



An Evaluation of Educational Trends in Economic and Ethnobotany¹

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Resumen

En 1995-96, se envió por correo un cuestionario a 217 estudiantes miembros de la Sociedad de Botánica Económica (SBE), a 943 miembros de la SBE, incluyendo a todos los miembros extranjeros y 250 decanos, presidentes y directores de universidades estadounidenses en el área de biología, botánica, ingeniería forestal y herbarios importantes. Dicha encuesta contenía preguntas relacionadas con las oportunidades de educación en botánica económica en las instituciones de los encuestados. Un total de 169 respuestas de parte de los estudiantes fueron divididas en dos categorías: estudiantes de post-grado y estudiantes de grado. Las respuestas de los docentes totalizaron 187 y fueron divididas en cuatro categorías que representaban: 1) instituciones sin programas, 2) instituciones que ofrecían 1 curso, 3) aquellas que ofrecían varios cursos pero que no contaban con programas y 4) aquellas instituciones con cinco cursos y/o programas completos en botánica económica o en áreas relacionadas. Los resultados preliminares de la encuesta fueron presentados y discutidos en un foro abierto en la reunión anual de la SBE de 1995. Dicho foro generó datos adicionales que fueron incorporados en una presentación y discusión de grupo promovida en la reunión de la SBE de 1996. Los resultados de las encuestas y los dos períodos de discusión indican que hay 30 programas disponibles, con 13 escuelas que ofrecen de 2 a 4 cursos y 43 escuelas que ofrecen por lo menos 1 curso. Cincuenta y tres encuestados reportaron la ausencia de cursos. Los resultados de la encuesta y las discusiones de 1995-96 indican que existe una gran demanda de más cursos por parte de los estudiantes y el personal docente por programas de post-grado más intensos, así como también por el desarrollo de cursos de grado y programas en el área de etnobotánica. Las tendencias en la encuesta son presentadas en términos de análisis previos de oportunidades de educación y desarrollo futuro de cursos y programas. Hasta este punto, proveemos líneas generales de posibles cursos en niveles más básicos y más avanzados así como también programas de post-grado que representen una cohesión de programas ya disponibles, recomendaciones de los docentes, ideas de los estudiantes y nuestros análisis de las tendencias educativas en botánica económica. Los datos presentados son incompletos y representa solamente respuestas positivas y participación a través de encuestas.

The field of Economic Botany/Ethnobotany has been growing at a rapid pace since the late 1960's, as represented by increases in the numbers of articles published (Cotton 1996:14). The expansion of the field has occurred at different levels of interest and involvement ranging from the passing attention of the general public to the focused scholarly works of academicians. Because of the growing interest in the subject, college students are increasingly seeking out educational opportunities and literature in ethnobotany and related "ethno" studies. As members of the Society for Economic Botany (SEB), we have repeatedly

encountered students seeking information about available programs, and as students ourselves, we wanted to determine what educational opportunities are actually available. Thus, in the 1995-1996 school year we conducted a survey of the membership of the Society for Economic Botany (SEB) and the deans/directors of the major North American schools of Botany, Biology and related fields in order to identify the range of possible courses of study in ethnobotany.

In addition to receiving questions from students, we also frequently receive inquiries from faculty members at different institutions who are interested in developing courses and curricula in economic botany/ethnobotany. These faculty

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usually want advice on course content and recommendations for texts/reading materials. We chose to gather this information from the survey participants for presentation here as part of our analysis of educational trends.

Students who contact us frequently express uncertainty about their futures and discuss their motivations for exploring ethnobotany as a discipline. Through surveys of students as part of the following study, we gathered information about motivations, educational desires, and anxieties. All of these topics except for student anxieties, were discussed in one of the previous SEB meetings. Thus herein, we present only a short discussion of the more commonly reported student anxieties and our perceptions of the reality of these anxieties.

Previously, two major resources were available for those interested in learning more about economic botany educational opportunities: the SEB newsletter, *Plants and People* and a 1964 article in *Economic Botany*, by Harriette Bartoo, entitled "A Survey of College Courses of Economic Botany". Information about course listings and available programs is regularly updated in the newsletter, but Bartoo (1964) has never been revised.

Prior Published Surveys of Educational Opportunities

The only prior published survey of educational opportunities in Economic Botany was produced over thirty years ago (Bartoo 1964) based upon a study conducted in 1962-1963. Bartoo's principle result was a tabulation of the courses in economic botany offered at U.S. schools. She identified 110 universities with courses in economic botany. No schools surveyed were found to have more than two courses and none of those indicated that they offered specialized degrees in Economic Botany (although at least two schools were singled out for their expertise and strides in that direction). Bartoo furthermore indicated that five of the universities only offered courses to graduate students. Bartoo (p.298) drew special attention to the courses taught at Harvard University and at Iowa State University at Ames. The Harvard courses were taught by Richard Schultes, were accompanied by laboratory field work, and included access to good research facilities and resources. The Iowa State courses were recognized as offering the most in-class lecture time.

Useful recommendations provided by Bartoo included proposed course work, curricula, and textbooks. Textbooks recommended by Bartoo included Hill (1952), Schery (1952), Hutchinson and Melville (1948), Stanford (1934), Hayward (1938), and Bailey (1949). Also cited as texts for graduate studies of ethnobotany were Luomala (1963), Towle (1962) and Faulks (1958). Two laboratory manuals were recommended: Lawrence (1952) and Schultes & Hill (1960).

The major conclusions of the 1964 paper were: 1) economic botany courses were increasingly being offered, 2) there was a strong demand for these courses by students, 3) there was an insufficient number of qualified/interested instructors, 4) economic botany courses and research were increasingly multi-disciplinary, and 5) multi-disciplinary

approaches and specialization of knowledge had not yet penetrated to the level of the available textbooks.

Bartoo's analysis included a set of useful observations and speculations about the future that we have used as an outline for discussing our results (see below). Key observations in her survey include not only a review of available courses but also an analysis of both the existing and probable future of economic botany education. Her basic approach for gathering data upon which to make her observations was one of selected solicitation. She solicited information based upon published course listings that directed her equally to all schools listing an aptly named course. In turn, this method led her to schools with listed courses, either offered (good) or no longer offered but still listed (dead), but only courses. Our 1995-96 survey (as described below), however, used a very different approach. We were hoping to obtain information about programs, and resources as well as information about course offerings and course content. Furthermore, we did not want to identify every economic botany course, but rather wanted to focus upon institutions with programs of courses.

1995-96 SURVEY

Methods and purposes

The survey of the membership of the SEB was conducted using a mailing to all members with addressed return envelopes included and a cover letter outlining our purposes. The purposes outlined in the letter were; 1) to prepare a contemporary review article, comparing the current state of education dealing with Economic Botany with that in 1963 (Bartoo 1964), 2) to produce a summary of the educational programs available for students, 3) to encourage the advancement of all programs in this area by disseminating institutional information that could assist both students and faculty developing their respective programs. These purposes were presented as part of the justification for individual responses to survey. It was assumed that those responding would represent faculty in the best positions to answer the questions as well as those who have an interest in the development of educational programs and courses.

With these purposes in mind, our survey was expected to provide a listing of available programs in economic botany and ethnobotany for interested students and faculty. Secondly, the surveys were expected to, in some manner, provide an updated version of Bartoo's (1964) survey of college courses of economic botany. Third, the surveys were expected to focus the respondents upon determining what they wanted from an educational program in these fields. Finally, the study of the survey results was expected to produce a set of model programs and program directions based upon faculty and student educational motivations, needs, and interests.

