

## VIDEO FLORAS AS A COMPLEMENT AND ALTERNATIVE TO LOCAL HERBARIA

by

Arturo Gómez-Pompa  
University of California, Riverside

There is no doubt in our minds of the fundamental role of scientific plant names in all kinds scientific endeavors. The well known statement "that human activities are threatening of extinction to a vast amount of species, without even knowing their scientific names" speaks for itself.

Unfortunately for the general public -and many science colleagues as well- the process of naming plants is taken for granted. To name a species is the beginning of a learning process about nature. Without names, ecological, biological and phytochemical research has no value. Even the most appealing new approach of DNA sequencing research has no meaning, without knowing the name of the species under study.

In the early sixties I was dramatically confronted with the problem of naming species. I saw the fundamental importance of botanical names for my ecological research in Veracruz. No one was able to identify the thousands of specimens that were collected in the ecological surveys underway at that time.

In 1967 I decided to start a pilot floristic project for Mexico: the flora of Veracruz. I must confess that I was unaware of the difficulties to do a project of that magnitude. I saw the scarce human and economic resources available in Mexico for doing this type of research: a very poor herbarium and botanical library and a very limited number of trained taxonomists.

On the other hand, I also saw the great need of accurate ecological and botanical information for the many research and development projects that Mexico needed badly.

At that time, I saw the enormous constraints of classical floras to respond to those needs. I learned very early that a major monographic flora project is a long term commitment that goes beyond any individual. In order to succeed it has to be a team commitment, but must of all, it should be an institutional commitment.

Seeing these constraints and the impossibility at that time to generate those commitments, I decided to use the Flora of Veracruz project to explore alternative approaches for the production of a Flora. I saw the enormous information bank stored in herbaria, and the inefficient retrieval systems for that information.

It was then when I realized the importance of computers as a possible solution to our information retrieval problems. I figured that if we could input all the recent information on the species of a certain region, we could have in fact an updated database of the knowledge on those species. Computers were clearly designed to store and retrieve these amounts of information.

The idea was there. The problem was to find a computer. In 1967 PC's did not exist. The main frame computers were scarce, big and extremely expensive. The problem was solved by the lack of competition in those times for the computers available. The first central computer of UNAM needed additional users beyond the central administration. I decided to start a project to create a floristic data bank for Mexico and I was fortunate to use the central computer of UNAM for free. This was the beginning of the computerization of Flora of Veracruz.

The idea was to capture basic information on Veracruz species from literature and herbarium specimens. A large commitment of funds and human resources were allocated through time and the first set of Floristic and Environmental databases of Veracruz were started in the late 60's. It is a great pleasure in deed to see that the effort was successful and it is continued in Mexico in spite of economical and institutional crises that are the normal process in developing countries.

The advances in the Flora of Veracruz and other related projects will be or have been presented by my colleagues.

What I will present to you today are some of our recent experiences in some technological advances for the production of plant information.

We know there is a great need for new knowledge on plant resources of the tropics. But there is also a need to make this knowledge available to all kinds of users.

We have to encourage more people to learn about the diversity of life and the threats that we, as humankind are posing to it. We have to reach the new generations in schools in large and small cities.

The popularization of botanical knowledge in the developing world is extremely important and efforts should be directed toward that goal. Today, this knowledge is almost a property of an elite of scientists in Museums, Herbaria and Universities.

Let me give you an imaginary example that may help me illustrate the principal message of this presentation.

Suppose I am a teacher in a small rural town of Chiapas. I have been hearing through the media about extinctions of species in the tropics, the importance of biodiversity conservation, about the importance of traditional knowledge.

I have been converted! I am now a convinced conservationist! I have to think globally and act locally!

