

SEB 49TH ANNUAL MEETING 2008 SCIENTIFIC PROGRAM

Monday, June 2nd 2008

SYMPOSIUM: BUILDING A LEGACY OF BOTANICAL EDUCATION AND TRADITIONAL KNOWLEDGE Mary Eubanks, Chair

- 8:30-8:45am **Welcome.** Duke University Vice Provost for International Affairs, Gil Merx
8:45-9:00 **Introductory Remarks.** Mary Eubanks
9:00-9:45 **Keynote Address.** Peter Raven
9:45-10:15 **Ethnobotany in the Urban Environment.** Michael Balick
10:15-10:35 Coffee Break, East Duke Alcove
10:35-11:05 **Ethnobotanical Link between Research and Communities.** Robert Bye and Edelmira Linares
11:05-11:35 **Ethnobotany Segues to Science.** Will McClatchey
11:35-12:00 **Panel Discussion**

12:00-1:30pm **Lunch at the Marketplace with Round Table Discussion Groups**

AFTERNOON SESSION: CURRICULUM AND OUTREACH Gail Wagner, Chair

- 1:30-1:45 **Ethnobotany: Plants and People.** Gail Wagner
1:45-2:00 **Plants, People and Culture.** Mike Balick.
2:00-2:15 **Advanced Ethnobotany: Ethnic Markets Research.** My Lien Nguyen
2:15-2:30 **Advanced Ethnobotany: University-Garden Partnership.** Brad Bennett
2:30-2:45 **Method and Theory in Ethnobiology.** Rick Stepp
2:45-3:00 **Paying it Forward: Investing in Economic Botany Education.** Valerie Imbruce
3:00-3:20 Coffee Break, East Duke Alcove
3:20-3:35 **Developing an Ethnobotany Major Top Down Ground Up.** Linda Lyons
3:35-3:50 **Ethnobotany and Master Naturalist Training.** Karen Hall
3:50-4:05 **Nature Education Outreach for Children.** Ann Nashold
4:05-5:00 **Computer-based Method for Teaching Plant Identification.** Bruce Kirchoff
5:00-5:30 Announcements
5:30 Board buses for Barbeque at JC Raulston Arboretum at North Carolina State University

Tuesday, June 3rd 2008

CONTRIBUTED PAPER SESSION 1: EDUCATION Diane Ragone, Chair

- 8:10-8:15am Announcements
8:15-8:30 **Reassessing Traditions: A Decision Making Model for Cultural and Natural Resources Management that Builds Upon the Legacy of Traditional Hawaiian Botanical Education.** Puanani Anderson-Fung
8:30-8:45 **Adaptation of Ethnobotany to the Education Curricula in Castilla-La-Mancha (Spain).** José Fajardo Rodríguez, Alonso Verde López, Diego Rivera Núñez, Concepción Obón de Castro
8:45-9:00 **Developing an On-line General Education Ethnobotany Course.** Robert E. Loeb
9:00-9:15 **Practical Applications for Botanical Education in Native American Traditional Ecological Knowledge.** Suzanne Fluharty

- 9:15-9:30 **Education, Medicinal Plant Uses and Traditional Knowledge System in Castilla-La Mancha (Spain) a Monograph.** Alonso Verde López, Diego Rivera Núñez, José Fajardo Rodríguez, Arturo Valdés Franzí
- 9:30-9:45 **Botanical Knowledge of South Carolina College Students.** Gail E. Wagner
- 9:45-10:00 **Applying Student Ingenuity to Invasive Species Issues: Glenville State College Undergraduates Seek Novel Uses of Tree of Heaven (*Ailanthus altissima*).** Lisa M. Castle
- 10:00-10:15 Coffee Break, East Duke Alcove

CONTRIBUTED PAPER SESSION 2: TRADITIONAL KNOWLEDGE Diane Ragone, Chair

- 10:15-10:30 **Linking Education, Research and Development: A Case Study on the Nutritional Assessment of Moringa (*Moringa oleifera*) in Sub-Saharan Countries.** H Rodolfo Juliani, Yudy Fonseca, James E. Simon
- 10:30-10:45 **A Few Drops of Lavender Oil.** Margaret Delfeld
- 10:45-11:00 **Ethnobotanical Encounters in the Colonial World.** Robert Voeks and Charlotte Greene
- 11:00-11:15 **Local Knowledge of the Biodiversity Among the People of Mandakini Valley of Central Himalaya, India.** D. P. Semwal
- 11:15-11:30 **Ethnobotany as the Science of Survival: Lessons from Paradigms of Limited Resources.** Kawika Winter and Will McClatchey
- 11:30-11:45 **Love or Life: Local Preference and Species Survival in Boumba, Niger.** Jocelyn Muller, Hama Hasanne and Iro Dan Guimbo
- 11:45-12:00 **Ethnobotany and Ecological Status of Chewing Sticks in Southern Benin.** Jean Didier Akpona, Romain Glèlè Kakaï, Hugues Akpona and Brice Sinsin
- 12:00-1:00pm **Lunch at the Marketplace with Round Table Discussion Groups**
- 1:00-1:45 **Poster Session 1, Upper Eastside**

CONTRIBUTED PAPER SESSION 3: MEDICAL ETHNOBOTANY Patrick Van Damme, Chair

- 1:45-2:00 **Earth Healing with Bamboo.** Adam Turtle and Susanne E. Turtle
- 2:00-2:15 **Importance of Medicinal Plants Use in Rural Agro-ecosystems: Case Lama Reserve in Benin.** Méryas Dègbémabou Kouton, Brice Sinsin and Valentin Kindomihou
- 2:15-2:30 **Relational Efficacy and Traditional Plant Medicine.** Nat Bletter
- 2:30-2:30 **Health for Sale: The Medicinal Plant Markets in Trujillo and Chiclayo, Northern Peru.** Rainer W Bussman, Douglas Sharon, Ina Vandebroek and Ana Jones
- 2:45-3:00 **Diversity of Green Leafy Vegetables and Perceived Health Benefits in Madanapalie, India.** Julie Bélanger, Shoba Katumalia and Timothy Jones
- 3:00-3:15 **An Assessment of the Antioxidant Potential of Selected Plants used as Cooling or Medicinal Teas in Barbados.** Sonia Peter
- 3:15-3:30 Coffee Break, East Duke Alcove

CONTRIBUTED PAPER SESSION 4: GENERAL ETHNOBOTANY Patrick Van Damme, Chair

- 3:30-3:45 **Exploding Typological Myths in Paleoethnobotany: The Case for Morphometric Analysis.** Irwin Rovner

- 3:45-4:00 **Folk Classification, Perception and Preferences of Baobab Products in West Africa: Consequence for the Species Conservation and Management.** Patrick Van Damme, Achille Ephrem Assogbadjo, Flora Josiane Chadare, Brice Sinsin
- 4:00-4:15 **A Mouthful of Diversity: Knowledge of Cider Apple Cultivars.** Dave Reedy, Will McClatchey, Kim Bridges and Cliff Smith
- 4:15-4:30 **African Ethnobotanical Heritage for Domestication and New Crop Development.** Patrick Van Damme and Celine Termote
- 4:30-4:45 **Guitar Woods.** Bradley C. Bennett
- 4:45-5:00 **Study and evaluation of Plants Used by the Tay-Nung Ethnic Groups in Northeastern Vietnam.** Khac Ban Ninh, Van Thanh Bui, Dam Cu LuU and Manh Cuong Nguyen
- 5:00pm Announcements
- 5:30pm Board buses for the North Carolina Botanical Open House in Chapel Hill
- 8:00pm Student Mixer, Satisfaction in Brightleaf Square

Wednesday, June 4th 2008

CONTRIBUTED PAPER SESSION 5: ETHNOPHARMACOLOGY Mary Theresa Bonhage-Freund, Chair

- 8:10-8:15 Announcements
- 8:15-8:30 **Comparison and Quantitative Determination of Bioactive Components of Essential Oil of *Alpinia calcarata* Rhizome and Leaf from South India.** C.T. Sadashiva, S. Ravi, G.V. Srinivasan, K.M. Hashim
- 8:30-8:45 **Screening Antibacterial Activity in Medicinal Plants Grown by Rural Zulu Women (Maputaland Area, South Africa).** Helene de Wet, Phelelani Dlodla, Siyabonga Mkhalihi and Sbonakaliso Shabalala
- 8:45-9:00 **Herbal Statins.** Charlotte Gyllenhaal, Keith Block, Amanda Koch and Michael de la Torre
- 9:00-9:15 **Wormwood Suppresses Tumor Necrosis Factor Alpha, Accelerates Healing and Improves Mood in Patients with Crohn's Disease—A Placebo Controlled Study.** Simone Krebs, Bilal Omer and Talib N. Omer
- 9:15-9:30 **Evaluation of Antiacne Activity of Alkaloidal Fraction of *Coscinium fenestratum* (Gaertn) Colebr.** G.S. Kumar, K.N. Jayaveera, C.K. Ashok Kumar and Sanjay P. Umachigi
- 9:30-9:45 **Quorum Sensing Inhibitors for Methicillin-Resistant *Staphylococcus aureus* from Italian Medicinal Plants.** Cassandra L. Quave, Lisa RW Plano and Bradley C. Bennett
- 9:45-10:00 **Evaluation of In-vivo Wound Healing Activity of *Anthocephalus cadamba* Leaf on Different Wound Models in Rats.** Sanjay P. Umachigi, K.N. Jayaveera, C.K. Ashok Kumar and G.S. Kumar
- 10:00-10:15 Coffee Break, East Duke Alcove

CONTRIBUTED PAPER SESSION 6: ETHNOECOLOGY Mary Theresa Bonhage-Freund, Chair

- 10:15-10:30 **Ethnoveterinary Medicine among the Aguaruna of the Peruvian Amazon.** Kevin A. Jernigan
- 10:30-10:45 **Ethnoecology of the Tsawataineuk T'aki'lakw, the Wffect of Cultivation on Productivity and Palatability of Tleksem, *Potentilla anserina* ssp. *pacifica*.** T. Abe Llyod

- 10:45-11:00 **Effects of Bark Harvest and Other Human Activity on Populations of the African Cherry (*Prunus africana*) on Mount Oku, Cameroon.** Kristine Stewart
- 11:00-11:15 **Maple Sugar Production of Western Maryland.** M. Chad Smith, Tim Pegg, Alison Croner, Michael Clark
- 11:15-11:30 **Social and Ecological Feasibility of *Colophospermum mopane* Seed Commercialization from Namibia.** Laura Weiss
- 11:30-11:45 **Culture and Agrobiodiversity Persistence among a Group of Immigrant American-Mexican “Gringo” Communities in Sierra Madre Occidental Mountains of Northern Mexico.** James R Veteto
- 11:45-12:00 **Human Use of *Prosopis* in Hawai’i: Ethnobotanical History and Ecological Implications of a useful Alien Pheatophytic Species,** Mark D. Merlin
- 12:00-1:00pm **Marketplace Lunch, Round Table Discussion Groups**
- 1:00-1:45 **Poster Session 2, Upper Eastside**