Questionnaires targeting students (Figure 1) were sent to 217 SEB student members. Questionnaires targeting faculty and adjunct faculty (Figure 2) were sent to 943 members of SEB including all international members. Additional faculty

consisting of 250 deans, department chairs and directors of major North American colleges of biology, botany, forestry and herbaria were also mailed the survey questions. Student questionnaires were sent along with the faculty mailings to encourage responses from "ethno"science students who were not members of SEB. Questionnaires were received over the period of almost two years with the last response arriving in January of 1997.

RESULTS

Of the 1,193 surveys sent to faculty, 187 responses were received, giving us a 16 % response rate. Forty-six of these responses, were alternative faculty describing offerings at the same institution. Additionally, a number of the responses were received from companies, foundations or other non-degree granting institutions. The results of these responses are sorted into tables 1-4. Of the 217 surveys sent to student members of SEB, 169 responses were received. The full responses to the student surveys are not included in this publication but will be available through the University of Hawai'i, Department of Botany and the University of Florida, Department of Botany, World Wide Web home pages.

The survey identified 135 institutions world-wide offering courses in economic botany. Of these, 106 were from the United States with 21 reporting a program in economic botany or 5 or more courses (see table 1 for list of institutions.) 11 offer two to four courses (see table 2), and 29 feature one course (see table 3.) Worldwide, 30 institutions report offering a program in economic botany or 5 or more courses, 13 have two to four courses, and 43 offer one course. An additional 58 institutions indicated that they did not offer any courses or programs (see table 4.)

The results of the student surveys included data on their class standing, chosen field(s), curriculum interests, mentors, and anxieties about studies in economic botany/ethnobotany. All but the anxieties have previously been reported at SEB annual meetings in 1996 and 1997. The most commonly reported anxieties were: lack of research funding, lack of good mentors and strong university programs, post-graduation occupational opportunities, and feelings of lack of respect for their chosen field.

DISCUSSION

Student Anxieties

The student survey attempted to identify the types of anxieties experienced by the students as a result of their decision to study economic botany/ethnobotany. An attempt to understand some of the reasons that students might begin, but not complete, their studies of economic botany was made based upon their reported anxieties. The following are selected anxieties along with our analysis of each.

Lack of Funding

Lack of funding is not terribly unique to ethnobotany, in fact most areas of study are experiencing funding limitations, cutbacks, etc. Traditionally, ethnobotanical research has been funded secondarily by grants in related fields, e.g. agronomy, cultural anthropology, pharmacognosy, plant anatomy, taxonomy, etc. More recently, additional funding has been provided through the burgeoning fields of conservation biology, ecology, sustainable development, etc. Students of ethnobotany should follow the example set by former students of the later fields who experienced a dearth of funding, i.e. using funding from one source to fund a primary project, such as taxonomy of a group of plants and secondarily conducting ethnobotanical field studies. Just as ecology and conservation biology have come of age, and of funding, so too will ethnobotany as the field develops a basis for recognition in the world of science. Orphans often are impoverished, but entrepreneurial orphans may rise to the top and develop their own funding. Ethnobotany is a young, scientific orphan about to come of age.

Lack of good mentors and strong university programs

Perhaps rather than there being a lack of good mentors, there is a lack of widely distributed mentors. Once again, in an emerging discipline it is unreasonable to expect every university to have both economic botanists and ethnobotanists or even either of these. Hopefully, this paper will help alleviate some of this anxiety by providing students with a list of mentors and programs. We do not attempt to rate the faculty or universities as good, bad or otherwise. We do report the number of courses offered and perhaps that is a limited indication of the level of intensity provided. The concern of studying under a well respected economic botanist is a valid one. It would serve potential students well to review the literature produced by potential mentors and to discuss programs and mentors with recognized leaders in the field. One of the best mechanisms that potential students have to encounter potential mentors and to evaluate the respect of each fellow economic botanist, is to attend the annual meetings of SEB and Ethnobiology, etc. Additionally, recent meetings of SEB have featured sessions dedicated to examination and discussion of educational opportunities in economic botany and ethnobotany.

Occupational opportunities

The occupational opportunities in economic botany are expanding, particularly in developing countries where there is a desire to internally identify and reap economic benefits from indigenous uses of plants. As with research funding, students would do well to consider employment in parallel fields with future expansion into economic botany/ethnobotany occurring as more positions become available. Some general occupational opportunities outside of academic employment include working in and using ethnobotanical skills in one of the following areas: pharmaceutical field research, land/use development, herbal medicine industry, health food industry, agricultural introduction/new crop sciences, state and federal agriculture, forestry, and land management units, non-U.S. cultural

conservation organizations and government positions, primary and secondary science education, and for those trained at the highest levels, college instructor of economic or ethnobotany.

One of the more exciting and rapidly expanding opportunities for students of economic botany is that of the primary school science teacher. Many state systems of education now require teachers to obtain a bachelors degree in a specific field followed by a masters degree in education. Ethnobotany training certainly provides a student with a sound background in biological and social sciences as preparation for the modern classroom. It should be noted that Bartoo (pp 303-304) also noted the potential of this type of training for primary and secondary teachers.

Lack of respect

Economic botany, and particularly ethnobotany, will continue to suffer from a lack of respect until a substantial theoretical basis for the field has been developed. As more purely ethnobotanical studies such as Alcorn (1984), Johns (1990), Moerman (1979), are produced, this respect will be earned. Additional recent theoretical papers have been reviewed by Peters (1996) and Phillips (1996). General guidelines and standardization of research techniques have been reviewed by Alexiades (1996), Balick & Cox (1996), Cook (1995), and Martin (1995). The development of respect for ethnobotany will follow the pattern experienced by ecology which endured years of disrespect until theoretical models and a systematic structure for investigation was developed. Respect will only be won with hard work and good science. Students should see this as their opportunity to make the contributions which will define a future field.

Comparison of the 1964 to the 1996 Survey

Bartoo fully expected many of the courses identified in 1963 to evolve into economic botany programs in the future (for 1963). In 1963, 101 courses, 24 associated courses and two programs were identified in the U.S. The 1996 survey showed 86 schools with courses and 30 programs worldwide. Perhaps the most striking change since 1963, is the number of institutions offering programs. Bartoo accurately predicted the development of these programs from solitary courses, based around the influences of the SEB membership, and it is surprising to see how many of the programs have evolved to incorporate the elements of her proposed graduate curriculum (p.309).

In 1963, Bartoo concluded that the development of courses in Economic Botany was linked to the formation of the SEB. Because of this relationship, she recommended that an education committee be formed within SEB (this has occurred) and that SEB direct a summer institute or conference where teachers of Economic Botany could meet and discuss teaching methods and course content. Interestingly, she also provides a list of recommended elements of a Ph.D. program. Our data lends itself to an updated analysis of this point. Consequently, we also provide outlines of possible undergraduate and graduate degree programs that represent an amalgamation of available

programs, faculty recommendations, and student conceptions.

International distributions of courses and programs (Table 5) indicate limited availability of educational opportunities outside of North America, with South America being next. The skewed distribution may simply be a reflection of the limited survey of the SEB members (mainly in North America) and the inclusion of North American departmental chairs, deans, etc. all of which weighted responses toward North America. Cotton (1996:13) has presented evidence for more extensive local research efforts in Asia, Australia and Africa and it seems likely that educational programs are either already associated with that research or soon will.

