

Learning botany in the field: can we afford to give it a miss?

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The throbbing and rich discipline that Botany is today is due to its founders who travelled across the Earth studying plants growing in different parts and geographical niches of the world. Equipped with a keen sense of observation, they helped develop the discipline of field botany that records the habit and habitat of a plant and assists in the taxonomic identification of plants, including those that appear similar but, in reality, are different. Field study is an essential and integral part of learning about living organisms, including plants, animals and the teeming microbes that outnumber all plants and animals taken together. Learning biology in field settings is a real-time experience which helps develop creativity, environmental awareness and a sense of accountability towards nature among students. Observations on the natural habitats, plant habits, ecology, growth cycle and biology provide deep insights regarding plants that are important sources of food, fuelwood, timber and medicine. Since neither the environment nor the diverse living organisms inhabiting a constantly changing interconnected world remain the same, field botany is never static and requires monitoring by the days, weeks, months and years. Further, it has been realized that field-based education is critical to biological sciences in general and plant sciences in particular since it provides basic training for key aspects such as behaviour, ecology, evolution and conservation of plants. However, during the last two decades, there has been a considerable decline in the interest in field studies among both students and teachers in botany. This has amplified further in recent times, leading to a total disconnect between learning botany in the laboratory and in nature. Young budding botanists are deprived of holistic field-based training and learning opportunities, limiting them to the rather suffocating confines of laboratory settings. As a result, the practice of supplementing teaching and learning botany with field-based studies has been completely taken over by classroom teaching alone. This disconnect is so deep that students studying about *Pinus* or *Cycas* know about them only through specimens preserved in glass jars. They cannot relate the bookish laboratory study of these preserved plants to those growing right in their home gardens or public parks. Such students who study botany of important

crop plants can hardly identify a plant in its natural habitat or in a farmer's field. Our teaching-learning method has been reduced to 'botany in glass jars' instead of field botany.

With the emergence of biotechnology in India during the last few decades, there is growing interest in molecular biology and genomics, ignoring the importance of basic botany. One has to realize that without knowing about plants, molecular studies will have little value. The challenge, in fact, is to combine and relate good holistic botany with the good molecular biology of the plants. Unfortunately, most teachers are also attracted towards the modern molecular branches of botany, resulting in tragic neglect of the plant as a whole.

Historically, short- and long-distance botanical excursions used to be an essential component of the syllabus, and it was mandatory for every student to take part in these excursions without fail. Gradually, the long-distance botanical excursions became 'fun tours', while short-distance excursions turned out to be essentially 'picnics' in the midst of plants. Such deviations were facilitated by incompetent and disinterested teachers influenced by the choices of students. Currently, this activity has either been completely abandoned (with a few exceptions) or replaced by non serious activity. The botanical excursions allowed students to observe plants in their natural habitats of different geo-climatic regions of the country. However, these excursions also had negative consequences. Untrained student groups from various parts of the country caused harm to our natural biodiversity while visiting these ecosystems. We need to think about alternative ways that allow the study of field botany without disturbing the natural habitats. Sensitizing our students about the importance of the conservation of biodiversity can be another facet of our teaching-learning process in field settings, which will automatically inspire students to observe plants and make limited collections under the guidance of a knowledgeable field botanist. Indeed, no specimen should be collected unless it is ensured that a replacement plant is growing in the vicinity of the site of collection. We must find ways to cultivate renewed interest among students as well as faculty members in this area. Students, while be-

ing mindful regarding the conservation of plants, must be taken for botanical excursions to a variety of locations on a regular basis. In many universities and colleges, there used to be botanical gardens to study and observe various plants. These botanical gardens served as repertoires of rare plants collected from different geographical locations, aiding in their *ex situ* conservation. Several universities continue to have botanical gardens with many plants belonging to different taxonomic groups and categories. However, many botanical gardens in colleges and universities have become victims of the apathy of the college/university administrators, with poor financial resources for their maintenance, inadequate staffing, a lack of interest among the faculty members and paucity of land space. All these factors together have cumulatively led to the poor state of the existing botanical gardens. There are no new initiatives to revive these gardens, which can serve as important resources for learning botany.

We need to ponder why field-based methods of teaching-learning are important for the advancement of biological knowledge. At a time when many plants are either on the verge or have become extinct, it is all the more important for educational institutions to spread awareness regarding the specific care that specific plants require. Governments must interact with field botanists to learn about the implications of plant extinctions, and competent field botanists must join the political system to support the plants growing in our vast fields. Forest officers must work in tandem with field botanists so that the administration fully supports science. Needless to say, the Government of India must create jobs for such field botanists to facilitate the best management and conservation of our floral wealth. We need to determine why students are not offered field-based studies. Field studies not only result in better science but also better scientists and citizens, thereby substantially affecting the human-nature relationship that forms the basis for sustainability. An eminent ecologist, Paul Dayton¹, rightly said, 'there is simply no substitute for actually experiencing nature, to see, smell, and listen to the integrated pattern that nature offers to an open mind'. Field studies contribute to improved academic

performance and cognitive learning among the students of botany.