CONTRIBUTED PAPER SESSION 7: NEW WORLD ETHNOBOTANY Rick Stepp, Chair

- 1:45-2:00 **Cherokee White Oak Basketry, a Traditional Craft Dependent on Depleted Natural Resources.** Sunshine L. Brosi, Scott E. Schlarbaum and Ami Sharp
- 2:00-2:15 **The Significance and Use of *Theobroma cacao* in Ancient Copan, Honduras.** Cameron L. McNeil
- 2:15-2:30 **Impacts of Ancient Maya Forest Gardens of Mesoamerican Tree Species Composition: How to Approach This Idea?** Nanci Ross
- 2:30-2:45 **Classic Period Maya Agroforestry at the Chan Site, Belize.** David L. Lentz and Sally Woods
- 2:45-3:00 **Origins of Cultivated Vanilla.** P. Lubinsky
- 3:00-3:15 **Yucatec Maya Medicinal Plant Knowledge Variation and Social Networks.** Allison Hopkins
- 3:15-3:30 Coffee Break, East Duke Alcove

CONTRIBUTED PAPER SESSION 8: THE BERLIN INFLUENCE IN ECONOMIC BOTANY

Rick Stepp, Chair

- 3:30-3:45 **Travels with Folk Botanical Classification: In Honor of Brent Berlin.** Anderson, E.N.
- 3:45-4:00 **The Forest for the Trees: Applying Berlin’s General Principles of Ethnobiological Classification to Indigenous Landscape Taxonomies of Amazonia.** Glenn H. Shepard, Jr.
- 4:00-4:15 **Designing Collaborative Methods for Ethnobiological Research in Diet and Nutrition: Conceptualizing the “Compleat Maya Diet” in Chiapas and Beyond.** Rebecca K. Zarger
- 4:15-4:30 **The Ethnoecology of Wild Mushroom Use by the Tzeltal Maya of Chiapas, Mexico.** Aaron Lampman
- 4:30-5:30 SEB Business Meeting
- 5:30-9:30 Shuttle Bus to Sarah P. Duke Gardens leaves from East Duke Bus Stop

6:00-9:00 Awards Banquet, Doris Duke Center, Sarah P. Duke Gardens
Distinguished Economic Botanist Lecture Brent Berlin and Elois Ann Berlin

POSTER SESSION 1: EDUCATION, TRADITIONAL KNOWLEDGE, MEDICAL ETHNOBOTANY, GENERAL ETHNOBOTANY Tuesday, June 3rd 2008, 1:00-1:45pm Upper Eastside

Hypoglycemic Formulations Used by the Traditional Medicinal Practitioners (Vaidyas) of Bangladesh. Muhammad Mazharul Anwar, Marjina A. Kalpana, Rownak Jahan and Mohammed Rahmatullah

Wild Plants and Fungi Use in Northern Maine: Traditional Ecological Knowledge and Changing Land Ownership. Michelle Baumflek, Marla Emery, Clare Ginger and Dave Putnam

Meetings Without Talks – Talk Without Meetings. Kim Bridges and Y. Han Lau

Botanical Knowledge of South Carolina Elementary School Students. Chanda L. Cooper

Indigenous Treatment of Malaria: An Ethnobotanical Survey of Ewaso-Narok, Laikipia District, Kenya. Jesse Davis and Aswini Pai

The Green Belt Legacy of the Midzichenda Makaya: A Case Study at Kaya Fungo Investigating the Role of Apiculture in Forest Conservation. Jonathan Ferrier, Boniface Kalama, Staline Kibet and Alex M. Chai

Ethnobotanical Survey of Medicinal Plants Used Against Gastrointestinal Disorders by Various Tribes in Bangladesh. Abu Hanif, Shahadat Hossan, Rownak Jahan and Mohammed Rahmatullah

A Survey of Medicinal Plants used by the Marmas of Bangladesh. Shahadat Hossan, Abu Hanif, Rownak Jahan and Mohammed Rahmatullah

Laying the Foundation for In Situ Conservation of Teosinte (*Zea mays* ssp. *parviglumis* Iltis & Doebley), the Wild Progenitor of Maize. Matthew Hufford

Linking Education, Research and Development: A Case Study on Developing Quality Control Standards of *Vocanga africana* Seeds. H. Rodolfo Juliani, Daniel Kulaskowski, Adolfin R. Koroch and James E. Simon

Trade in Agroforestry Products: Insights from Rattan and Pineapple Trade in Sabah, Malaysia. Shreya Kamath and Aswini Pai

A Spatial Database of Ethnoveterinary Medicinal Plant Use In and Around the Greater Limpopo Transfrontier Conservation Area. Tiffany Kershner, Ronette Gehring, Deon van der Merwe and Craig Beech

Assessment of the Potential and Conservation Priorities of Indian Thar Medicinal Plants: An Ecological Approach. Manish Mathur

Methodological Approaches to Studying Eggplant Varieties Used for Medicinal and Culinary Purposes. Rachel Meyer, Amy Litt, Edward Kennelly and Bruce Whitaker

The Experience of Integration of Ethnobotany as Cross-curricular Material in Secondary Education (Instituto Los Olmos, Albacete, Spain). Pedro Núñez, Alonso Verde Lopez, A. Valdés, V. Benlloch, R. Ciudad, A. Rius, G. Piqueras, R. Valiente, J.L. Ortiz, A.T. Moreno, C. Pérez, Calero P. Núñez, A. Villa, A. Jiménez. A. Alfaro, A. Piera

Ethnopharmacy of Chunchi. Carla Salazar

Ethnobotanical Survey of Medicinal Plants Used by the Santal Tribe of Bangladesh. M. Shahnawaz Sarwar, Rownak Jahan, Sazzadul Bari, Mohammed Rahmatullah

Maple Sugar Production in Western Maryland. Rebecca L. Shipe, Sunshine L. Brosi and Alison Croner

Study of Medicinal Plants in Nepalese Community of Hawai'i. Neeva Shrestha and Will McClatchey

Ethnomedical Field Research in Cayo District, Belize, 2006-2008. Erik Terdal, Rhea VandeVusse-Terdal and Benjamin Kracht

Ethnomedical Survey of the Garo Tribe, Bangladesh. Aminul Hoque Tushar, Rownak Jahan, Mujib Khan and Mohammed Rahmatullah

Survey of Medicinal Plants Available in St. Martin's Island, Bangladesh. Aminul Hoque Tushar and Mahmuda Munmun

Uses of Medicinal Plants by the Inhabitants of Ziarat, Pakistan. Mudassir Asrar Zaidi and Rasool Bakhsh Tareen

POSTER SESSION 2: ETHNOPHARMACOLOGY, ETHNOECOLOGY, NEW WORLD ETHNOBOTANY
Wednesday, June 4th 2008, 1:00-1:45pm Upper Eastside

Fixing a Hole: Archaeobotanical Evidence of Middle Woodland Horticulture in the Etowah River Valley of Northwest Georgia. Mary Theresa Bonhage-Freund and Leslie E. Raymer

Inference of Genetic Relations and Intraspecific Variability in Agave using ISSR Molecular Markers. Martha Davila, Miguel Castillo and Hernan Laurentin

Ethnomedical Search for Anti-Tuberculosis Compounds from Lao Palm Leaf Manuscripts. Bethany G. Elkington, Bounhong Southavong, Kongmany Sydara, Onevilay Souliya, Kongdeuane Nettavong, Bounleuth Thammachack, D. Doel Soejarto and Scott G. Franzblau

Rainforest Conservation through Use in Northwestern Ecuador. Maria Fadiman

Novel Synergistic and/or Side Effects Neutralizing Combinations in Botanicals. Anwarul Hassan Gilani

Anti-inflammatory Activity of *Andropogon muricatus* Extract. Anwarul-Hassan Gilani, Shagufta Khan, Anita Nausir Akbar Ali, Abdul Jabbar Shah and

Studies on Spasmolytic and Anti-Diarrheal Effects of *Valeriana hardwickii*. Anwar H. Gilani, Samra Bashir and Raafia Memon

Assessing *Serona repens* (Arecaceae) Quality at the Retail Level using Spectroscopic and Chemometric Methods. Bryan A. Hanson, Tao Ye and M. Daniel Raftery

Medicinal Plants used by the Chakma Tribe of Bangladesh for Treatment of Various Diseases. Shahadat Hossan, Abu Hanif, Sazzadul Bari and Mohammed Rahmatullah

Linking Education, Research and Development: Organoleptic and Chemical Profile of Plant-derived Oils from Zambia. H Rodolfo Juliani, Natasha Norville and James E. Simon

Linking Education, Research and Development: Chemistry and Quality of Herbal Tea and Spices from Africa. H Rodolfo Juliani, Mike Bukuc, Osman Siddiqui and James E. Simon

Comparison of Alkaloid Content Among Three Closely Related Medicinal Species. Shreya Kamath, Matthew Skeels and Aswini Pai

Investigation of the Bio-active Phytochemical Constituents of Highbush Blueberry Fruit. Radhika Kota, Ara DerMarderosian, John Porter and Diane Morel

Evidence for Maize (*Zea mays* subsp *mays*) x Teosinte (*Z.m.* subsp *mexicana*) Introgression from Central Mexico. L. Blancas, N.C. Ellstrand, D.M. Arias and P. Lubinsky

Variation in Alkaloid Content of the Medicinal Species *Coptis trifolia* in Old and Secondary Growth Forests of Northern New York. Mukhaye Muchimuti, Aswini Pai and Matthew Skeels

Hypoglycemic and Hypolipidemic Effects of *Treculia africana* Decne. Moraceae and *Bryophyllum pinnatum* Lam. Crassulaceae Ethanolic Extracts on Streptozotocin (STZ)-induced Diabetic Rats. Joy I Odimegwu and SO Ogbonnia

An Evaluation of Rapid Assessment Protocols in terms of Species Richness and Stand Structure in a Permanent Plot in Palanan, Isabela, Philippines. Dolores C. Tongco

Medicinal Plants used by the Khasia Tribe of Bangladesh to Treat Diabetes, Hypertension and Cardiovascular Disorders. Aminul Hoque Tushar and Mohammed Rahmatullah.

Challenges and Opportunities Concerning Exotic Invasive Plants in Appalachia. Marc N. Williams

Sacred Giants: Ethnobotany of the Bombacaceae by the Southern Lowland Maya. Charles M. Zidar

ORAL PRESENTATION ABSTRACTS

Ethnobotany and Ecological Status of Chewing Sticks in Southern Benin

Jean Didier Akpona, Romain Glèlè Kakaï, Hugues Akpona, Brice Sinsin

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Chewing sticks are secondary forests products used for oral hygiene. They provide substantial income,

sanitary and medicinal benefits for communities in Benin. Little is known and evaluated about how population use and manage this species strongly involved in the culture of populations of all ethnic groups in Benin. To assess the diversity, the ecological status and endogenous conservation practices as prerequisite to elaborate a long lasting model of chewing sticks exploitation in Benin. We conducted an ethnobotanical survey (through interviews of 105 randomly selected informants) and collected dendrometric and ecological parameters in eight districts of Benin. All socio-linguistic groups are involved in the use of chewing sticks. Medicinal properties and taste were among frequently used criteria to choose chewing sticks species. 35 species of chewing sticks were inventoried and classified in three groups according to their origin and market values. Prices and forms of commercialization vary according to the species and the category of retailers. The most important families are Euphorbiaceae, Combretaceae, Anacardiaceae, Rubiaceae and Rutaceae. Density and species richness of chewing sticks were significantly higher in Savanna than in forest. Diametric distribution of most of the stands has an irregular form reflecting the effect of anthropic pressures on them. Women play an important role in the commercialization of sticks and conservation strategies could not be engaged without them. The research revealed that many species are used as chewing sticks. Those species however chosen according to their medicinal importance are not justified according to their phytochemical composition. Moreover the exploitation of chewing sticks has an impact on the regeneration of species in natural areas.