Courses, curricula, and definitions

The interrelated fields of economic botany, ethnobotany, ethnoecology and ethnobiology have been evolving over the 100 years since Harshberger coined the term "ethnobotany" (Harshberger 1896). This group of fields can be divided into two sub-disciplines which, although being inseparable, represent two levels in the evolution of the discipline. The older of these two subsets, herein called economic botany, is based upon the definition provided by Hill (1937): the study of the array of plant usages by peoples. The focus of economic botany studies is on plants, with such studies being largely descriptive, contributing to a database of plant usages by different cultures. Furthermore, studies in economic botany typically present both traditional and new uses of plants. These studies often present either the use of a single plant or a group of plants throughout an array of cultures, or present an array of plant uses from one or a few cultures. Economic botany can be differentiated from studies of the anthropologically based material culture, which focus on cultures, secondarily mentioning the plants that are used (sensu Ford 1987).

The more evolved sub-discipline, herein called ethnobotany, is based upon the definition provided by Jones (1941): the study of the interactions between people and plants. Ethnobotany then, emphasizes interactions, and is neither plant nor culture specific. Ethnobotany is built upon a base of data provided by studies in economic botany. Indeed, most papers written on economic botany include short discussion sections that could be considered as ethobotanical studies. In contrast, publications in ethnobotany, as a theoretical science of human/plant interactions (see Davis 1995) are, from our observations, relatively rare. Examples of recent publications include: Anderson (1996), Begossi (1996), Bye (1995), Campbell et al. (1997), Casas & Caballero (1996), Johns & Kimanani (1991), Joyal (1996), and Phillips et al. (1994). Theoretical issues are coming under greater scrutiny as represented by recent contributed papers at the annual meetings of the SEB and the Society for Ethnobiology: Ehringhaus (1997), Ford (1997), Jones (1996), Ostraff (1995), Paul (1997), Peacock (1996), and Ugarte (1997).

The terms economic botany and ethnobotany have been defined in order to demarcate the two major foci of the educational programs available. Simply put, programs which

train/teach students how to observe and document the physical data of plant use in field settings are considered programs in economic botany. However, some programs appear to teach economic botany and are encouraging students to ask questions about the economic botany data they collect in order to produce interpretations and evaluations of the implications of plant-human interactions. These, largely student driven studies, are thus being used to develop an extended science of implications and interpretations from economic, linguistic, and cultural data sets. In neither type of program are considerations given to arbitrary categories of primitive/advanced, western/non-western, or traditional/non-traditional. It may be interesting to note that recognition of these two subsets in this form does not begin with this study but was recognized in 1963 by Bartoo (p.300).

Virtually all respondents reporting having programs indicated that they had an "ethnobotany" program. The reports of faculty and student research interests, and textual and course work materials tended to alternatively indicate that many programs focused upon economic botany data gathering and instruction. Because these fields are tightly related, and because all ethnobotanists must first be economic botanists, we have not attempted to categorize programs (all directly reported evidence would support only ethnobotany programs and no economic botany programs). Despite this, it would serve new students well to ask probing questions about research and educational opportunities at selected universities in order that they may identify a university that will provide the type of education they want (economic botany, ethnobotany or both.) Clearly, students who want a very practical knowledge of the uses of plants should avoid a program that emphasizes theoretical ethnobotany. Alternatively, students wishing to probe into theoretical questions may wish to avoid programs that are rich in economic facts and lack strong bases in ethnobotanical theories.

Development of programs in ethnobotany and economic botany first requires development of basic courses. Tables 6-9 present common elements of lower and upper division courses in economic botany and ethnobotany. Principle differences between upper and lower division courses include prerequisite courses and depth of study within the course. Common responses from faculty and students involved in programs of study pointed to the importance of: 1) language training, even at the undergraduate level, 2) organic chemistry, 3) anthropological training for botanists and botanical training for anthropologists, 4) course work in basic geography, and 5) some significant level of field work, even at the undergraduate level. Tables 10-13 contain recommended areas of study that seem to be almost universal. It is worth noting that little difference in course work recommendations exists between undergraduate and graduate programs, therefore development of undergraduate programs may not be that difficult and where graduate programs are currently in place, and may exist by defacto.

The course and curriculum suggestions generally are based upon the results of our survey, Bartoo's survey, and the authors teaching experience. Content of a course in

economic botany or ethnobotany will vary widely due to local availability of plant materials, local cultural activities, and available expertise, resources, and local ecology, etc. Despite the differences, there are clear patterns of information that are typically found in courses that may be useful for new instructors seeking to establish a new course with little background upon which to build. We have included these elements in tables 6-9.

Educational trends in economic botany and ethnobotany

Educational trends and changes that have occurred over the last 33 years have involved all levels of educational study as well as the nature of the students and faculty themselves. Changes in courses have led to fewer (as reported here) courses, but offered greater diversity in content. Curriculum changes have moved departments from offering single courses toward offering whole programs in ethnobotany. Target audiences of courses and curricula as well have changed, with many courses now teaching few traditional botany students, instead focusing upon those in general science, education, and social sciences. The instructors of these courses are now either multi-disciplinary in training or in activities or are from non-botany disciplines. Student interests have broadened from general uses of plants to include studies of diverse cultures, ethnoecology, and cultural conservation. Demands for courses and curricula in medicinal plants dominate current student requests. Both graduate and undergraduate students currently choose to conduct field research in ethnobotany and many are making strides towards development of theoretical models of plant-culture interactions. In general, the future looks bright for current graduates with ethnobotanical training.

Courses that have been offered through traditional universities or through community colleges and trade schools in the past are now being presented through short extension services and in service training sessions. Recent development of summer field schools in the southwestern United States and in Mexico are evidences of growing temporary course bases. As these course offerings spread out, the material is becoming more generalized while reaching a wider audience. Ethnobotany is rapidly becoming a common word in certain circles, although the depth of scientific understanding behind its common usage is questionable. We are both excited and concerned to see proliferation of ethnobotany courses: excited because of the spread of valuable concepts and practical considerations of ethnobotany; concerned because of the shallow and sometimes misapplication of information considered to be ethnobotanical in origin.

Technology has changed the potential course work materials and the potential to provide courses to a wider audience. Modern ethnobotany courses are beginning to incorporate the power of the Internet and local computer applications for presentations and increased student access to course contents. Computer technology and easier, cheaper forms of travel even allow instructors to bring realtime demonstrations of cultural uses of plants, either physically or

via remote connections, into the class, room. These “hands-on” demonstrations allow students to develop greater depths of knowledge about the subjects covered. Non-high tech components of courses still include visits to botanical gardens and industries, but with increased public awareness of conservation issues, the sites visited are more likely now to include plants used culturally or to deal with ethnobotanical topics.

Curricula and programs of study are clearly on the increase as noted by the change from 2 programs in 1963 to 30 (23) in 1996. The developing programs do not just represent proliferations of courses, but also proliferations of faculty and student research projects that support the continued development and content specialization of ethnobotany courses. Increased intensity in curricula has gone hand in hand with increased complexity and depth of information available in published research articles in the equally proliferating journals: *Economic Botany*, *Ethnobiology*, *Ethnopharmacology*, *Ethnobotany*, and etc. These publications no longer accept merely simple lists of plants used by cultures, but now require advanced, probing, discussions of the findings, i.e. ethnobotany. Curricula have also expanded geographically and in depth as instructors have more fully recognized the value of traditional peoples who use plants, through co-instructed courses, indigenous led field schools, and publication of research results recognizing intellectual contributions of local peoples in research projects. Programs that now offer all or part of their courses in regions where local uses of plants can be incorporated into teaching schedules also offer students unique opportunities to establish and continue with relatively low cost research programs.