Suppose I want to share my interest with my students and go beyond the conservation discourse. Since I have to act locally. I have to learn more about the local flora and share that knowledge with my students. The first thing I would like to do, is to know more about the biodiversity of my region. I want to learn more about my local flora. I want to know what are the species in my region. I need their scientific names. I already have learned that my students know the local names and uses of many local plants. But me as the teacher, I have to do better, I should go beyond the local uses and local names. I will start a school herbarium with the help of my students. We will go to the field and collect plants, take photos and study them at school.

I did it. I brought from a field trip all kinds of botanical specimens. But my plants have no scientific names.

What should I do? I learned that in Tuxtla Gutiérrez, the capital of my state, there is a Herbarium where people can help me identify plants and obtain additional information. I decided to do it. Unfortunately the local herbarium is very small, with almost no botanical library, the scarce identified collections available are donations from visiting botanists and many of them have no species names. The resident botanist is not a trained taxonomist. There are no books available that can help me, there is no Flora of Chiapas and of course no local florulas. I learned that my collection of plants probably can not be identified locally and that I have to send my collections to a larger herbarium.

I decided to send them to the closest larger herbarium: the Herbarium at Xalapa, or to the National Herbarium of Mexico at UNAM. Both of them have a large collection of plants from Chiapas and a good number of taxonomists. After some months, I learned that they cannot help me. They have many other duties in addition to identify plants from a local school teacher of Chiapas. In addition many of my collections are incomplete, many of them are sterile. The collections were never returned to me. There is a great probability that those collections ended in the storage room with other problematic collections. Or they may will end in a waste basket.

After a year of my initiative and after many letters and phone calls, I came to the conclusion that to name a plant in a developing country you have to be an expert located in a large herbarium. For a teacher like me it is impossible to learn about my local flora and to teach my students about the biodiversity of plant life in the region. Maybe the next generations of teachers will have available all the published floras that are underway now and could use them in their classrooms.

The final result is that I, a new user of botanical information and a potential contributor to plant exploration, became disappointed and will never try to do it again.

This imaginary example is, unfortunately, the rule in developing countries. There are very few local floras available written in the local language, teachers in schools have no educational materials or ways to inquire about native plants. In rural communities where

students may have traditional knowledge on plants will not have any possibility to connect that knowledge with that of modern science.

They may be bombarded with newspaper and TV information on the extinction of plants and the importance of biodiversity, but no linkage with their day to day activities.

It is clear to me that we need to change this trend, we have to look for other ways to address the need for plant information from the many thousands, if not millions, of potential users of this information.

Unfortunately, there is a very widespread idea that the only way to solve this problem is by establishing new herbaria as the centers for botanical research and plant information. Even though the idea is good, the reality is that many of these new institutions never achieve the critical size to be meaningful. They are usually underfunded or not funded at all and their resources are minimal. So, the result is a poor service to users and increasing frustration.

The result of this, is that floristic research becomes more and more concentrated in fewer and fewer institutions, and for the same reason become more ineffective to deal with local users in the countries that need most the information.

The production of floras is strongly linked with this problem. Fewer floras of developing countries are actually developed and published in the developing countries themselves.

Many developing countries have to face the paradox of knowing that their development is based mainly on their natural resources. Yet they don't know what they have. They do not have the basic facilities to find out what they do have. Pressure exists for the conservation of their biodiversity, but no efforts exist to help them know what they have or even to help them learn how to know.

It seems to us that a major reason for these problems, in addition to lack of funds, is the lack of more efficient means of access to the available information. If we improve that access, we would also improve the basis for the identification of new species as well as known ones. We would also improve the process of learning more about the distribution of species, abundance and threats to their extinction.

One promising approach is the combination of the use of floristic databases with the use of video disks. We have been experimenting with the possibilities of using the Floristic textual databases with video images. We have developed two laser videodisks projects:

One is a project to develop a video disk for the Flora of Veracruz. We have been capturing images on different groups of Veracruz plants in optical disks that later will be transferred to the final laser disk. This project is being developed with Andrew Vovides. The other is a videodisk of the Trees of the Great Peten.