Travels with Folk Botanical Classification: In Honor of Brent Berlin

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Dept. of Anthropology, University of California, Riverside

Brent Berlin's research in folk botany opened the anthropological door on a fascinating and complex field. The psychology and anthropology of folk classification has advanced greatly since the original work of Harold Conklin, Charles Frake and Brent Berlin in the 1950s. Historians of botany and philosophers of science have begun to take note. Work that once seemed arcane and specialized is providing great insights into human thinking and into human-plant relationships, as well as the philosophy of truth and representation. This paper explores the truths and sciences that folk plant taxonomy expresses. Examples come from the English, Chinese and Yucatec Maya languages. The methods used in eliciting the Yucatec Maya materials were those of Brent Berlin, largely frame elicitation complementing extensive field experience and interviewing, as well as work with specimens, and detailed interviews. English and Chinese materials are largely from the literature, plus my own speaking competence, and, in the case of Chinese food plants, more extensive frame elicitation and field interviewing. English, Chinese, and Yucatec classifications of plants are quite similar, with differences predictable from cultural salience of particular plants and plant groups. Even perceptions that are errors from a formal botanical standpoint are often the same. Evidently these three very different cultures and languages share a common ground in human perception. Observations support Brent Berlin's conclusions about a universal tendency of humans to classify, and to see things in comparable ways. This has implications for current debates in the nature and philosophy of science.

Reassessing Traditions: A Decision Making Model for Cultural and Natural Resources Management that Builds upon the Legacy of Traditional Hawaiian Botanical Education

Puanani Anderson-Fung, puanania@hawaii.edu

University of Hawai'i

People of indigenous cultures are faced continually with the need to reassess their traditional practices due to gradual, on-going changes in their cultural and natural environment. This is especially so in Hawai'i, where modern Hawaiians live in environments almost completely devoid of those plant species and natural spaces that surrounded their ancestors every day and influenced greatly their cultural beliefs and practices. To determine what aspects of traditional Hawaiian resource management should be considered by modern Hawaiians who wish to maintain their cultural identity and practices while living in contemporary society. To determine if these are compatible with the traditional scientific resource

management and botanical education. To suggest a way to blend these two powerful “magisteria” to drive a more effective conservation movement. I conducted informal, semi-structured interviews with Hawaiian cultural practitioners. Data from these interviews were then integrated with a previously devised flow chart for decision making, and this was further integrated with findings from the literature regarding learning styles and the nature of modern “western” science. One cultural practitioner listed those “units” of Hawaiian TRM that were always considered in ancient Hawai`i before a decision was made regarding resource use or environmental modification. These units exactly coincided with the modules in my early conceptual model and they also agreed with the information obtained from all of the cultural practitioners. Components of all types of botanical education studied were also overlain onto the model. This model is useful in several ways. 1) Young Hawaiians are reminded of what things are most important before choosing or modifying a traditional practice. 2) The model indicates that incorporating certain aspects of Hawaiian botanical education and TRM into modern science teaching will help to fill many of the “gaps” of traditional western science education in the manner suggested by proponents of “teaching by inquiry.” 3) The model strongly suggests specific reasons why scientific work is distrusted by indigenous persons, and what we can do to earn their trust. This trust will be invaluable in strengthening efforts to save Hawai`i’s remaining native ecosystems.

Folk Classification, Perception and Preferences of Baobab Products in West Africa: Consequence for the Species Conservation and Management

Achille Ephrem Assogbadjo, Flora Josiane Chadare, Brice Sinsin, Patrick Van Damme
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The present study reports an ethnobotanical survey among local people of Benin, Burkina Faso, Ghana and Senegal. The study aims to (i) understand local perceptions of baobab tree variation; (ii) identify local peoples’ preferences of baobab traits (iii) Assess correlations between various traits according to local people. In each country, structured interviews have been conducted on a total of 129 women and 281 men of different ages that were randomly drawn from nine ethnic groups. Interviews included questions on perceptions and human/cultural meaning of morphological variation, use forms, preferences (desirable/undesirable traits) and links between traits. Local people in the four countries used 21 criteria to differentiate baobab individuals in traditional agroforestry systems. These criteria are related to the characteristics of leaves, fruits, bark and the whole tree. The preferences of local people were for baobab trees having delicious leaves, sweet or slightly acid pulp, non slimy pulp, yellowish pulp, capsules producing high yield of pulp, bark easy to harvest, and which are considered as female are the desirable ones in rural areas of West Africa. In rural areas, local people are also aware of the linkages between different traits of baobab. In Benin and Senegal, especially between the oldest Ditamari and Wolof, local people have a wide knowledge about links between baobab traits. According to them, the easier the bark harvesting, the tastier the pulp and leaves; the slimier the pulp, the less tasty it is; the softer the seed coat, the higher the probability of the resulting baobab to be a male. Moreover, Ditamari people from Benin have outstanding knowledge to link specific baobab traits: hairy leaves are invariably tasteless, male baobabs give tasteless leaves, long shaped fruits of intermediate size invariably yield a sweet pulp. In contrast, local people from Ghana and Burkina Faso do not appear to possess knowledge of links between baobab traits. Within *A. digitata*, farmers are able to guide researchers in collecting germplasm from trees with preferred combinations of traits. This can allow selecting of candidate plus trees for propagation, and planning a domestication programme based on the indigenous knowledge.

Ethnobotany in the Urban Environment

Michael J. Balick, mbalick@nybg.org
New York Botanical Garden

In his over 20 years experience teaching at the Yale School of Forestry and Columbia University, Dr. Balick has found that students have an extraordinary experience breaking out from the typical classroom setting to doing fieldwork in the urban environment that is familiar to few and is equally complicated as international fieldwork. In the course students develop and implement an original research project in an urban environment. They produce and present an original paper on their research to the class by the end of the course. The range of projects students have done will be discussed. Also of note, is the first medical ethnobotany project sponsored by NIH through the National Center for Complimentary and Alternative Medicine for work with the Dominican community in New York City. This includes an education component that compliments the research through teaching botanica owners and local physicians about plants, their origins, conservation status, and use in traditional medicine.

Diversity of Green Leafy Vegetables and Perceived Health Benefits in Madanapalle, India.

Julie Bélanger, Shoba Katumalla, Timothy Johns

Presenting Author: Julie Bélanger, julie.belanger@mail.mcgill.ca

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Wild and cultivated green leafy vegetables (GLV) make important contribution to health and nutrition and are sources of several nutrients and phytochemicals (Chweya and Eyzaguirre, 1999). In addition to reducing micronutrient deficiencies, GLV consumption is believed to help prevent the onset and development of age-related eye diseases, namely cataract and macular degeneration (Krinsky et al., 2003). As part of a project on the contribution of GLV consumption to the prevention of cataract in rural Indian women, we conducted an ethnobotanical field study to document the use, collection and perceived health benefits related to cultivated and wild GLV in the drought-prone surroundings of the Madanapalle mandal, Chittoor District, South Andhra Pradesh, India. We interviewed 100 women from approximately 20 different villages and collected voucher specimens for each species mentioned. Information was recorded on cultivation, gathering, ecological areas where GLV were found, cooking, medicinal properties and frequency of consumption. Identification was confirmed with the Sri Krishnadevaraya University Herbarium, Anantapur. Village women of Madanapalle and surroundings reported the consumption of 40 leafy vegetables, of which 34 species belonging to 20 families were formally identified. Most GLV were collected in and around fields, in waste lands or near ponds and some were either bought at local market, cultivated in fields or grown in home gardens. All species except 2 are consumed cooked according to various local recipes. A total of 22 medicinal uses were reported. Madanapalle women extensively use local resources in the form of leafy vegetables for food. The most frequently reported species were selected for carotenoid analysis and were included in a hospital-based study to investigate their role in preventing age-related cataract.

Guitar Woods

Bradley C. Bennett, bennett@fiu.edu

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The world's most popular instrument, the guitar evolved from ancient Persian and Arabic instruments. Around 1850, Spanish luthier Antonio Torres Jurado established modern dimensions of the classical guitar. German luthier Christian Frederick Martin migrated to NYC in 1833 and founded the company that bears his name. In 1934, C.F. Martin Company produced a 14-fret, x-braced, dreadnought size guitar, which remains the standard for steel string instruments. The classical guitar with nylon strings and 12 frets clear of body is made with a spruce (*Picea* spp.) top and rosewood (*Dalbergia* spp.) back and sides. Flat-top steel string guitars often are made from the same material. They usually have 14 frets clear of body, a narrower neck and a larger body. Necks of these guitars are usually mahogany (*Swietenia macrophylla*), Spanish cedar (*Cedrela odorata*) or rosewood (*Dalbergia* spp.). Fingerboards and bridges are made from ebony (*Diospyros* spp.) or rosewood. Flamenco guitars made with a spruce top and Spanish cypress (*Cupressus sempervirens*) are similar to their classical cousins but are lighter and more

percussive. Archtop guitars have a carved top and f-shaped instead of the more common round sound hole. Species of hard maple (*Acer* spp.) are used for both the top and the backs and sides. Until recently, most guitars were made from around a dozen species of woods. Due to the increasing rarity and cost of many of these traditional wood (e.g., Brazilian rosewood – *Dalbergia nigra*), luthiers have begun to experiment with new guitar woods. In interviews with luthiers and guitar dealers, I identified more than 250 wood species employed in guitar construction. Eleven of the most frequently employed species are listed by international conservation organizations due to their rarity or rapid population decline. Two physical characteristics, modulus of elasticity (MOE) and density are strong predictors of which woods can be employed in the various parts of guitars. Top woods or sound boards have the lowest densities and MOEs; fingerboard and bridges have the highest densities. Back & side materials are intermediate. Analysis of 40 additional species (either recent additions to the guitar wood palette or experimental woods) showed similar patterns. Objectives 1. Determine what wood species are employed in the manufacture of acoustic guitar. 2. Identify the most frequently employed species 3. Evaluate the supply and conservation status of the most frequently used species 4. Create model of wood physical properties and application in guitar construction (sound board, back & sides, neck, bridge & fretboard). 5. Use model to evaluate newly employed or potential woods. I interviewed luthiers and guitar dealers and collected wood specifications from ca. 50 guitar manufacturers. Frequently employed species were those cited by 50% or more of the sources, IUCN, CITES, and national rankings were employed to evaluate the conservation status of each species. I compared application of woods by creating a model using wood physical properties (density and modulus of elasticity) from the U.S. Forest Service Laboratory and other sources. A random selection of forty additional wood species was analyzed similarly. More than 250 species of wood are employed in the manufacture of guitars. Fourteen species are employed in most guitars. These include several species of rosewood (*Dalbergia*), spruce (*Picea*), maple (*Acer*), and ebony (*Diospyros*) along with big leaf mahogany (*Swietenia macrophylla*), Spanish cedar (*Cedrela odorata*), and koa (*Acacia koa*). Eleven of the most frequently employed species are listed or have restricted populations. The most highly prized wood Brazilian rosewood (*Dalbergia nigra*) is ranked on the CITES I list. When modulus of elasticity (MOE) is plotted against wood density, top, back and side, and fingerboard & bridge woods form clusters. Top woods have the lowest densities (368-513 kg/m³) and MOEs (7.70-11.10 GPa); fingerboard and bridges have the highest densities (719-1009 kg/m³) and MOEs (11.44-18.88) GPa. Back & side materials are intermediate. Physical properties for neck woods are more variable, probably because they can be laminated. Analysis of 40 additional species (either recent additions to the guitar wood palette or experimentally woods showed similar patterns. Until recently, luthiers used only a few species of woods to make both classical and steel-string acoustic guitars. The application of each wood can be predicted with a model that employs two physical characteristics of the wood: density and modulus of elasticity. The scarcity of many traditional woods has led to the experimentation with other species. The density-MOE relationship can predict which woods can be employed in the various parts of a guitar. However, other factors including ability to bend, appearance, texture, and ability to bond with glue are important. Musical instrument manufacturers consume only a small fraction of the world's timber production. Nonetheless, the importance of music in almost all cultures allows, makes the sustainable use of sound woods a strong metaphor for conservation.