Laboratory and field studies are important additions to most of the programs recognized herein, with many of these including microscopy, ethnographic observations, demonstration or plant processing procedures, and use of visual aids such as raw plant products, artifacts, and tools used in plant processing. Laboratory and field studies are incorporated as part of existing courses, as independent courses, and as individual study programs. All of the programs that reported inclusion of laboratory and field studies also emphasized the importance of library research and the availability of quality research references. In a few cases, curricula required students to either participate in group research projects in classes or to produce independent novel research (for advanced degrees).

Instructors of ethnobotany courses have of necessity become more interdisciplinary in training and outlook as the multi-disciplinary nature of ethnobotany has emerged as a dominant theme in the academic rhetoric. Since students in courses are from diverse disciplines, instructors must become better versed in the array of subjects that they cross in ethnobotany in order to present clear, accurate, information to the students. Some instructors have chosen to team teach ethnobotany courses to take advantage of individual strengths, e.g. an anthropologist and botanist working together teaching an ethnobotany course. As the titles of courses have shifted from “economic botany”, “plants in human affairs”, and etc., to “ethnobotany”, so have instructors’ priorities. Instructors in ethnobotany programs

typically include social discussions of ethics, reciprocal responsibility for field research results, intellectual property rights, acknowledgment of local support and financing, and social responsibility of researchers to studied cultures. Western economics have been down played in exchange for more in-depth reviews of sustainable systems, local market management, energy/time input-output analysis, and etc. Although large-scale industry appears to have moved away from (or been removed from) participation with ethnobotany instructors and their research, some smaller companies and members of the herbal and pharmaceutical industries are still contributing to training and research funding for instructors. We are hopeful that future instructors will once again join forces with industrial partners who can provide training for students and research funding for faculty and students.

A review of the research interests of faculty members whom are actively involved in developing curricula of ethnobotany programs indicates that they are principally researchers whose research is in ethnobotany. Perhaps one of the major shifts that has been occurring over the last 33 years, accounting for all or part of the growth in ethnobotany programs, is the shift of researchers’ focus from other areas of botany (with side interests in economic botany) into studies directed specifically at answering ethnobotanical questions. Based upon student and faculty responses to our survey, it appears that the best researchers are also among the best instructors.

Students of ethnobotany are often older, with diverse, experienced backgrounds. Students do not appear to easily decide to study cultural uses of plants, but rather are more likely to arrive at that decision after following several other pathways, sometimes including experiences in foreign services such as the peace corp, missionary work, or military duty. Students who are successful in programs generally have these background experiences and/or experience living in other cultures and/or speaking other languages. Students of ethnic minorities may be more successful in studies of ethnobotany if able to take advantage of abilities to “switch” cultural perspective while conducting research. These students also are able to take advantage of unique insider opportunities frequently encountered in partially westernized cultures. A final category of students taking courses in ethnobotany is that of students foreign to the country in which they are taking an ethnobotany course. These students offer unique perspectives and experiences that enrich courses, particularly interactive discussion courses. Ethnobotany training also offers many of these students the opportunity to return to their home countries with fresh perspectives on plant uses and revitalized pride in their own culturally unique ethnobotanies.

Successful students report having valuable course work backgrounds in chemistry, biological sciences and language skills. This does not completely parallel descriptions of students who are interested in ethnobotany. Interested students are generally more knowledgeable of ecology, interested in medicinal plants, and concerned about cultural conservation, but are poorly trained in basic sciences: chemistry, physics, mathematics, biology, anthropology,

sociology, etc. Clearly, a balance must be struck in many students who, although eager to learn, are ill prepared to understand many of the lessons that ethnobotanical studies can teach them about life, dealing with people, and the complexities of plant-culture interactions. Although ill prepared for many concepts discussed in advanced ethnobotany courses, these students are generally willing to learn and will take remedial courses if directed to do so. In general, there is a large body of good students who want to learn about uses of plants and applied aspects of botany. Sadly, based upon the results of our student survey, these students are not always being given direction and advising that will prepare them to both learn about cultural uses of plants and also to secure jobs with their newfound knowledge.

Graduate students in ethnobotany often enter programs with deficiencies in one or more major areas of course work, e.g., anthropology student might enter a program with no background in botany. This usually means that the student must spend at least one year taking basic (undergraduate) courses in the deficient areas in order to then begin participation in the program. Students entering a program without a broad basis of education should expect to be advised to take more courses, and if not advised in this manner, should strongly question the strength of the program in which they have found themselves. Recent graduate student projects presented at SEB annual meetings have been conducted in a broad range of cultures, which more often than not, involved theoretical questions of plant usage impacts on cultural evolution. Graduate students must follow their interests in selection of their research projects, but it is worth noting the trajectories of currently developing ethnobotanical thought: increased emphasis upon reproducibility of field results and applications of results to creation of theoretical and applied models of cultural decisions and change.

Undergraduate students studying to become primary and secondary teachers may particularly benefit from ethnobotanical educations. These future instructors may move into school systems in which budgets are tight, materials in short supply, and have students who sometimes finding it difficult to connect classroom concepts with real world realities. Study of local uses of plants, through ethnobotany, is usually cheap (or free), can involve local volunteer experts, and may provide new reinforcements of cultural continuity between older generations of experts and younger apathetic students. Materials used in ethnobotanical presentations, if selected from plants and objects commonly seen by the students, will provide a level of reality and constant reminders of each lesson. Ethnobotany, therefore is put forward as a practical, applicable and fiscally wise educational investment in future instructors. Similar arguments can be made for undergraduate students of anthropology, business, geography, and other social sciences.

CONCLUSIONS

Some suggestions for the future of economic and ethnobotany educational opportunities can be based upon the results of both the 1963 and 1996 surveys and the educational trends observed in the intervening 33 years. The following list is thus modified from Bartoo (p. 307-308) and our analysis of trends (see above).

a. Education committees from the SEB (and other societies) should be coordinating an exchange of information from researchers to educators and equipping instructors with information that is current and applicable for their courses in economic botany and ethnobotany. The committees would furthermore represent the societies in encouraging development of new courses and maintenance of established courses through meetings at institutions and encouraging graduate students to pursue teaching careers.

b. Education committees and active faculty should develop, maintain, and distribute regularly, updated reviews of text books, journal articles and research bulletins that could be of value to economic botany instructors. This can easily be accomplished with current availability of the internet and easily updated information files.

c. Nationally, courses in economic botany and ethnobotany should be recommended as resource courses for education, business, geography, and biology students. This will not simply serve selfish motives for class popularity, but will also serve to provide a valuable service through infusion of better, more broadly trained basic educators, business persons, and general science graduates.

d. The members of the SEB and other related societies should provide encouragement for botanical gardens that prominently feature plants of economic and cultural importance. These will serve as points of teaching reference, reminders for the public of our close relationships with plants and plant materials, and provide occupations for some students.

e. Members of the SEB should establish a summer institute for instructors of economic botany and ethnobotany, to train them in the basics of the science of plant uses by cultures and to encourage developments of educator networks for self support (Note that workshops and summer in service courses in ethnobotany are currently being sponsored by some major school districts such as the Atlanta Georgia Public Schools). These sessions can and should be conducted in conjunction with educators from other countries as part of an effort to strengthen their programs as well.

f. The SEB education committee should encourage continued development of economic botany and ethnobotany research outside of the United States. The authors feel that in the near future, much more of the research interest, focus and talent will shift to developing countries as they increasingly

develop their own resources, including ethnobotanical resources.

g. The SEB should encourage international organizations, non-governmental organizations, and national exchanges such as the Peace Corps, to include one of these courses in their standard training. Furthermore, these organizations should be encouraged to look for these types of training as part of their minimal and desirable job qualifications.

h. The SEB and other professional organizations should advance course and curriculum recommendations such as those presented here as part of an effort to improve quality of education. By seeking out, accumulating, and advancing the recommendations of successful course instructors, the societies can begin to develop either accreditation standards or standards for recognition of quality educational programs.