In the Flora of Veracruz we have produced a demo disk in which we included samples of images with its corresponding textual floristic and environmental database. This demo was produced with the main objective to illustrate what we wanted to do and use it for fund raising.

This disk includes about 10,000 images of plants. Let me show you slides made from a TV screen connected to a laser disk video player.

Every image is backed by a textual database from the Flora of Veracruz. The images can be displayed manually or through a computer program. In this demo-disk we have included several images of herbarium specimens.

Since botanical illustrations are a powerful tool in plant identification we included some images from drawings of the artists of Flora of Veracruz, from classical drawings like this orchid from the Book Orchids of Guatemala of Copeland, and from ancient manuscripts like this one from the Badianus.

An important tool in plant identification is a glossary of botanical terms. We also included illustrations of the Botanical Glossary of Flora of Veracruz of Nancy Moreno. This image database is also backed also by a textual database available for this glossary.

A few slides were captured as images in the video-disk. This information has great potential for plant identification and for capturing information of ecological value.

Since many type specimens have been photographed in black and white, we included a few of these images. Unfortunately, they turned

out very bad. We need to improve the capture technique for these photos.

However, black and white scan photos of pollen came out all right, and added value to the demo disk.

We also included a set of images of maps of Veracruz that are linked with the geographic database of Flora of Veracruz. Satellite images can be included as well. This is from the Sontecomapan area of Los Tuxtlas region.

With this information it is possible to develop all kinds of uses for the video-disk: educational, curatorial, plant identification and lectures. One of this projects is the orchids of Veracruz that we have been developing with the Orchid Society of Mexico, unfortunately this project was interrupted for lack of funds.

In order to illustrate the potential of this disk for educational purpose, we have produced a demonstration videotape, that is available, if any of you wish to see it.

The demo disk of Veracruz and demo videotape on Q'Taxa were developed for granting agencies. Unfortunately, up to now I have been unsuccessful in getting funds for all of these projects for a video flora of Veracruz. I am hoping that the new Commission on Biodiversity could be interested to help us find the funds for this project.

However, I felt that a smaller project could have better possibilities. For that reason I decided to create another video disk for a complete project. I chose the Trees of the Great Peten area of Guatemala, Belice, and Mexico as a full demonstration project. We have produced a first version of this disk. I will show you some slides of images from this laser disk.

This project has been funded by grants from the MacArthur Foundation, the University of California at Riverside and Conservation International. This is a team project with collaborators from Riverside and Mexico. The idea was to capture images of the tree species that are known to occur in this region. For this project we used images from specimens from several herbaria.

Specimens were photographed and then captured in the video disk.

For this project we attempted to have photos of living trees. We used photos of several colleagues and also hired field photographers. We included drawings from publications. In this disk we also included motion video clips from aerial views taken with a video camera.

The first check disk is now under review for errors and omissions in the video as well as in the textual database. After this is done it will be distributed at a low cost (just to recover expenses) to educational institutions.

In the computer package that will come with the disk we are planning to include some practical programs. For example: Nisao Ogata is developing an online identification program for the trees of the Peten using the Delta format and the Pankey program. This program will be linked with the laser video disk.

This disk will have an image based help procedure, that will bring to the screen photos or drawings to help with the on-line identification, and, the actual parts of the plant that are used in the keys. After keying out a species, the images available of that species can be brought to the screen for the ultimate comparison.

This new videodisk will have a program to run it that will include a large bibliographic database on the trees of the Peten.

Our experience with the use and development of these videodisks have convinced us that optical storage technology could be an extremely useful and economical solution to the problems of plant identification and plant information. But, even most important is the access of this information to non-conventional users such as our local teachers or amateur naturalists.

One key element of this solution is that developing countries can actively participate in the production and usage of these disks.

Floristic databases that include laser videodisk technology provides a partial solution to the limitations of accessibility of information on plants for identification purposes and also for information in general on plant resources. One side of a twelve inch videodisk can hold 54,000 different images.