The Relationship between Ethnobotany and Botanical Gardens

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Botanical gardens and ethnobotany are intimate partners - or at least they should be. Gardens are a metaphor for the oldest and most important relationships between humans and the natural world. This relationship exists at a variety of levels from the philosophical to the pragmatic. Gardens are a manifestation of one way that humans think about the plant world. They are neat, ordered, and controlled. Gardens reveal the processes of the biological systems and reveal interactions between the physical and living world. Gardens are forms of cultural expression and they are places physical,

spiritual, and psychological restoration. The relationship between gardens and ethnobotany too frequently is ignored. Ethnobotanists often give little attention to the aesthetic values of plants, even though it is a universal value. Gardens fail to use ethnobotany as the key to public interpretation the botanical kingdom. Here, I discuss one example of how gardens can serve as a teaching resource and how gardens can use an ethnobotanical approach to better interpret the botanical world. In 1996, I helped Fairchild Tropical Botanical Garden create the Chachi exhibit. The Chachi are an indigenous group living in Ecuador's lowland Pacific forests. Along with Patricia Terrack, a former Peace Corps volunteer with the Chachi, we arranged a convention with the Chachi Federation. We then shipped material for a typical Chachi house, 4 dugout canoes, and other artifacts to Fairchild. In October of 1996, three of our Chachi colleagues flew to Miami to assemble the house and to interact with garden visitors. Students in my ethnobotany course helped with the project and learned much about the culture of our Ecuadorian friends. The five year-long exhibit was widely popular with garden visitors and with the local and national press. It afforded an easy opportunity to teach the public about the Chachi culture, their rainforests plants, and the plight of indigenous peoples and their forest homes. Moreover, it demonstrated the crucial role of plants to all people.

A Fusillade of Arrows and Other Milestones on the Trail of Medical Ethnobiological Research: Anthropological Reflections about the Last Fifty Years: Distinguished Economic Botanist Lecture
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Nearly fifty years ago, a series of chance meetings took us down an unlikely trail that led first to ethnobotany, then to more comprehensive research on subsistence, nutrition, and health, and eventually to what has been called medical ethnobiology. Some the major milestones on the way take place in the highlands of Chiapas, Mexico, then the rainforests of Amazonas, Peru, and finally, back to the mountains and valleys of our first fieldwork. Tonight we mark the honor to address the Society for Economic Botany by providing some brief reflections on the scientific and ethnoscientific collaborators we have met on this journey and how they have influenced our research on ethnomedicine seen as a complex system of traditional knowledge.

Relational Efficacy and Traditional Plant Medicine

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Selling ethnobotany by claiming it will find a great cure for cancer, AIDS, or diabetes has done wonders for the image of the field in the popular conception, but little to win respect for the field in other areas of science because this claim has been a largely hollow. There are a many new techniques available that have been adopted by other areas of biology, such as large botanical databases, elucidations of plant and disease evolution, high-speed computational power, and bioinformatics, that can be adopted to discover new, effective medicinal plants at a reasonable cost and effort. We attempt to delineate a predictive quantitative ethnomedicine system, termed "relational efficacy," to synthesized medicinal plant knowledge from many cultures and the phylogenies and relations of plants, diseases, and cultures to create a list of medicinal plants prioritized by their potential medicinal efficacy and determine which plants to analyze first in the laboratory to verify their efficacy out of the thousands of described but untested medicinal plants. The phylogenetic relations of eight diseases, the ethnic groups being studied, and plants collected with the Peruvian Asháninka and the Malian Malinké were determined from the literature and disease-treating plant phylogenetic analysis. The relatedness values derived from this were fed into a computer program written to synthesize these values into a potential efficacy for each species using the equations discussed herein. These potential efficacy values were compared to the efficacy values derived from bioassays to determine the correlation between the two measures, to validate the predictive power of the "relational efficacy" system. Many new useful ethnobotanical techniques were developed in the process of this research and "relational efficacy" was shown to be a powerful predictive

tool for determining effective plant medicines. New ways were found of connecting diseases that were previously unavailable, and lab time was reduced, allowing more time in the field. Ethnobotanical research can be made much more efficient with a few key field, lab, and analysis techniques that will speed the rate of discovery of new plant medicines, and allow the field to fill some of its promises.

Cherokee White Oak Basketry, a Traditional Craft Dependent on Depleted Natural Resources

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Exotic forest insects and pathogens have been impacting Appalachian forests for over 150 years. Increasing trade has caused a progressive increase of exotic forest pest problems. Resistance breeding is a feasible strategy to address many resident exotic pests, however, relatively few breeding programs that have been successfully completed. The traditional Cherokee arts are dependent upon many species that are threatened by over harvesting and exotic pests on the Qualla Boundary of western North Carolina. White oak basketry, a unique Cherokee craft, uses material from young, straight-grained trees, which have virtually been eliminated due to demand. In addition, many other species that are threatened are used as material to dye baskets. Opportunities exist to increase the supply of products used in baskets would reduce the use of synthetic dyes and preserve the cultural aspects of traditional basketry methods. Cultivation of materials specific to the basket trade would decrease profit loss to outside merchants and reduce the demand on wild populations. White oak seedlings were planted to increase the supply of material and to protect natural regeneration. A study of various sizes of seedlings, tree shelters, and open-pollinated genotypes will derive protocols for growing white oaks specifically for the basketry trade. Three year results of production using various protocols will guide future plantings of white oak specifically for basket materials. Cherokee artisans also use butternut bark, roots, and nut husks to produce dye for baskets. Southeastern populations of butternuts have been reduced by approximately eighty percent due to an introduced fungal pathogen. In order to protect this threatened tree species, artisans have been provided with material from seedling roots and nut husks and determine the most effective material for dye. Butternut plantations, resistance screening tests, and a locally-adapted seed orchard have been monitored to develop a resistance breeding program for the Qualla Boundary. Growth of white oak seedlings relates significantly to various treatment factors, indicating potential for ideal shelter size selection. Five year results indicate some genotypes and initial seedling condition are more resistant to disease development. These projects increase material available to artisans, protect the art and natural resources for future generations, and provide a model for protecting other species at risk.

Health for Sale: The Medicinal Plant Markets in Trujillo and Chiclayo, Northern Peru

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Traditional methods of healing have been beneficial in many countries with or without access to conventional allopathic medicine. More and more people are becoming interested in the knowledge maintained by traditional healers and in the diversity of medicinal plants that flourish in areas like Northern Peru. While scientific studies of medicinal plants are underway, concern has arisen over the preservation of both the large diversity of medicinal plants and the traditional knowledge of healing methods that accompanies them. To promote further conservation work, this study attempted to document the sources of the most popular and rarest medicinal plants sold in the markets of Trujillo and Chiclayo, as well as to create an inventory of the plants sold in these markets, which will serve as a basis for comparison with future inventories. Individual markets and market stalls were subjected to cluster analysis based on the diversity of the medicinal plants they carry. Surveys focusing on medicinal plants sold and their properties were conducted at the markets in Trujillo (Mayorista and Hermelinda) and Chiclayo (Modelo and Moshoqueque) each summer (June/August) from 2001-2006. In June-July 2007 an

additional questionnaire including questions about plant origin, pricing and quantities sold was included in the follow-up survey. In order to assess the amount of plant material sold, vendors were asked to estimate the daily and weekly amount of material sold for every species in their inventory. The inventory of 54 of 110 vendors in the Mercados Mayorista and Hermelindas in Trujillo, and Modelo and Moshoqueque in Chiclayo yielded a total of almost 400 medicinal plants and preparations sold at any given day. Exotics played an important role amongst all plants sold. The results show that markets were grouped based on the presence of: (1) common exotic medicinal plants; (2) plants used by laypeople for self-medication related to common ailments (“everyday remedies”); (3) specialized medicinal plants used by curanderos or traditional healers; and (4) highly “specialized” plants used for magical purposes. The overall value of medicinal plants in these markets reaches a staggering 1.2 million US\$/year. The plant trade in the study areas seems to correspond well with the specific health care demands from clientele in those areas. The specific market patterns of plant diversity observed in the present study represent a foundation for comparative market research in Peru and elsewhere.

Educational Activities Form an Important Link between Field Research and Communities

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Informal educational activities directed toward different segments of a community are much appreciated and enrich the development of the research projects. Our studies in Mexico have focused in different groups such as children, housewives, traditional healers, and traditional farmers among others; in some cases additional ethnobotanical information emerged that was not detected during interviews. Specific workshops are designed to satisfy the needs of local inhabitants in different parts of Mexico. The themes covered are usually of general interest and address a local issue. Local knowledge is included in the sessions and is enriched by placing it in the context of general information from other sources such as that found in historical references, geography, anthropology and botany among others. Each course or workshop has complementary activities that include direct observation of natural phenomena, audio-visual presentations, and organoleptic samplings in order to make the program attractive and dynamic. For each activity the group’s level of knowledge is evaluated before and after the program in order to evaluate the quality of our teaching as well as the acquisition of knowledge by the participants. Notable differences are found between different grades within elementary schools as well as between rural and urban schools. In our experience, children with less economic resources respond better than those from higher economic income families. Our work with traditional healers is based upon mutual respect and we offer new techniques for documenting their plant remedies that are useful to them in the long run. One problem with working with this group is the avoidance of creating an atmosphere of jealousy among specialists. On the other hand, the programs oriented toward housewives have synergized gastronomic creativity within each group for the benefit of each student’s family. Training programs for teachers have revealed a wide range of individual personalities and interests that are often reflected in the motivation and behavior of their students. Our experience has indicated that it is better to work with teachers and community multipliers who are dynamic and interested in learning so that their communities advance.

Applying Student Ingenuity to Invasive Species Issues: Glenville State College Undergraduates Seek Novel Uses of Tree of Heaven (*Ailanthus altissima*)

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A common goal of undergraduate science education is to engage student-scientists in student directed projects with unknown results and clear applications. Spurred by a NASA education grant and a concurrent statewide science initiative concerning the spread of Tree of Heaven (*Ailanthus altissima*) in West Virginia, biology students at Glenville State College were asked to study new uses of the invasive species. The educational goal was to further students’ understanding of the scientific process through

designing and conducting their own investigations. The conservation biology goal was raise awareness of the problems posed by invasive species. The economic botany goal was to find ways to use *Ailanthus altissima*. Fifteen students in “Techniques of Science” and “Biology Independent Research” at Glenville State College read papers about Tree of Heaven together and then individually designed experiments to test the potential uses of the plant. Projects ranged from using plant extract as an herbicide to determining energy output of the wood as a fuel source. In several projects, Tree of Heaven extract did measurably inhibit growth of other plants, although the statistical significance of the results varied greatly with type of extract, concentration and sample size. Two out of three projects concerning Tree of Heaven extract as an insecticide found the extract to deter, although not kill, insects, and the third found no measurable differences between the extract and water. Energy output from Tree of Heaven wood was found to be comparable to white oak wood and Tree of Heaven extract demonstrated no fungicidal properties. Students involved with the Tree of Heaven projects were actively engaged in the scientific process and learned valuable lessons about sample sizes, statistical significance, plant growth and the importance of pilot studies. While no one student found the clear method for use and alleviation of Tree of Heaven, this case suggests that student ingenuity and creativity might produce novel solutions and solid pilot studies when applied to other economic botany problems.