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Figure 1. Student Survey Questionnaire.

1) What is your current field of study?

2) At what level are you in your education? (circle one)

Undergraduate Master Doctorate Post-Doctorate

3) What area of research most interests you?

(number 1-10, 1 being the most important)

- | | |
|------------------------------|-----------------------|
| Ethnobotany _____ | Cultural Anthropology |
| Pharmacognosy _____ | Ecology |
| Ethnobiology _____ | Ethnotaxonomy |
| Medical Anthropology _____ | Linguistics |
| Non-specific, not sure _____ | Other |

4) What is your greatest anxiety with regards to the area of research that interests you most?

5) Do you think an undergraduate and/or graduate program designed specifically for those interested in Ethnobotany would be:

(Circle all which apply)

- | | |
|-----------------------------|-----------------------------|
| useful | useless |
| marketable (employment) | unmarketable |
| necessary (for yourself) | unnecessary |
| long overdue | premature |
| welcome by your institution | spurned by your institution |
| Other | |

6) If a graduate or undergraduate program were presently offered at your university would you pursue a degree in that program? What degree? (If already pursuing such a degree please indicate.)

7) What issues would you like to see discussed at the June meeting of the SEB student session?

8) Which faculty members, directors, NGO's, physicians, mentors, etc., have assisted you in your studies of interactions between plants and humans? Please provide names and addresses if possible.

9) Do you expect to attend the 1995 SEB meetings at Cornell University?

10) Other comments.

Figure 2. Faculty and Adjunct Faculty Survey Questionnaire.

- 1) Institution: Name of your institution, department(s) and mailing address(s) to which students should direct inquiries.
- 2) Personnel: Primary program director, faculty members, and contact person(s) for graduate and undergraduate students. _____
- 3) Telephone: Contact person(s): _____ Department: _____
 Fax: _____ E-mail: _____
- 4) History: Please provide a brief description of the history of your program, departments and active researchers that participate, faculty and other facilities or special resources that are available at the institution or in associated institutions/field stations.
- 5) Courses: a) What pertinent courses are available through your department for undergraduate/graduate students. _ b) When will the course(s) be offered again?
 c) Are there additional courses which are typically taken by ethnobotany students at your institution?
 d) If you offer courses: Which courses have been the most requested (#) and/or best attended?
 e) If possible, provide a list of the texts/reading lists for each course and any course outlines/syllabuses? These will be used to determine the rough relationships between the different programs which are available. Please help us by providing any other information which you feel important to a description of the courses in your program.
- 6) Education: a) What are your areas of **educational** expertise?
 _____ b) What are the educational interests of other significant faculty members?
- 7) Research: a) Is your research mostly university based or field oriented?
 _____ b) Please indicate three areas of research of most interest to the key individuals in your program.
 _____ c) What are some of the research areas of present or previous students in your program?
 _____ d) What type(s) of employment have previous (graduate) students obtain?
- 8) Program level: a) Is your program directed toward undergraduates, graduates, or both?
 _____ b) Are specific programs in place for "Ethnobotany" students?
 _____ c) Is funding available for undergraduate/graduate students?
 _____ d) How often do you receive requests for information about your program?
- 9) Program direction: a) Are there specific student research/study interests that are more compatible with your program? (For example: students interested in medical anthropology, pharmacognosy, ethnotaxonomy, ethnoecology, agriculture, etc.)
 b) Are there specific directions in which your program is moving that would be of importance to potential students?
- 10) Other: Are there any other comments you would like to make regarding your program or our survey of this field?

Table 1. Institutions offering more than five courses coupled with a formal or an informal program of study in Ethnobotany/Economic Botany:

Institution/Level of Study, Contact(s)/Telephone, Fax, E-mail

01. Brigham Young University, Department of Botany and Range Science, Provo, UT/ M.S., Ph.D.
Paul A. Cox (Botany)/801-378-3037, fax 801-378-5976, marilyn_asay@byu.edu
02. Centro Internacional de Agricultura Tropical, Cali, Columbia/ B.S., Post-graduate
Danielle G. Debouck (Botany)/ fax 57-2 445-0273, ddebouck@cnet.com
03. Conservatoire et Jardin Botanique, Ethnobotany, Chambesy, Switzerland/ Graduate
D. J. Roquet (Botany)/ roquet@cjr.unige.ch
04. Florida International University, Departments of Biological Sciences & Anthropology, Miami, FL/ M.S., Ph.D.
Bradley Bennett (Biology)/ 305-348-3586, fax 305-348-1986, bennett@servax.fiu.edu
05. *Harvard University, Arnold Arboretum, Cambridge, MA/ Ph.D.
R. E. Schultes, Otto Solbrig, E. A. Kellog (Botany)
06. Instituto Venezolano de Investigaciones Cientificas Department de Antropologia, Caracas, Venezuela/ Ph.D.
Stanford Zent (Anthropology)/ fax 58-2-501-1085, szent@medicina.ivic.ve
07. James Cook University, Departments of Botany & Anthropology, Townsville, Australia/ Post-Doc.
B. Jackes (Botany), P. Gorecki (Anthropology)/ 077-814574, fax 077-251570, betsy.jackes@jeu.edu.au
08. Miami University, Department of Botany, Oxford, OH/ B.S., M.S.
Hardy Eshbaugh, Adolph Greenberg (Botany)/ 513-529-4212, fax 529-4243, eshbaugh@miamiu.muohio.edu
09. Muhlenberg College, Biology Department, Allentown, PA/ B.S.
Richard Niesenbaum/ fax 610-821-3234, niesenba@max.muhlberg.edu
10. *New York Botanical Garden, Bronx, NY in association with (*Yale, Cornell, City University of New York, *New York University and *Columbia)/ Ph.D. David Lentz, Michael Balick (Botany)/ 718-817-8763, fax 718220-1029, dlentz@nybg.org, mbalick@nybg.org
11. Ohio University, Department of Plant Biology, Athens, OH/ B.S., M.S., Ph.D.
Jan Salick (Biology)/ 614-593-1122, fax 614-593-1130, jsalick@ohiou.edu
12. Southern Illinois University at Carbondale, Department of Plant Biology, Carbondale, IL/ Ph.D.
Donald Ugent (Biology)/ fax 618-453-3441, ugent@siv.edu
13. St Cloud State University, Department of Biological Sciences, St. Cloud, MN/ B.S.
Thomas Clapp (Biology)/ 612-255-2288, fax 612-255-4166
14. Universidad de Chile, Escuela de Quimica y Farmacia, Santiago, Chile/ B.S.
Nadine Backhouse, Rosa Negrete, Lazaro Sanchez (Pharmacy)/ fax 22 27 900, carnad@abello.seci.uchile.cl
15. Universidad de Guadalajara, Department de Ecologia y Recursos Naturales, Jalisco, Mexico/ B.S.
Bruce Bentz
16. Universidad de Tarpaca, Department. de Arqueologia Y Museologia, Arica, Chile/ Diplomado
Elina Belmonte (Anthropology)/ fax 22 42 48(58)