Mogk and Goodwin² have mentioned that 'the field setting is one of the important crucibles where science and scientists co-develop'. Unfortunately, molecular biology, genomics and biotechnology have become fanciful words for many who find these areas more lucrative, leading to complete neglect of classical botany. It is high time that botany teachers identify the causes for the gradual decline of interest in field-based education among students and younger faculty members. It is equally important to regenerate interest in field-based studies in botany.

One of the prime reasons for the complete neglect of field-based studies is the defective teaching-learning process. The current approach is to complete the curriculum within the given timeframe, ignoring the elements of learning. Privatization of education in India has led to the management of higher education by under-qualified/incompetent owners who fail to realize the importance of field-based studies in biological sciences. They encourage only classroom teaching, because of financial, operational and disciplinary reasons and therefore discourage field trips. The instability of regular faculty is another reason that such practices have lost priority. Poor salary for faculty members makes it difficult to retain good teachers for long. The management of the educational institutions unaware of the importance of the plants neglects the field studies.

State-run colleges and universities have also started following the same course due to the lack of resources, intent and enthusiasm. The new breed of teachers in colleges and universities are also the product of complete neglect of field-based studies, and therefore they are not properly trained to take students on field excursions. Since their field knowledge is extremely poor, they try to avoid such activities. There is an acute dearth of knowledgeable teachers who can identify plants in the field, and recognize various diseases in plants caused by viruses, phytoplasma, bacteria, fungi, nematodes and mistletoes. Consequently, the new generation of teachers in our schools, colleges and universities has no field-based experiential knowledge. Botany has been constricted from expansive fields to the neglected corners of laboratories.

There has been growing disinterest, rather apathy, towards classical botany, particularly taxonomy and systematics of plants, which has reduced the number of competent and knowledgeable teachers who can help students identify plants under natural conditions. The importance of field-based studies of plants cannot be undermined, especially with respect to taxonomy, plant pathology and ecology. For example, in plant pathology, the symptoms observed in the farmer's field do not match those observed in preserved samples in glass jars or herbarium sheets. No ecological exercise can be complete unless the students are taken to field settings comprising different ecosystems representing a myriad of plant populations and edaphic factors. The real experience of different types of pollution in the natural environment and their impact on living organisms is possible only if field-based studies are undertaken.

We need to reverse the process before it is too late. We must create an ecosystem for learning botany in the laboratory and the natural environment. Taxonomists and ecologists may extol the benefits of field-based studies. The common perception of such studies as curricular 'extras' has percolated deep into the minds of many, rendering this activity unimportant for making a part of the core curriculum. The field experiences must be put into proper context to make their core importance readily apparent. Field studies must be made a part of the regular examination and assessment system, and appropriate grades must be awarded as an incentive so that such studies become relevant and attractive.

Concerted and coordinated efforts need to be put in place in order to revive the old practice of studying plants in the field coupled with laboratory studies. We have to create a new generation of experts in the field of botany who can serve as master trainers. This can be done by the University Grants Commission (UGC), New Delhi, or similar regulatory bodies by creating a mechanism by which we can regularly train a certain number of our faculty members in colleges and universities in this area of expertise. Special incentives are needed so that students are encouraged to take classical botany. For this, UGC must establish a 'Task Force' which can work out modalities for implementing suitable programmes. A pool of scholars trained in the methods of

field botany can propagate this knowledge further to keep the process going.

Additionally, the Botanical Survey of India through its headquarters and regional centres, State Forest Departments, Indian Council of Forestry Research and Education through its headquarters and regional institutions, and Centres of Advanced Studies in Botany or other departments with a strong base of classical studies can play a pivotal role in this direction. They can conduct regular refresher courses involving field-based studies and motivational lectures on the acquired knowledge. To strengthen our base of experts in the field of botany, the Government could consider creating additional positions in the universities to fill the gap of experts in this area of study. It can be made mandatory for colleges and universities to send at least one faculty member of botany for such refresher courses on a regular basis.

All the above-mentioned organizations must join together to provide opportunities for the current and future generation of students and faculty members in botany for appropriate training so that we can generate a pool of experts in the traditional areas of botany such as plant taxonomy, evolutionary and developmental botany, conservation biology, ecology and plant pathology. This pool could then serve as an important resource of experts who can make wise decisions as suggested by trained field botanists. The problem is too critical to postpone immediate remediation measures.

1. Dayton, P., In *The Way of Natural History* (ed. Fleischner, T. L.), Trinity University Press, 2011, pp. 65–80.
2. Mogk, D. W. and Goodwin, C., In *Earth and Mind II: A Synthesis of Research on Thinking and Learning in the Geoscience* (eds Kastens, K. A. and Manduca, C. A.), Geological Society of America, Special Paper No. 486, 2012, pp. 131–163.

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