Screening for Antibacterial Activity in Medicinal Plants Grown by Rural Zulu Women (Maputaland area, South Africa).

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Zulu people living in the rural areas of Maputaland, rely heavily on their home grown medicinal plants, because of the remoteness and poverty in these areas. Not surprisingly, the poorest people are the most severely affected by infectious diseases. In 2002 more than 60% of all deaths in southern Africa were due to infectious diseases (Global Health Council, 2008). With the current problem of multi drug resistance bacteria (Alanis, 2005), there is a great surge to discover new potent antibiotics. To determine which plants are used for treating diarrhea and wound infections. To test these plants for antibacterial activities against *Staphylococcus aureus* (ATCC 13883) and *Escherichia coli* (ATCC 11775). Plant material was sampled from thirty homesteads in the Mbazwana area and at the Mtubatuba muthi market. Dried powdered plant materials were extracted with acetone and hot water. The Minimum Inhibition Concentration for these plant extracts against the two microorganisms was determined using the microplate technique of Eloff (1998). Medicinal uses for two species were recorded for the first time in South Africa. New information was gained regarding the use of four species to treat diarrhea and wound infections. Sixteen species were tested for the first time for antibacterial activity. Only two of the species collected from the home-gardens are also sold on the muthi market. All interviewees were women, with an average age of 58 years. All the plants collected from the home gardens showed some antibacterial activity against *E. coli* and/or *S. aureus*. Plants sold on muthi markets do not correspond to home garden diversity, suggesting that traders sell indigenous plants that are not easily cultivated. This study underscores the value of home gardens as it ensures a sustainable way of harvesting and managing medicinal resources.

A Few Drops of Lavender Oil

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General Web searches give thousands of hits, with useful sites lost in the mob of irrelevant, untrustworthy and repetitious information. Even specific searches may have far more hits than I have time to sort through, and there is still the problem of trust. To see how useful a Web search actually is. In Google, I used both Advanced Search and Scholar Search to gather information on each of three different uses for lavender oil (*Lavandula* spp., Lamiaceae). I tried a number of combinations of search terms to find the

most useful ones. 1. When I searched for “*Lavandula* AND lavender AND (burn OR sunburn)” I got 10,600 English hits. Most of the sites - at least the ones I looked at - recommend lavender oil for burns. But I found none that cautioned about using essential oils: they should be diluted in vegetable oil before use, and they must never be taken by mouth. The most useful site I found, a US NIH summary of tested herbal remedies, didn’t even show up under Scholar Search. Most of the first hundred or so hits were newsletters or newspaper articles, which I don’t consider unbiased or trustworthy. 2. Lavender oil has been used by artists even though it’s not a drying oil. Using “paints OR paintings OR artists AND (lavender oil)”, I had 11,900 English hits. Among the first ten were a useful article in Wikipedia and an authentic-sounding discussion of china-painting. However most of the sites I looked at were selling something. 3. A report at the 2006 Endocrine Society meeting indicated that young boys who used personal care products containing lavender sometimes developed breasts like those of pubescent girls. The report was summarized in Science News, and six months later it was published in the New England Journal of Medicine. Under Advanced Search there were 2,150 hits, and some of them actually cited SN or NEJM. The Scholar Search for “*Lavandula* AND lavender AND (breast OR breasts)” had 67 English hits, and the NEJM report was the first one. As a general finding, there was no overlap. I didn’t find any information in any of the searches that applied to the other two subjects. Searches on the Web have to be very specific or they are a waste of time. Then each site on the list of hits must be evaluated for relevance and biases. But specific searches, by definition, exclude sites with information you’re not looking for.

Adaptation of Ethnobotany to the Educative curricula in Castilla-La Mancha (Spain)

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Starting fifteen years ago, the team has been studying the relationships with plants of the Traditional Knowledge System in Castilla-La Mancha (Spain). We focused mainly in Ethnobotany. The dissemination strategy adopted included printed and electronic materials, courses and workshops in order to raise the awareness of our own community on this knowledge as cultural heritage and valuable resource for sustainable development. Systematically record the interactions environment/natural resources/TKS among our community. - Spreading and disseminating these results through links with different education levels. Ethnobotanical research: open interviews, general questionnaires addressed to the use in primary and secondary school (asking pupils and students to work together with their grand fathers), specific species questionnaires on gathered food plants, workshops with elder rural people in cities and rural areas. Dissemination of Knowledge: Centres of Professors for secondary school teachers (introduction to basic and applied ethnobotany), “Universidad Popular” Ethnobotany courses for adults; Curricular materials for secondary school (printed and electronic), Books and booklets addressed to the general public, Papers in specialized journals of the Educational community, VHS documental on traditional uses of natural resources of Castilla-La Mancha. Curricular materials reached nearly 200.000 children of primary and secondary school, mainly they are used in the Applied Botany courses and as transversal material. Specialized courses attended by over 200 primary and secondary school teachers. “Universidad Popular” courses were followed by 1.500 adults during the last 12 years. Books and booklets are in public libraries of Castilla La Mancha, available for consult. Three are freely downloadable in pdf format at: www.dipualba.es/iea/. This methodology helps the preservation of the TKS within the community and complements the oral transmission system, now almost in disuse. However encouraging the intergenerational transmission of knowledge is still a goal and will not be successfully replaced by any other methodology or approach.

Practical Applications for Botanical Education in Native American Traditional Ecological Knowledge

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This paper documents a case study demonstrating the role that classical botanical education has in the transfer of information necessary for the maintenance, recovery, and continuing evolution of traditional ecological knowledge. The loss of TEK is considered as one of the great tragedies of the forced removal of Native American Tribes from their ancestral lands during the “reservation years.” There is evidence however that while some is missing, much is not lost but rather separated from the day-to-day practices necessary to inform its knowledge base. I propose that this has created a disjunct between the cultural and spiritual customs of the Native American Tribes residing in Southern Oregon and much of their traditional ecological knowledge, but that the two can and are being realigned and re-connected. Furthermore, I show the practical utility of plant anatomy, physiology, and taxonomy as a resource in the struggle for restoration and renewal of tribal memories and inter connections with ancestral lands. To identify the extent and means that botanical information can aid in building connections to historical traditional ecological knowledge. Ethnographic research including the review of historic records, participant observation, and interviews with tribal members were collected on Oregon’s southern coast over seven years and cross-referenced with botanical field surveys and herbarium specimens. Botanical scientific knowledge offered information reconnecting cultural practices with ecological knowledge in at least three ways. 1) A plant species known through historic ethnographies as a traditional tea was identified, allowing the re-introduction of its use. 2) The traditional timing for harvesting basketry materials was re-established by referencing anatomical features with thanksgiving prayers. 3) Physiological differentiation was documented as a result of traditional practices giving evidence for tribal managers to re-introduce cultural land management. The continuing displacement of peoples from their traditional lands due to social, political, and ecological factors can create a disjunct between cultural practices and their traditional ecological knowledge. Native plants are a vital component of local cultures and an integral factor in traditional knowledge both historically and currently. Scientific botanical knowledge and research can offer information to bridge gaps, realign customs to practice, and maintain connections to traditional knowledge.

Herbal Statins

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Prescription drugs that lower cholesterol through the inhibition of the enzyme hydroxymethylglutaryl-coenzyme A reductase (hmg-coA reductase inhibitors) are referred to as statins. Statins are among the most widely prescribed drugs. Herbs and phytochemicals have also been reported to have hmg-coA reductase inhibition activities. Numerous dietary supplements for healthy cholesterol levels contain these “herbal statins.” Statin drugs are known to have adverse effects ranging from minor muscle aches to severe muscle damage; drug interactions appear to be responsible for some of these effects. Similar adverse effects have occasionally been reported for some herbal statins. Herbs may also interact with statins through the cytochrome P450 pathway, involved in metabolic breakdown of drugs. This presentation will review the literature on herbal statins, with a particular emphasis on reports of adverse events involving muscle pain and damage when such herbs are given with statin drugs. The NAPRALERT, PubMed and Natural Standard databases were searched for herbs, phytochemicals and other dietary supplements that may lower cholesterol. Results are categorized as laboratory analysis, case reports, observational trials, randomized trials and meta-analyses. Labels of herbal cholesterol-lowering supplements were surveyed for mentions of muscle pain. Widely used supplement ingredients that possess hmg-coA reductase inhibitory activity include red yeast rice (which contains monacolin K, a compound identical to the prescription drug lovastatin), policosanol, artichoke, guggul, plant stanols, reishi, fish oil and others. Some but not all clinical trials indicate that these supplements lower cholesterol. Supplements that may inhibit the cytochrome P450 enzymes that break down statins include berberine, bromelain, grapefruit, Oregon grape, resveratrol, Uncaria and others. Case reports of muscle

damage related to herbal statins are discussed. Supplements for healthy cholesterol often contain substances with hmg-coA reductase lowering activity. It is plausible that some such supplements may cause statin-like muscle problems, especially in cases where several supplements are taken together, or when taken with statin drugs. Other supplements may contribute to muscle problems because they inhibit metabolic breakdown of statin drugs. Health professionals and users of herbs and drugs with statin activities should be aware of these potentials.

Ethnobotany and Master Naturalist Training

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In this talk we will focus on Master Naturalist Programs, now in place in over 26 states. Master Naturalist and other natural resource outreach and service programs provide training on natural history and natural resource management to members of the general public. These folks are then asked to provide volunteer service in citizen science, ecological services, educational and interpretation projects. What does ethnobotanical training bring to the table with these programs? How can our cultural and biologically savvy viewpoints contribute to members of the general public who might be participating in these programs? Further, what can we recoup from them?

Yucatec Maya Medicinal Plant Knowledge Variation and Social Networks

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Medicinal plant knowledge varies within a sociolinguistic group. Social network analysis may be able to explain some of the variation in intra-cultural medicinal plant knowledge. The basic premise is that socially acquired knowledge is transmitted through social networks. Therefore, people in different positions within the social network will have access to different information, resulting in patterned variation in knowledge. This research was performed to determine if an individual's position within a social network can help explain the variation in medicinal plant knowledge found within one Yucatec Maya community. Data were gathered on ethnomedical conditions and medicinal plant treatments for those conditions using free lists. Then the free lists were used to create a knowledge test that was analyzed using cultural consensus analysis. This analysis provides a consensus score for each participant, which is then used to describe the distribution of knowledge within the community. Whole network and personal network data were gathered and analyzed using social network analysis. Multiple regression analysis was performed to understand the influence of network structure variables on the distribution of knowledge. Preliminary analysis suggests that individuals in a close knit group will have similar knowledge which will differ from knowledge of members in other close knit groups. In addition, people who bridge two or more groups will have similar consensus scores with other individuals who participate in more than one group. Combining social network and cultural consensus analyses is a useful technique because it provides researchers a way to systematically study influences of relational variables on intra-cultural knowledge variation.