17. Universidad Nacional Mayor de San Marcos, M.S.
Joaquina Alban Castillo (Botany)/ etnobot@musm.edu.pe
 18. University of Arizona, Office of Arid Lands Studies, College of Agriculture, Tucson, AZ/ Ph.D.
Joseph Hoffman (Agriculture)/ fax 520-741-1468, jjhoff@ccit.arizona.edu
 19. University of California, Departments of Plant Sciences & Anthropology, Riverside, CA/ Ph.D.
Arturo Gomez-Pompa (Anthr.) E. N. Anderson, Giles Waines (Bot.)/ fax 909-787-5409, gene@citrus.ucr.edu
 20. *University of Connecticut, Department of Ecology and Evolutionary Biology, Storrs, CT/ B.S.
Gregory J. Anderson (Biology)/ 203-486-4555, fax 203-486-6364, ander@uconnvm.uconn.edu
 21. *University of Hawai'i, Departments of Anthropology, Botany & Geography, Honolulu, HI/B.S., M.S., Ph.D.
Nina Etkin (Anthropology)/ fax 808-956-4893, etkin@hawaii.edu/ Isabella Abbott, Will McClatchey (Botany)/ fax 808-956-3923, mcclatch@hawaii.edu/ Mark Merlin (Biology) fax 808-956-4745, merlin@hawaii.edu
 22. University of Illinois at Chicago, College of Pharmacy, Chicago, IL/ Ph.D.
Norman Farnsworth, Audrey Bingel (Pharmacy)/ fax 312-996-7107
 23. *University of Illinois, Department of Plant Biology, Urbana, IL
David Seigler (Biology)/ 217-333-7577, fax 217-244-7246, d-seigler@uiul.edu
 24. University of Maryland, Department of Plant Biology, College Park, MD/ B.S.
George Bear (Biology)/ fax 410-314-9082, gb9@umail.umd.edu
 25. *University of Michigan, Departments of Biology & Anthropology, Ann Arbor, MI/ Ph.D.
Erich Steiner, Richard Ford (Anthropology)/ fax 313-747-0884, esteiner@biology.isa.umich.edu
 26. University of Montana, Department of Pharmaceutical Sciences & School of Forestry, Missoula, MT/ B.S.
Rustem Medora, Stephen Siebert (Forestry)/ 406-243-4943, fax 406-243-4353, siebert@selway.unt.edu
 27. University of Northern Colorado, Department of Biological Sciences, Greeley, CO/ B.S.
Robert Reinsvold, Bill Harmon (Biology)/ fax 970-351-1269, rjreins@bentley.univnorthco.edu
 28. University of Saskatchewan, Depts. of Anthropology & Biology, Saskatoon, Saskatchewan, Canada /B.S., Ph.D.
V.L. Harms, David Meyer, Robin Marles (Biology and Anthropology) 306-966-4950
 29. University of Victoria, Environmental Studies Program, Victoria, British Columbia, Canada/ Ph.D.
Paul West, Nancy Turner (Environmental Studies)/ 604-721-6124, fax 604-721-8985, njturner@sol.uvic.ca
 30. Washington University, Department of Biology, St. Louis, MO/ Ph.D.
Memory Elvin-Lewis, Debbie Gunkel, Walter Lewis, (Biology)/ 314-935-6860, lewis@biodpt.wustl.edu
- * Institutions with courses in 1963 (Bartoo 1964)

Table 2. Institutions with 2-4 courses

01. Antioch College, Department of Biology, Yellow Springs, OH
02. College of Charleston, Department. of Sociology/Anthropology, Charleston, SC
03. *Middle Tennessee State University, Biology Department, Murfreesboro, TN
04. Oregon State University, College of Pharmacy, College of Forestry, Department of Botany, Corvallis, OR
05. Texas A&M University, Center for Semi-Arid Forest Resources, Kingsville, TX
06. Universidad Autonoma del Estado de Mexico, Escuela de Ciencias Instituto Literario, Toluca, Mexico
07. University of Alberta, Department of Biological Sciences, Edmonton, Alberta, Canada
08. *University of Florida, Departments of Agriculture, Anthropology, Botany, & Geography, Gainesville, FL
09. University of Maryland, Department. of Plant Biology, College Park, MD
10. University of Massachusetts, Biology Department, Crop Evolution Laboratory, Boston, MA
11. University of Oklahoma, Department of Anthropology, Norman, OK
12. University of Texas, Department. of Botany, Austin, TX
13. Washington State University, Departments of Anthropology & Botany, Pullman, WA

* Institutions with courses in 1963 (Bartoo 1964)

Table 3. Institutions with 1 course (or more than one related course, e.g. pharmacognosy, cultural geography, archaeology, etc.)

01. Anadolu University, Medicinal and Aromatic Plant and Drug Research Centre (TBAM), 26470 Eskisehir, Turkey
02. Augusta College, University System of Georgia Department of Biology, Augusta, GA
03. Boston University, Department of Archeology, Boston, MA
04. California State University, Department of Biological Sciences, Fullerton, CA
05. Central Connecticut State University, Department of Biological Sciences, New Haven, CT
06. Duke University, Department of Botany, Durham, NC
07. Faculdade de Ciencias Agronomicas, Departamento de Horticulture, Botucatu, Brasil
08. Florida State University, Department of Biological Science, Tallahassee, FL
09. Linfield College, Biology Department, McMinnville, OR
10. Louisiana State University, Department of Plant Biology & Department. of Anthropology, Baton Rouge, LA
11. *Michigan State University, Department of Botany, East Lansing, MI
12. New England Wild Flower Society, Framingham, MA
13. NGRL/ USDA, Bethesda, MD
14. North Carolina State University, Department of Botany and Department of Horticultural Sciences, Raleigh, NC
15. *Northern Illinois University, Department of Biological Sciences, Dekalb, IL
16. **Northfield Mount Hermon School, Science Department, Mount Hermon, MA
17. Notre Dame- Saint Mary's College, Department. of Biology, North Bend, IN
18. *Ohio State University, Department. of Anthropology, Columbus, OH
19. Padova University, Department of Biology, Padova, Italy
20. Pontificia Universidad Catolica del Ecuador, Department. de Biologia, Quito, Ecuador
21. Royal Botanic Gardens, Kew, Centre for Economic Botany, Richmond, Surrey, United Kingdom
22. San Diego State University, Department of Geography, San Diego, CA
23. Satya Wacana Christian University, Faculty of Sciences and Mathematics, Salatiga, Indonesia
24. Southwest Missouri State University, Department of Life Sciences, Springfield, MO
25. St. John's University, College of St. Benedict, Biology Department, St. Joseph, MN
26. The Natural History Museum, London, United Kingdom
27. Universidad Popular Autonoma del Estado de Puebla, Department de Fitotecnica, Santiago, Puebla, Mexico
28. Universidad de Guadalajara, Department de Ecologia y Recursos Naturales, Jalisco, Mexico
29. University of British Columbia, Botany Department, Vancouver, BC, Canada
30. University of California, Davis, Genetic Resources Conservation Program, Davis, CA
31. University of California, Davis, Department of Pomology Section of Plant Biology, Davis, CA
32. University of Colorado, Department of Biology, Boulder, CO
33. University of Edinburgh, Institute of Ecology and Resource Management, Edinburgh, Scotland
34. University of Geneva, Botanical Garden and Conservatory, Geneva, Switzerland