Floristic video disks that include images of plant specimens can be a very good complement for any herbarium. It requires at least a videodisk player (an investment of approximately US\$1,000 or less at manufacturer-suggested retail prices).

But for easy interactive use, one needs to have that videodisk player attached to a computer (whether a IBM-compatible PC, Macintosh, Sun workstation, or whatever).

A video flora video disk can be a very powerful tool in the identification of plants. The great advantage is that the identification can be done in situ. Several hundred thousands of images of specimens, species and data can be accommodated in a few laser disks.

The images and data one needs for identification or other information purposes can be at one's finger tips in a school classroom, library, or at a field station, anywhere where electrical power can be made available (through existing lines, gasoline generators or solar panels).

In addition, these disks are by no means limited in use to identification aids. Simply by changing the philosophy of interaction, the same disk can be used for many different purposes including education, ecological research, etc.

The value of a video flora disk will be related to the precision and accuracy of its information. Images based on actual specimens and slides of living plants from which those specimens were collected have a higher value to those that do not have a voucher. And here is the Achilles tendon of this approach. The capture of the data and the images has to be done in coordination with an active field research program. This may take a lot of time and effort. I believe that this work should be done by local scientists that will prude the image banks in exchange with other visual banks of herbarium specimens bibliographic information, etc.

By doing this we are fomenting organized field work for a precise objective: the production of a video flora. The local centers will be enriched with information and local collections. Larger institutions with duplicates and information. And the most important: this accessibility will promote more activities in the study of local floras by all kinds of people from school children to amateur botanists.

Video disk players will be in a few years as common and as popular as video tape players. Computers are everywhere. The challenge is to produce programs at a reasonable price that encourages its widespread use.

We see video-flora as an ideal solution for the crisis in plant exploration and research for the following reasons:

(1) the cost and resources for producing satisfactory video floras are within the capacity of most countries of the world and the agencies and foundations funding natural conservation and resource management.

(2) the cost of providing the equipment (videodisk players, CD-ROM drives and even IBM-compatible or Macintosh computers, if necessary) for research institutes is also within the capacity of most funding capacity of world conservation agencies and foundations, not to mention governments.

This approach opens the possibility of having electronic herbaria in remote places with a small investment (7-8000 DLLs) and access to information through video disks from every where. The challenge is in the acceptance of this approach by the botanical community and by the grant agencies to encourage, support, and fund video flora projects.

Let's go back to our local teacher and think that a video flora of Veracruz is already available in video disk. This teacher could search in his disks for the scientific names of the local names of the plants. He could see illustrations of dried specimens, living plants of his species and compare them with his specimen. He could then do literature searches on the species, to learn about their distribution, uses, biological characteristics, etc. He could learn about new research that needs to be done, etc. He could choose to try to identify his specimen using the on-line identification programs linked with images. He could find information on how to start a local florula. He could print descriptions, lists, keys for his students. He could do many more things, his limit is his initiative. This possibility is not a dream or a science fiction, it is within the reach of our hands. We are working on it. I have done a video-demo of this approach that we are trying to develop.

Unfortunately, I am finding many obstacles to develop a project such as the one I am describing. The production of a video-disk can be an expensive enterprise. Funding agencies in developed countries are interested in more exploration of unknown areas rather than experimenting in new approaches such as the one I have been proposing. Since the most benefited by this approach are the local institutions in developing countries, maybe the funding should come from the developing countries themselves.

Projects such as these in fact could be the best way to contribute to the repatriation of crucial biological information from large museums and herbaria of the world that holds priceless collections. But even more important than this, is that a video flora will stimulate the interest on local plants by people that normally do not have the opportunity to learn about their own plant resources. To me this is a direct contribution to our efforts to conserve nature and its resources.

Xalapa, Ver. a 9 de noviembre, 1992