Paying it Forward: Investing in Economy Botany Education for Urban Youth

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In contrast to returning research results to communities that host and inform scientists, "paying it forward" connects the skills, knowledge, and experiences of scientists who conduct fieldwork in distant places to high schools near their home institutions. This effort addresses some of the shortcomings of secondary education and contributes to developing a forward-looking and ecologically literate population (Orr et al. 2005; Gadotti 2003). The program presented here emphasizes education of urban minority students and pedagogical training of doctoral and post-doctoral students. We work with the Center for

Advanced Study in Education and College Now, of the City University of New York, to develop and teach locally focused field-based courses (Sobel 2004) enriched by material drawn from our research and education to New York City high school students. Courses are structured to close learning gaps between high school and college, place students at the center of the scientific process, and make current economic botany related issues meaningful to urban youth. Doctoral and post-doctoral fellows work in teams to develop learning goals and activities for courses that are pilot tested in high schools and then offered as pre-college courses on City University of New York campuses. Based on teaching experiences and student evaluations, the curriculum is further refined and disseminated for other educators to adapt. Two doctoral and two post-doctoral fellows have developed four economic botany related semester-long research courses: The Green Monster (forest ecology in New York City); Nature's Drugstore (medicinal plants); Health, Community and the Environment (ethnoepidemiology); Writing Science not Science Fiction (archival research and writing). Since 2007, six courses have been taught to 110 students in the Bronx and Manhattan. Course implementation has contributed to developing student ecological literacy, research skills, and motivation to pursue higher education and careers in the related sciences. It has also uncovered challenges of shifting science education from fact driven to process oriented. "Paying it forward" enriches high school science and makes students aware of options that did not exist in the prevalent curriculum. For researchers, it develops us as educators and fieldworkers while challenging us to apply our knowledge in novel ways.

Ethnoveterinary Medicine among the Aguaruna of the Peruvian Amazon

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Research on plant medicines that the Aguaruna use to treat illness in dogs was carried out in fall, 2007, in the northern Peruvian Amazon. Dogs play a very important role in Aguaruna society in hunting local game animals and guarding homes. The research investigated whether the Aguaruna tend to use the same medicinal plants in the same manner for treating people and dogs. Specifically, it addressed the hypotheses: 1) plants that the Aguaruna use to treat dogs will be the same plants that they use to treat people and 2) plants that are used to treat both people and dogs will be used for the same illnesses in both cases. Methods included structured interviews with nine expert informants. Botanical voucher specimens were collected for all but a few of the plants mentioned. Informants mentioned 27 folk genera of plants used to treat 14 kinds of illness in dogs. Twenty of the 27 plants mentioned (74%) were also said to be medicinal for people. For plants used to treat both people and dogs, the same plant was said to treat the same illness for both in 52% of the cases. Although most plants used to treat illness in dogs are also used for people, they are used to treat different illnesses in a significant number of cases. Dog medicine appears to be a cognitive domain that overlaps with, but is partly distinct from human medicine for the Aguaruna.

Linking Education, Research and Development: A Case study on the Nutritional Assessment of *Moringa (Moringa oleifera)* in Sub-Saharan countries

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Nutritional deficiencies remain problematic for many populations around the world. A model to reduce poverty and overcome malnutrition uses a traditional ethnobotanical approach to identify plants that are rich sources of nutrients. This model uses indigenous or naturalized plants as effective affordable delivery systems to improve health and nutrition to targeted populations. *Moringa (Moringa oleifera)* is an important multipurpose tree, known as "The Miracle Tree", because of its high nutritional value (e.g. the leaves are rich sources of minerals, vitamins and bioactive flavonoids; the seeds are rich sources of edible oils protein). The objective of this study was to assess the nutritional value of *Moringa oleifera* leaves. We

also sought to establish simple procedures to develop in-country quality control programs for evaluating this plants' nutritional value. This study was also used as a vehicle to involve undergraduate students in research and development activities within the field of economic botany.

Quality control, elemental, and proximate analysis were conducted in leaves samples of *M. oleifera* collected from commercial and naturalized varieties, from Zambia, Ghana and Senegal. The moringa leaves from Zambia and Senegal, particularly the commercial PKM-1 variety, contained high amounts of total minerals, and were found to be excellent sources of calcium (2-3%), potassium (1.5-2%), magnesium (0.2-0.3%), iron (31-59 mg/100g), manganese (8-13 mg/100g) and copper (0.7-1 mg/100mg), all of which are an essential part of a nutritional diet. The moringa from Ghana showed a lower nutritional value. In Zambia, little differences were observed in the nutritional value of leaves harvested at different seasons. The results also showed that moringa leaves can provide significant sources of proteins (10-15%) and antioxidant polyphenols (5%). These findings confirm the use of moringa leaves as a plant-based affordable delivery system that can provide significant sources of elements, proteins, and antioxidants to the diet. Moringa leaves can be an affordable avenue to improve health and nutrition in Sub-Saharan countries, for children and pregnant/lactating women. This project has led to the creation of new micro-agricultural enterprises and generated interest by the governments for using it within their public health care systems.

Woody Plants of the Southeastern United States: A Field Course on CD

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Woody plants of the Southeastern US (WPSEUS) is a cross-platform computer program designed to efficiently teach plant identification. It does this by helping users become visual experts in species recognition. Unlike novices, experts are able to quickly recognize patterns. This allows chess masters to recognize chess configurations, and botanists to identify species from a glimpse out the window of a moving vehicle. WPSEUS helps students rapidly achieve this mastery by adapting techniques from cognitive psychology to the task of species recognition. It is designed to promote holistic processing, the visual processing mode used by experts. The principles of WPSEUS have also been incorporated into a card game (Poison Ivy) suitable for use in K-8 classrooms.

Importance of Medicinal Plants Use in Rural Agro-Ecosystems: Case Lama Reserve in Benin.

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Lama classified forest is the largest relic in Dahomey gap. The Holly populations living the areas around this reserve constitute indigenous and deprived of hospitals and all formal infrastructures of medical care. As they are constrained to preserve the woody resources of the forest, practice a type of agro-forestry while saving useful trees in their fields. These trees serve them in the recovery of numerous illnesses. Determine the contribution of the medicinal plants saved in the fields in the income of the households and to characterize that agro-forester system. Three phases: - 1 hectare plot samples in the fields to count the saved woody gases and to note their dendrometric characteristics, - Investigation with the respective owners on the basis of a questionnaire on the utility of trees saved in the fields and their monetary importance - Meeting of village to standardize the information. 20 plant species constitute the woody saved in the cultivating fields to medicinal purposes. They are distributed in 15 genera and 12 families. Moraceae are the most frequent and Rubiaceae followed. All parts of the plants are used and serve to heal 20 illnesses classified in four groups: illnesses of skin, digestive troubles, malaria, and troubles of reproduction. The plants are also used in the ritual religious and convenient magic. The contribution of the medicinal plants from the plant brush to the drunk infusions is valued to more than 1US\$ per person daily. The average size of the household being 10 peoples, it is noticed that the medicinal plants occupy

the first place in the economy of the households, before the agriculture that supports more than 70% of the national income. These trees have an uncertain distribution in the fields and it had been noticed neither affinity nor preference from an owner to another. Holly save in their fields trees as medicinal plants constituting an important sum of money thus for the well-being of their household. Although parts of plants are not sold in the locality, they constitute the first source of economy of the households.

Wormwood Suppresses Tumor Necrosis Factor Alpha, Accelerates Healing and Improves Mood in Patients with Crohn's Disease – A Placebo Controlled Study

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Suppression of tumor necrosis factor alpha (TNF- α) and other interleukines by wormwood (*Artemisia absinthium*) extracts were reported recently in some in vitro studies. To find out if wormwood can suppress TNF- α in Crohn's Disease patients, and thereby accelerates healing. In a vehicle-controlled double-blind trial, 20 patients suffering from CD were given in addition to their basic CD therapy either 2-3 g of wormwood (Seda CrohnR) or placebo under double blind conditions for 6 weeks. Ten patients were allocated to each study group. Minimum score of 200 on Crohn's Disease Activity Index (CDAI) was required at baseline. Patients who received infliximab or similar were excluded from the trial. TNF- α levels in serum were measured at baseline, and after six weeks. All concomitant CD medications was maintained at the baseline dose levels. Average serum TNF- α levels fell from 24.5 ± 3.5 pg/ml at baseline to 8.0 ± 2.5 pg/ml after six weeks. Corresponding levels in placebo group were 24.7 ± 4.6 (week 0), and 22.1 ± 3.2 (week 6). Remission of CD symptoms was observed in eight patients (CDAI below 170 or reduction by 70 points), compared to only two in the placebo group. IBDQ also reflected accelerated clinical response with wormwood addition. Of clinical significance were the findings that wormwood also improved mood of the CD patients, as reflected in Hamilton's Depression Scale. Wormwood suppresses tumor necrosis factor alpha, accelerates healing and improves mood in patients with Crohn's disease, The use of wormwood in CD and other TNF- α targeting diseases seems justifiable in future trials.

Evaluation of Antiacne Activity of Alkaloidal Fraction of *Coscinium fenestratum* (Gaertn) Colebr.

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Acne vulgaris is a skin disease whose inflammatory component is produced by the host response by *Propionibacterium acnes* and *Staphylococcus epidermidis* have been recognized as pus-forming bacteria triggering an inflammation in acne, occurring in specialized pilosebaceous units on the face back, and trunk. To evaluate antiacne activity of alkaloidal fraction of *Coscinium fenestratum* (Gaertn) Colebr., an Indian medicinal plant. Alkaloidal fraction of stems of *Coscinium fenestratum* was evaluated by antimicrobial susceptibility by disc diffusion and broth dilution methods against selected bacteria. High performance thin layer chromatographic profile of alkaloidal fraction was established and berberine content was quantified which showed potent antiacne activity. Alkaloidal fraction of stems of *Coscinium fenestratum* showed maximum antiacne activity the minimum Inhibitory concentration values were the same (0.039 mg/ml) for both bacterial species and the minimum bactericidal concentration values were 0.039 and 0.265 mg/ml against *Propionibacterium acnes*, and *Staphylococcus epidermidis* respectively. Detection and quantification were performed by densitometry at λ 415 nm. The content of berberine was found to be 0.375%. The mechanism of action of highly aromatic planar quaternary alkaloids such as berberine is attributed to their ability to intercalate with DNA it is possible that alkaloidal fraction containing berberine in *Coscinium fenestratum* may act in the same mechanism to inhibit *Propionibacterium acnes* and *Staphylococcus epidermidis*. Therefore, the active component of the alkaloidal fraction could be of interest for further development as an alternative treatment for acne.

The Ethnoecology of Wild Mushroom Use by the Tzeltal Maya of Chiapas, Mexico

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Folk taxonomies are part of a larger domain of ethnoecological knowledge that influences when and how cultural groups use living things. This paper, written in honor of Brent and Elois Ann Berlin, examines Tzeltal Maya knowledge of ecological characteristics of mushrooms found in the Highlands of Chiapas, Mexico, and explores how ethnoecological knowledge, although detailed and sophisticated, is limited by the structure of the folk classification system. Knowledge of habit, substrate, development and seasonality of mushrooms influences mushroom hunting strategies and informs individuals when to hunt mushrooms and how habitat changes are affecting mushroom diversity and abundance. Ethnoecological knowledge is, however, limited to those species that are recognized and classified – which in turn are limited to those species that are edible, medicinal, physiologically salient, or extremely poisonous.