35. *University of Kansas, Department of Botany, Lawrence, KS
36. University of Malaysia, Sarawak, Kuching, Malaysia
37. University of Massachusetts, Department of Biology, Crop Evolution Laboratory, Boston, MA
38. University of Puerto Rico, Departments of Biology & Chemistry, Mayaguez, PR
39. University of South Carolina, Departments of Anthropology & Biology, Columbia, SC
40. University of Vermont, Department of Geography and Anthropology, Burlington, VT
41. University of Washington, Departments of Botany & of Anthropology, Seattle, WA
42. *University of Wisconsin, Botany Department, Madison, WI
43. Washington State University, Departments of Botany & Crop and Soil Sciences, Pullman, WA

* Institutions with courses in 1963 (Bartoo 1964)

**Secondary School

Table 4. Institutions indicating no courses or programs

01. Auburn University, Department of Botany and Microbiology, Auburn, AL
02. Arnold Arboretum, Harvard University, Cambridge, MA
03. Biodiversity Foundation for Africa
04. Brooklyn Botanic Garden, New York, NY
05. Carnegie Museum of Natural History, Section of Botany, Pittsburgh, PA
06. Catawba College, Department of Biology, Salisbury, NC
07. Cornell University, Fruit, and Vegetable Science Department, Ithaca, NY
08. Economic Botany Associates, Small Consulting Group, New York, NY
09. Educational Concerns for Hunger Organization (ECHO), North Fort Myers, FL
10. Field Museum of Natural History, Department of Botany, Chicago, IL
11. Gentry Experimental Farm, Murietta, CA
12. Herb Research Foundation, Boulder, CO
13. Hudson Valley Community College, Department of Biology, Troy, NY
14. *Indiana University, Department of Biology, Bloomington, IN
15. Institut Botanique de l'Univ. de Montreal, Montreal, Canada
16. *Iowa State University, Department of Botany, Ames, IO
17. Kansas State University, Department of Biology, Manhattan, KS
18. *Kent State University, Department of Biological Sciences, Kent, OH
19. Lebanon Valley College, Biology Department, Annville, PA
20. Missouri Botanical Garden, St. Louis, MO
21. New Mexico State University, Biology Department, Las Cruces, NM
22. New York State Museum, Biological Survey, Albany, NY
23. Northeastern University, Bouve College of Pharmacy Sociology Department, Boston, MA
24. Pace University, Department of Biological Sciences Center for Urban Horticulture, New York, NY
25. Rancho Santa Botanic Garden, Claremont, CA
26. Redwood City Seed Co., Redwood City, CA
27. *Rutgers University, Department of Biological Sciences (Botany), Camden, NJ
28. San Diego Zoo, San Diego, CA
29. Santa Barbara Museum of Natural History, Anthropology Department, Santa Barbara, CA
30. Scotia Pharmaceuticals Ltd., Guildford, Surrey, England
31. Southeastern Oklahoma State University, Department of Biological Sciences, Durant, OK
32. The Morton Arboretum, Lisle, IL
33. Tulane University, Department of EEO Biology Department of Anthropology, New Orleans, LA
34. Ulster Museum Botanic Gardens, Department of Botany, Belfast, Northern Ireland
35. Universidad Nacional de Loja, Centro Andino de Tecnologia Rural, Loja, Ecuador
36. University of Aarhus, Institute of Biological Sciences, Risskov, Denmark
37. University of Alaska, Department of Biological Sciences, Anchorage, AK
38. *University of Arkansas, Department. of Botany and Microbiology, Fayetteville, AR
39. University of Calgary, Department of Biology, Calgary, Alberta, Canada
40. University of California, Berkeley, Department. of Botany & Department of Anthropology, Berkeley, CA

41. University of Guelph, Department. of Botany, Ontario, Canada
42. *University of Louisville, Department. of Biology, Louisville, KY
43. University of Maine, Department of Botany and Plant Pathology, Orono, ME
44. *University of North Carolina, Department of Biology, Chapel Hill, NC
45. University of Oregon, Department. of Geography, Eugene, OR
46. University of Puerto Rico, Department of Biology, San Juan, PR
47. University of Richmond, Department of Biology, Richmond, VA
48. University of Southampton, School of Biological Sciences, Southampton, United Kingdom
49. University of Toronto, Erindale College, Department of Anthropology & Archeology, Mississauga, Toronto, Canada
50. University of Waterloo, Department of Biology, Waterloo, Ontario, Canada
51. University of Wisconsin, Biology Department, Oshkosh, WI
52. University of Wisconsin, Department of Biological Sciences, Manitowoc, WI
53. University of Wyoming, Department of Botany, Laramie, WY
54. Virginia Polytechnic Institute and State University, Department of Biology, Blacksburg, VA
55. *West Virginia University, Department. of Biology, Morgantown, WV
56. Wild Food Adventures, Portland, OR
57. Winthrop University, Departments of Biology & Anthropology, Rock Hill, SC
58. World Botanical Associates, Laurel, MD

* Institutions with courses in 1963 (Bartoo 1964)

Table 5. International Distribution of Courses and Programs

<u>Regions</u>	<u>Number of Institutions Offering Courses</u>	<u>Number of Institutions Offering Programs</u>
North America	70	23
South America	7	5
Europe	6	1
Asia	3	None identified
Australia	1	1
Africa	None identified	None identified

Table 6. Proposed elements of a lower division Economic Botany Course.

Core topics: Origins of Agriculture, Survey of Important Crop Plants, Survey of Spices and Condiments, Survey of Herbal Medicines, Ethics, Important Plant Resources: Wood, Bark, Latex, Tannins, Dyes, Fibers, Resins, Oils, Waxes

Other topics of possible inclusion: Ornamental Plants, New Crops, Plant Poisons, Plants used in Specialty Areas: Construction, Clothing, Paper, Shipping, Food Processing, etc.

Laboratory and Field Experiences: Laboratory work should include demonstrations and practical experiments about useful plants. Field Experiences should include trips to local industries, farms, and stores that feature economically important plants.

Current Texts:

- Heiser, C. B. Jr. 1985. *Of Plants and People*. University of Oklahoma Press, Norman, Oklahoma.
- Levetin, E. & K. McMahon. 1996. *Plants and Society*. Times Mirror Higher Education, Dubuque, IA
- Lewington, A. 1990. *Plants for People*. The Natural History Museum, London.
- Simpson, B. B. & M. Conner-Ogorzaly. 1995. *Economic Botany: Plants in Our World.*, 2nd Edition. McGraw-Hill, New York.

Prerequisite Courses: None.

Table 7. Proposed elements of a lower division Ethnobotany Course.

Core topics: Material Culture of Hunter & Gatherers, Agriculturalist, and Pastoralists; Ethics; Cultural Significance of Clothing, Shelter, and Transportation; Cordage; Traditional Medicine; Traditional Taxonomies; Ethnoecology; Cultural, Botanical, and Intellectual Conservation; Wild Plant Resources; Ethnobotany Field Methods.

Other topics of possible inclusion: Studies of Specific Local Cultures; Palaeoethnobotany; Phytochemistry; Intellectual Property Rights; Sustainable Agricultural Systems; Linguistic Ethnobotany; Plant Folklore.

