate the interests of new researchers in this field. And also to provide local facilities to scientists in the lowland tropical areas so they can live comfortably for extended periods of time with the minimum difficulties.

Another related problem in the botanical research of tropical lowlands in Mexico is the incomplete information on the tropical environments. There are very few research programs on tropical soils and climate.

It is quite evident that very little can be done in botanical research without the help of other scientific disciplines. So, it is necessary, I think, to encourage interdisciplinary research projects. We cannot understand plant distribution without the aid of good geological, climatological, and edaphic maps. And the lives of plants can hardly be understood without the knowledge of their animal relationships. So, zoological and botanical research are very closely related in these regions.

Because of all these facts we can better understand why many of the floras, revisions, and monographs which include tropical lowland species are incomplete. We are still very far from understanding many of the species' relations and their variation in the lowland tropics. As more collections and data are accessible, many species described for incomplete materials fall into synonymy. As many revisions are based on few specimens per species (often only one), the results are obviously far from being precise.

In addition to all of these problems we have the most important of all, the alarming rate of destruction of the primary ecosystems with no hope for future regeneration.

The demand for new land in Mexico is so great that a large number of people are moving into the lowland tropical areas. And these are regarded as the

promised land of endless resources. The results are the explosive increase of agricultural and grazing land at the expense of the natural original ecosystems. Because of the lack of knowledge of these ecosystems their resources are destroyed without being used. Tropical forestry is still to be developed. In these areas there are almost no national parks or reserves and no active botanical gardens. So, there are almost no possibilities for conserving fragments of the natural ecosystems. In this race with time we know we started late, and it will be almost impossible to win; but we are trying. How?

We have tried to follow some of the solutions I just mentioned. Some of them are already been applied in our country, but many of them still need to be effected.

1. In the educational schemes at our University we are training new biologists with an awareness of the problem of tropical lands. Hundreds of students take our tropical biology field courses, and they become involved with short term research problems. A great number graduate and undergraduate students are getting trained in different fields of tropical botany, and it is my hope that they will provide the necessary critical number to have some influence in the whole country.

2. In our research projects in lowland areas we are planning to train personnel not only of our University but from local state universities as well. This will be done by scholarships, assistantships, and other means. We are completely aware that if we do not develop the local personnel, we will never go very far.

3. In the "Flora of Veracruz" program we are supporting scientific collecting activities in the areas by local personnel. And, we are planning that part of the collections remain in the local institution when appropriate personnel are available. This will help them obtain their own local support. We are going to encourage new botanists to go to centers in these areas and stay for longer periods of time. For this purpose we are expecting an increasing support from the government.

4. The new research institutions within the areas will need much support and for that reason we are promoting joint research programs with visiting professors, students, lectures, seminars, etc.

5. The gaps in knowledge and personnel are being filled by close cooperation with foreign institutions. Among them is our joint research project with Harvard for the "Flora of Veracruz" program which has the same basic objectives I have talked about: research and training.

Another action that has been taken is the acquisition of two biological reserves by our University, one in the Veracruz lowland humid region and the other in the Pacific Coast tropical lowland area. The new school of tropical Agriculture in Tabasco also has set apart a small rain forest reserve. These efforts are very small, but we hope that some response can come from other institutions with more power.

The last possible solution is to include applied aspects in any research program in which this could be done. We should emphasize the fact that tropical rain forests are very poorly used ecosystems. We do not know how to use their resources or how to regenerate them. It seems clear that the only way to protect these ecosystems is to know them and to know how to use them with conservation

methods. We should remember that we have to feed a rapidly growing population that will not stop to wait for us to study the rain forests.

From what I have said it seems there are a few suggesions that could be followed in general:

1. To include tropical biology problems in any biological curriculum.
2. To encourage plant collecting in the lowland tropics as much as possible before the plants have disappeared.
3. To promote joint research programs that include preparation of new personnel and especially those which include local persons.
4. To help local research institutions develop.
5. To create new research institutions in critical areas with a mixture of local and "foreign" staff.
6. To encourage funding institutions or associations to help finance local botanical research in the lowland tropics with no discrimination of nationality. It is rather sad to see how other sciences are being helped at an international level and no effort has been directed toward the botanical sciences, which should be the basis of development of higher priority. An International (Interamerican) Science Foundation is badly needed. Foreign aid agencies should invest in this line, which can be of greater and more effective impact.
7. To encourage research programs that can have some local application and to find ways to promote them.

To finish I would like to say that plant scientists cannot live in an ivory tower ignoring what is happening in the place they are working. The problems are larger than any national border, and to solve them there is a great need to remember that we have the obligation to make the general public know the importance of conserving the living plant resources of the world. Also we have an obligation with the society in which we live that exceeds geographical and institutional boundaries.

The future of botanical research on the tropical lowlands of Mexico seems to be very promising as many new young scientists are beginning to work in many different fields. What is not clear to me is the future of the primary vegetation still left in those areas. It is quite evident to me that secondary vegetation is taking over as it has happened in many other tropical areas and the consequences are not predictable. A new revolution in evolution is taking place and we are now merely unconscious spectators. I think the moment is here to study what is left, to conserve as much as we can at any cost, and to study the changes that are occurring. We should try to predict what will happen next in this new environment, and what are the evolutionary trends of the new secondary communities and species that are replacing the magnificent rain forests of the past. It may sound rather sad, but that is the way I see the future of most lowland tropical rain forests in Mexico, and probably this can also be applied in other countries as well.