Classic Period Maya Agroforestry at the Chan Site, Belize

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The Chan site, located in the upper Belize River drainage, was occupied from Middle Preclassic to Terminal Classic times. The paleoethnobotanical record from this extraordinary Maya site provides a 1500 year record of forest use by the ancient Maya. The objectives of this study are to identify trends in forest product use over time and to aid our understanding of agroforestry practices of the past. All plant materials were identified as precisely as possible through microscopic examination, using light and scanning electron microscopes, and compared to reference collections. Chan currently is surrounded by a mosaic of farmland and tropical deciduous forest, probably much as it was in Preclassic times. Just 20 km to the south are the pine forests of the Maya Mountains. Analysis of more than 271 samples of macro-remains and flotation extracted plant materials from Chan revealed several patterns of wood use that included the decline of pine during the Classic period, an increase in palm exploitation at the same time and a dramatic diachronic increase in hardwood utilization. Results provide a reflection of the prevailing socioeconomic and ecological milieu of the Chan occupants through time. Pine seems to have been imported into the site from the Maya Mountains along with other trade items during the Late Preclassic period. That exchange seems to have come to a halt, however, during the Late Classic period when locally obtained hardwoods and palm became dominant in the assemblage of wood remains. Results from Chan reveal evidence for the use of pioneer species and an increase in the rate of forest harvesting during the Late and Terminal Classic periods. These findings parallel models that describe extensive habitat degradation and rampant deforestation just prior to and perhaps contributing to the Maya collapse of the 9th century.

Ethnoecology of the Tsawataineuk T'aki'lakw, the Affect of Cultivation on Productivity and Palatability of Tleksem, *Potentilla anserina* ssp. *pacifica*.

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The Tsawataineuk First Nation of the Kingcome River on the Central Coast of British Columbia traditionally managed four root species found in the high estuarine salt marsh in a garden system called the t'aki'lakw (Deur 2005). Euro-Canadian colonialism disrupted the management of the t'aki'lakw at the turn of the 20th century (Mckenna-McBride 1913-1916) and they remained fallow for nearly a century. The t'aki'lakw provides an interesting case study for ethnoecologists because it represents proto-agricultural subsistence among a people formerly categorized as hunter/fisher/gatherers (Deur 2000). While historical (Boas 1921, Curtis 1915), linguistic, and archeological (Deur 2005) evidence supports

the proto-agricultural use of the t'aki'lakw, no work to date has been done to measure the ecological and biological affect of this traditional management system. This thesis attempts to fill that void by experimentally restoring the t'aki'lakw and measuring the affect of traditional management. I employ two methodologies to stereoscopically illuminate this topic: qualitative historical ethnoecology and quantitative experimental ethnoecology. The historical ethnoecology draws upon limited written records such as Edward S. Curtis, Franz Boas and others, and contemporary interviews with elders, to create a model of what traditional management activities looked like. The experimental component attempts to test this model in a rigorous quantitative manner. To answer how the t'aki'lakw was traditionally managed I will explore historical records and conduct interviews with Tsawtaineuk elders. To test how traditional management affects the productivity of *Potentilla anserina* ssp. *pacifica* I will establish experimental plots and compare managed and unmanaged root biomass, length, and density. To better understand the variation in the palatability of *Potentilla* I will harvest managed and unmanaged root specimens every month of the growing season and submit samples for tannin and carbohydrate analysis. I will also propagate *Potentilla* roots in a laboratory setting to learn how genetics, soil conditions, and plant age affect the concentration of bitter tannins in the roots. No results at this time.

Developing an On-line General Education Ethnobotany Course

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A general education natural science and diversity course was developed in an on-line format through the integration of videos from the University of Hawai'i with readings from Balick and Cox's *Plants, People, and Culture: The Science of Ethnobotany*. Also, the students complete three assignments: create a bouquet of flowers by writing a letter using the symbolism of flowers; a description of the uses of a plant from Micronesia; and an ethnobotanical interview to learn how a relative or friend uses a plant growing in Pennsylvania. The course's student learning outcomes are: to gain an understanding of how the uses of some plants have shaped past cultural and historical developments; and to become aware of the critical roles that plants play in the modern world and into a sustainable future. The content of the course was focused on the culture related aspects of ethnobotany to meet the University's goals for general education natural science and diversity in the United States and International. The content selection process also was constrained by the requirement that the students access the learning resources, from the University's Angel Course Management System, except for the textbook. The on-line course will be offered only in the University's six-week summer; therefore, grouping of video topics followed the chapters in *Plants, People, and Culture: The Science of Ethnobotany*. Because the Angel Course Management System has limited storage space, the videos were compressed to a QuickTime format, which required the creation of some electronic documents for diagrams that were not clear after the video compression. Outlines of major points in the videos and chapters were provided to guide the students in the note taking process. Weekly quizzes were created for both the set of videos and the book chapters. The course will be offered for the first time starting May 19, 2008 and student feedback concerning the course will be utilized to revise the course before summer session 2009.

Origins of Cultivated Vanilla

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The sources of natural vanilla are *Vanilla planifolia* Jacks., originating from Mesoamerica, and *Vanilla tahitensis* J.W. Moore, found in production in French Polynesia, but unknown in the wild. The historical and evolutionary origins of these cultigens have been little characterized. (1) To synthesize available ethnohistoric literature and observations from fieldwork to compile a historical understanding of vanilla cultivation, past and present. (2) To use molecular markers (DNA sequences, AFLP genotyping) to characterize the relationships and diversity among cultivated vanilla.

AFLPs were used to test relationships and diversity in cultivated *V. planifolia* in Mesoamerica, the area of origin, and the Indian Ocean, the principal production region. A two-gene approach, ITS and trnH-psbA, was devised to test the putative mixed ancestry and hybrid origin of *V. tahitensis*. High genetic uniformity was found in cultivated *V. planifolia* from Veracruz, Mexico and in the Indian Ocean, which were also found to be genetically indistinguishable, suggesting a common clonal origin. *V. tahitensis* has found to have genetic contributions from two species, *V. planifolia* and *V. odorata*. It also showed a high percentage of additivity relative to these two species. This finding supports a recent, and perhaps F1, hybrid origin for *V. tahitensis* between these two species. The dispersal of vanilla outside of Mesoamerica was actually two dispersals, both taking place in the 19th century: (1) an Atlantic dispersal of cuttings of *V. planifolia* from Papantla and via Europe to the Indian Ocean and Indonesia, underpinning the vanilla monoculture in these areas today, and (2) a Pacific dispersal, probably from the Maya area, of vanilla via the Manila Galleon to the Philippines and eventually to French Polynesia. This latter dispersal, combined with the bygone production of vanilla in the Maya area, helps explain the worldwide singularity of Tahitian vanilla.

Ethnobotany Segues to Science

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Students enroll in a non-major Biology and Botany course either because of requirements or they have some interest in the subject matter. The former does not lead to excited students while the later is not a common occurrence in of these sorts of courses. An exception is Introductory Ethnobotany. This course has a large percentage of students who have an interest in the subject. While many of the students see Ethnobotany as an easier science alternative, many students are attracted to Ethnobotany because they see it as being more culturally relevant than other science options. The Ethnobotany Segues to Science program, developed at University of Hawai'i, uses the basic appeal of Ethnobotany as a starting point to introduce students to a diversity of scientific disciplines. Specific segue modules have been developed which bridge ethnobotanical science to another science *sensu lato* (e.g., physics, history, marine biology, nutrition, linguistics). The goal is to demonstrate aspects of these other sciences in ways that motivate students to consider taking a course in the discipline. On-line resources and faculty advisors further assist students by providing information on courses, degrees, and careers in the science segue modules discipline areas.

The Significance and Use of *Theobroma cacao* in Ancient Copan, Honduras

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Intensive study of *Theobroma cacao* L. residues and iconography at Copan, Honduras, has elucidated the role of this ancient food in the ritual life of the polity. The author set out to explore questions concerning the range of cacao comestibles produced by the ancient Maya and to determine whether specific vessel forms were associated with these foods or drinks. In addition, clues were sought to the meaning of cacao in ancient Maya culture. Residues of more than thirty vessels from Early Classic Maya tombs were sampled and sent to W. Jeffrey Hurst at Hershey Technical Laboratory, who determined the presence of caffeine and theobromine using reversed phase HPLC. In addition, cacao iconography, common in the Late Classic period was documented and analyzed. Cacao was not solely used as a beverage by Copan's inhabitants and had a complex set of references for these ancient people. In iconography at the site cacao is linked to fertility, the rebirth of ancestors, the feminine, and maize. While these same themes are found at other contemporary Maya centers, the use of all of these associations at one location, has not been found at other sites, possibly because Copan's position at the crossroads between Maya and non-Maya traditions meant that it adopted a range of ancient ritual traditions.

Human Use of *Prosopis* in Hawai'i: Ethnobotanical History and Ecological Implications of a Useful Alien Pheatophytic Species.

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Prosopis first arrived in the Hawaiian Islands during the early part of the 19th century and rapidly became a widespread useful species, serving as a shade tree, fuel source, and bee food. It became a dominant in the arid areas of these islands, displacing many of the native endemic lower dry forest species because of its deep tap roots, thorny armor, and the presence of alien invasive and domesticated hoofed mammals. *Prosopis* is a genus of phreatophytic trees adapted to hot deserts and semiarid grasslands, especially in the New World from where the species in Hawai'i is ultimately derived. Although trees in arid areas are exposed to atypical environmental temperature and water stress, relatively few studies have evaluated their water relations. This is especially the case for *Prosopis* growing in areas where a large percentage of human water use comes from ground water such as in Hawai'i today. This paper reviews the origin, spread, use and hydrological implications of *Prosopis* for the human population in Hawai'i, with a special emphasis on potential ethnobotanical and ecological research. An extensive review of the literature was undertaken to determine the native range of *Prosopis* spp., their spread to Hawaii, and the history of their ecological adaptation, biogeographical range, hydrological relations, and human utilization in Hawai'i over time. *Prosopis pallida* is a dominant woody species in the arid areas of Hawai'i where native endemic species are now extinct, extirpated or threatened. Its deep roots allow it to thrive under stressful moisture conditions, while its armor protects it from alien hoofed herbivores. *Prosopis* is a highly esteemed charcoal source and has been a desirable shade, living fence and apiary resource. Nevertheless, its impact on available water for human uses is little recognized or known. The dominant ecological status of *Prosopis* in Hawai'i, as well as the human perception of its resource value, are liable to continue into the foreseeable future. However, in light of the human needs and demands on ground water resources in modern Hawai'i, more hydrological research is needed. Additional phylogenetic and ethnobotanical research is also called for in this presentation.

Love or Life: Local Preference and Species Survival in Boumba, Niger

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There is a complicated relationship between human affinity towards a species and its survival. Research has shown that preference toward a species can increase its risk of extinction through over-harvest, over-use and secondary affects of tourism (1). However, it has also been proposed that species that have greater appeal to people also have greater ability to draw conservation funding, participation in conservation and awareness regarding threats to species survival(2, 3). This study seeks to bring this question of how a species appeal to humans affects its survival to a local level. We ask the question does local preference predict a species local conservation status. Within an interdisciplinary participatory research framework, we used a mix of interviews, surveys and observation to create a community preference score and vascular plant surveys and questionnaires to evaluate local abundance and conservation status. The correlation between local preference composite score and local conservation status was not strong. However individual variables that influenced preference correlated strongly with conservation status, indicating that it is not preference itself that predicts conservation status but particular factors that influence preference also influence conservation. This research provides insight into the relationship between the species communities love and those they protect, which may be relevant to the discussion on conservation decision-making.