Laboratory and Field Experiences: Laboratory work should include demonstrations and participatory experiences that demonstrate elements of human interactions with plants. Field Experiences should include trips to local cultural groups, farms, and stores that feature ethnically important plants.

Current Texts:

- Balick, M. J. & P. A. Cox. 1996. *Plants, People, and Culture: The Science of Ethnobotany*. Scientific American, New York.
- Martin, Gary J. 1995. *Ethnobotany: A methods manual*. Chapman & Hall, London, UK.

Prerequisite Courses: None.

Table 8. Proposed elements of an upper division Economic Botany Course (Advanced Economic Botany).

Core topics: Regional and Crop Specific Origins of Agriculture; Phylogenetic and Anatomical Relationships of Important Crop Plants; History of the Spice Industry; The Chemical and Botanical Basis of Allopathic and Naturopathic Medicines; Ethics; The Physiological and Anatomical Basis for Plant Products Derived from: Wood, Bark, Latex, Tannins, Dyes, Fibers, Resins, Oils, Waxes.

Other topics of possible inclusion: New Crops; New Medicinal Plants; Local Industrial Plant Uses; Economic Forecasting of Plant Product Values; Agricultural Economics.

Laboratory and Field Experiences: Laboratory work should include practical experiments involving useful plants. Field Experiences should include trips to local industries, farms, and stores that feature economically important plants.

Current Texts:

-None suggested by this survey but, Lewis, Walter H. and Memory P. F. Elvin-Lewis. 1977. (*Medical Botany: Plants Affecting Man's Health*. John Wiley & Sons, Inc. New York, NY) and Cook, F. E. M. 1995. (*Economic Botany Data Collection Standard*. Edited by H. D. V. Prendergast. Royal Botanic Gardens, Kew, United Kingdom), would serve as a good supporting texts along with a selection of recent articles from *Economic Botany*.

Prerequisite Courses: general botany, systematics, plant anatomy or morphology

Table 9. Proposed elements of an upper division Ethnobotany Course (Advanced Ethnobotany).

Core topics: Mythology and Plant Origins; The Cultural and Botanical Environments of Herbal Medicine; Foods as Medicines; Wild Foods; Ethics; Intellectual Property Rights, Studies of Specific Local Cultures; Intellectual Property Rights; Linguistic Ethnobotany; Ethnic Taxonomies; Applied Ethnobotany; Conservation and Cultural Identity.

Other topics of possible inclusion: Palaeoethnobotany; Phytochemistry; Sustainable Agricultural Systems; Plants and Human Rights.

Laboratory and Field Experiences: Practical experiences in ethnographic interviewing of cultural plant experts; Development of plant collection and identification skills in a cultural setting; Discussion of ethical issues and dilemmas faced by ethnobotanical field researchers.

Current Texts:

-Alexiades, M. N. 1996. Editor of *Guidelines for Ethnobotanical Research: A Field Manual*. New York Botanical Garden, Bronx, New York.

-Cotton, C.M. 1996. *Ethnobotany: Principles and Applications*. Wiley, Chichester.

-Given, D. R. & W. Harris. 1994. *Techniques and Methods of Ethnobotany*. Lincoln University Printery, Lincoln, New Zealand.

-Schultes, R.E. & S. von Reis. 1995. Editors of *Ethnobotany: Evolution of a discipline*. Dioscorides Press, Portland, OR.

Prerequisite Courses: general botany, cultural anthropology, biogeography

Table 10. Proposed elements of an Undergraduate Economic Botany Program.

Background courses: Organic Chemistry; Economics; History of Agriculture; and General Forestry or Horticulture.

Tool courses: Plant Anatomy or Morphology; Systematic Botany; Biogeography; Agricultural Economics or Resource Economics.

Core courses: Economic Botany and Advanced Economic Botany.

Research: Applied research study(s) of (local?) economically important plants possibly including analyses of ways to implement, increase, or otherwise change patterns of plant usage.

Table 11. Proposed elements of an Undergraduate Ethnobotany Program.

Background courses: Cultural Anthropology; Plant Anatomy or Morphology; Sociology; and Geography.

Tool courses: Systematic Botany; Ecology; Anthropological Field Methods; Language training; and Biogeography.

Core courses: Ethnobotany; Advanced Ethnobotany; and Ethnoecology (Other possible courses include Medical Botany, Field Research Methods, and Local Ethnobotany)

Research: Applied or theoretical study(s) of (local?) cultural interactions with plants, including analysis of impacts of plant usage on cultural development patterns, trajectories, and possibilities.

Table 12. Proposed elements of a Graduate Economic Botany Program.

Background courses: Organic Chemistry; Macro and Micro Economics; Agricultural Systems; History of Agriculture; General Forestry; and Business Economics.

Tool courses: Plant Anatomy and Morphology; Systematic Botany; Biogeography; Agricultural Economics; and Resource Economics.

Core courses: Economic Botany and Advanced Economic Botany.

Research: Applied research study(s) of economically important plants possibly including analyses of ways to implement, increase, or otherwise change patterns of plant usage.

Table 13. Proposed elements of a Graduate Ethnobotany Program.

Background courses: Cultural Anthropology; Plant Anatomy and Morphology; Sociology; Human Physiology; and Geography.

Tool courses: Systematic Botany; Ecology, Ethnography; Anthropological Field Methods; Linguistics; and Biogeography.

Core courses: Ethnobotany; Advanced Ethnobotany; and Ethnoecology (Other possible courses include Medical Botany, Field Research Methods, and Local Ethnobotany)

Research: Applied or theoretical study(s) of cultural interactions with plants, including analysis of impacts of plant usage on cultural development patterns, trajectories, and possibilities.

Table 14. United States Distribution of Courses and Programs in 1996 and (1963)

<u>State</u>	<u>Institutional Courses (1963)</u>	<u>Institutional Programs (1963)</u>
Alabama	0 (4)	0
Alaska	0 (0)	0
Arizona	1 (3)	1
Arkansas	0 (2)	0
California	5 (11)	1
Colorado	2 (3)	1
Connecticut	2 (3)	2
Delaware	0 (0)	0
Florida	3 (1)	1
Georgia	1 (2)	0
Hawaii	1 (1)	1
Idaho	0 (2)	0
Illinois	4 (10)	3
Indiana	1 (2)	0
Iowa	0 (5)	0 (1)
Kansas	1 (3)	0
Kentucky	0 (4)	0
Louisiana	1 (2)	0
Maine	0 (0)	0
Maryland	3 (1)	1
Massachusetts	6 (3)	1 (1)
Michigan	2 (7)	1
Minnesota	2 (3)	1
Mississippi	0 (1)	0
Missouri	2 (1)	1
Montana	1 (0)	1
Nebraska	0 (1)	0
Nevada	0 (1)	0
New Jersey	0 (4)	0
New Hampshire	0 (0)	0
New Mexico	0 (1)	0
New York	5 (11)	4
North Carolina	2 (1)	0
North Dakota	0 (0)	0
Ohio	4 (7)	2
Oklahoma	1 (3)	0
Oregon	2 (0)	0
Pennsylvania	1 (1)	1
Rhode Island	0 (0)	0
South Carolina	2 (1)	0
South Dakota	0 (1)	0
Tennessee	1 (2)	0
Texas	2 (1)	0
Utah	1 (1)	1
Vermont	1 (1)	0
Virginia	0 (2)	0
Washington	3 (1)	0
Washington DC	0 (1)	0
West Virginia	0 (3)	0
Wisconsin	1 (7)	0
Wyoming	0 (0)	0