Nature Education Outreach for Children

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Nature education outreach at Duke Gardens incorporates several learning opportunities for pre-school, and elementary teachers and students. An original plant based curriculum called 'Native Tales' was produced and self-published to explore common native plants in the Southeastern region to reveal their 'stories' of cultural and ecological importance. In fourth grade all students in NC study NC history and 'Native Tales' supports this effort by looking to plants for ways to understand the connections between plants, animals, and people. By exploring the history, folklore, uses and ecosystems of native plants, students learn how plants influenced peoples lives and gain a deeper understanding of the state in which they live. This program uses native plants to explore the history of the land, people, and culture of our state. Two teacher training workshops are offered in partnership with NCBG and the Nasher Museum of Art to pre-school and elementary teachers to discover nature education in variety of ways. 'Take a Closer Look' is offered to pre-school teachers across the state. Strategies are explored to encourage teachers to use the outdoors as a means to support the developmental, intellectual, and physical growth of young children. The Nature of Art and the Art of Nature offered in partnership with the Nasher Museum of Art seeks to make connections between science and art elementary education. Creative, observational, and critical thinking are supported by activities using nature and art explorations. Children are experiencing a 'disconnection' from nature in their daily lives, which is leading to childhood obesity and stunted creative thinking. Through our nature education efforts we hope to support children, families, and teachers in ways that develop the whole child with a fully developed mind, spirit, and body. The goal for these projects at the children's education department of Sarah P. Duke Gardens has been to create original curriculum for fourth grade students and teachers and to train and create materials for pre-school and elementary teachers that support nature and outdoor education for young children. Grant funds were received from the Mary Duke Biddle Foundation to self-publish and produce a CD Rom of the original curriculum called 'Native Tales'. Copies were distributed for free to over 600, 4th grade teachers throughout five counties in the Triangle region for use in the classroom. Teachers are recruited through the Durham Public School System, NC Environmental Educators List Serve, and the NC Department of Public Instruction to attend teacher training workshops at Duke Gardens, the Nasher Museum, and the North Carolina Botanic Gardens. Evaluations have been conducted for all these programs and we have received very high ratings in our workshops, materials produced, and trainer expertise. These efforts are ongoing and will continue as part of our outreach mission to support elementary schools and teachers.

Study and Evaluation of Plants Used by the Tay-Nung Ethnic Groups in Northeastern Vietnam

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The Tay-Nung ethnic groups (Tay-Thai language group) comprised about 84% of population in Trang Dinh district, Lang Son province, northeastern Vietnam. Their experience and knowledge in using plants in every day lives have been studied and documented in our research. To survey and document traditional knowledge in the utilization of plants in study site, to evaluate the chemical basis of traditional use, and to recommend strategies for integrated conservation and development of plant resources. Six surveys over a period of three years have been conducted to collect data using participatory rural appraisal techniques and market analysis methods. Plant specimens for taxonomic identification and plant samples for chemical analysis were collected. The Tay-Nung ethnic groups use some 506 vascular plant species belonging to 332 genera and 128 families as medicines, dyes, foods, poisons and other uses. Some chemical components of two important medicinal plants have been identified. There are 14 species listed in the Vietnam Red Data Book and 23 species in the List of Precious Flora and Fauna of Vietnam. The value chain analysis and market assessment show there are 12 species for domestic market use and 15 species for export. The Tay-Nung ethnic groups have rich knowledge in using the plants of Trang Dinh district in northeastern Vietnam. They have developed some special uses of plants that are not practiced

by other cultural groups in Vietnam. Recommendations for sound conservation policies and sustainable development options are proposed.

Ethnic Markets Research

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Ethnic markets are rich sites for information on the interactions between people and plants. The goal of the course "Ethnic Markets Research" was to gain an understanding of the biocultural diversity of the ethnic markets in surrounding community through ethnobotanical field research. After an introduction to the city and area of Poughkeepsie, NY (the location of the Vassar College), students used census data, GIS, and Google Earth to propose markets sites. The final market sites were selected during the ground truthing at which time informed consent from each market was obtained and the markets locations recorded with GPS. Collections of all fresh food plants were made and vouchers deposited in the Vassar College Herbarium. As a form of return to the markets and community: 1) each market was geolocated in Google Earth with a link to the class website describing the project and results which included information about the markets and food plants available; and 2) Wikipedia was edited to provide information on the influence of ethnic groups to food plant availability in the area and where these plants can be found.

An Assessment of the Antioxidant Potential of Selected Plants Used as Cooling or Medicinal Teas in Barbados

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Rural Communities in Barbados are reserves of heritage knowledge regarding the use of plant species for medicinal purposes. A number of plants have been identified for their medicinal benefits and many have been categorized as 'cooling teas'. Cooling teas are considered to have a therapeutic effect by reducing 'heat stress' throughout the body. Many plants used for medicinal purposes have been found to be rich in natural products with antioxidant properties. There is increasing evidence for the application of plant species in lifestyle regimen aimed at relieving oxidative stress on the body. Selected plants identified as having a cooling or medicinal effect and belonging to the families Annonaceae, Myrtaceae, Moraceae and Poaceae were assessed for their antioxidant potential in terms of total phenol content. Plants of highest phenol content were *Pimenta racemosa* (bayleaf, Myrtaceae), *Artocarpus altilis* (breadfruit, Moraceae) and *Annona muricata* (sour sop, Annonaceae). *Cymbopogon citratus* (lemon grass, Poaceae) proved to be of lower phenol content. To estimate the reducing antioxidant potential of selected species of Barbadian medicinal plants, used as teas, against salicylic acid as the reference standard. An Electron Transfer (ET) assay using Folin-Ciocalteu reagent was used. Salicylic acid was chosen as the standard and methanolic leaf extracts of the selected species were used in the analysis. Antioxidant potential of the selected plant extracts was estimated in terms of 'Folin-Ciocalteu Reducing Capacity-FCR' (total phenol content) as milligram equivalents of salicylic acid per gram of dry mass. Lemon grass gave a total phenol content of 0.38 mg per gram dry mass while bay leaf had a total phenol content of 14 mg per gram dry mass. The FCR assay for reducing capacity and indicator of total phenol content proved effective in this analysis. Bay leaf, Breadfruit and Sour sop leaf extracts exhibited the highest reducing capacity. Further analysis of these extracts via other assays to assess radical scavenging capacity is now required.

Quorum Sensing Inhibitors for Methicillin-resistant *Staphylococcus aureus* from Italian Medicinal Plants

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Morbidity and mortality estimates due to methicillin-resistant *Staphylococcus aureus* (MRSA) infections continue to rise. Therapeutic options are limited by antibiotic resistance. New drugs that interfere with bacterial pathogenesis, rather than growth, could offer a solution to this problem. Inhibition of pathways responsible for the production of virulence factors allows for the mediation of pathogenesis without affecting growth, thus avoiding selective forces for drug-resistance. A cell-density dependent mechanism, known as quorum sensing (QS), is responsible for controlling protein expression in *Staphylococcus aureus*. Staphylococcal QS is encoded by the agr locus and is responsible for the production of virulence factors such as delta-hemolysin – a translational protein product of RNAIII. Quantification of delta-hemolysin produced by *S. aureus* and found in the culture supernatants allows for the analysis of agr activity at the translational level. To investigate the potential of plant extracts to inhibit the pathways responsible for the production of staphylococcal virulence factors. We screened 168 crude ethanolic and aqueous extracts from 104 Italian plants for inhibition of delta-hemolysin production. MRSA strain USA500 was grown in 24 well plates in the presence of the test extract at concentrations of 8-256 μ g/ml for 15 h at 37°C on a shaker. The well contents were centrifuged and the supernatant was analyzed for delta-hemolysin content using a RP-HPLC system with a Resource PHE 1-ml column [3]. Peak areas were measured and mean percent inhibition was calculated. Some degree of anti-QS activity is evident in 90% of the 168 Italian plant extracts screened, including those extracts with no growth inhibitory activity. Extracts from four plants (*Ballota nigra*, *Castanea sativa*, *Rosmarinus officinalis*, and *Sambucus ebulus*) exhibited a significant dose-dependent response (8-256 μ g/ml) in the production of delta-hemolysin, indicating strong anti-QS activity in MRSA. We have offered the first reports of plant extracts interfering with QS pathways in MRSA. Plant-based therapies that do not exhibit activity in the standard in vitro bacteriostatic or bactericidal tests are oftentimes dismissed as invalid treatments. These data, however, support the validity of south Italian folk remedies incorporating *Ballota nigra*, *Castanea sativa*, *Rosmarinus officinalis*, and *Sambucus ebulus* for the treatment of staphylococcal infection.

A Mouthful of Diversity: Knowledge of Cider Apple Cultivars

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There is a general assumption in the study of folk taxonomy that those people who have been interacting with a given crop the longest have the most knowledge about the crop's names. We treated this as a hypothesis that can be tested with the use of cider apples. This use of apples extends back many generations in some places, while in other regions people are just learning to make cider. The experimental design is to quantitatively assess the cider apple diversity being used, compared to the knowledge of this diversity by cider makers. The test involves two populations of cider makers: those who come from a long standing tradition of cider making and those who recently learned to make cider. Research was conducted in parts of England, Wales, the North of Ireland, and Washington State. Semi-structured interviews and questionnaires were used to illicit cider apple variety names. Traditional knowledge associated with cider production was also collected. 82 cider apple variety names were obtained. In addition, it is estimated that between 111 and 328 varieties were recognized but could not be named. There was a significant difference between the cider apple cultivars that cider makers could name and those that they could discern. On average, cider makers could name eight varieties, but discern 22 varieties of cider apples. There was no significant difference in the knowledge of cider apple variety names between long-standing cider makers and those that recently learned to make cider. As with cider apples, we would expect that farmers of other culturally significant crops would not always know named diversity if there are other cues to let them track varietal difference, such as appearance, taste or smell.

Impacts of Ancient Maya Forest Gardens of Mesoamerican Tree Species Composition: How to Approach This Idea?

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The Maya practiced intensive management and selection on Mesoamerican species for at least 3000 years. Is there a legacy of Maya plant use still apparent in the contemporary forest? If so, what would such a legacy tell us about the efficacy of Maya forest management relevant to establishment of a modern conservation program for Mesoamerican biodiversity? My objective is to determine the long-term impact of ancient Maya forest gardens on the species composition of the contemporary Mesoamerican forest. A major hurdle is developing the methods to control for other variables that could affect tree species composition. Ethnobotanical studies constitute the backbone of ethnoecology, documenting and exploring the relationships between people and plants in the natural world and the impact that has on the ecosystem. In light of the biodiversity conservation paradigm outlined in the recent Millennium Ecosystem Assessment, however, such studies alone cannot provide the data for a viable conservation model. I discuss the methodology and results of a project utilizing ecological methods within an ethnobotanical framework to examine the link between culture and ecosystem services. The essence of ecological methods, as in all scientific methods, is to establish experimental control over all factors affecting the system in question that are not the focus of the inquiry. For ethnobotanical research, controlling potentially confounding variables is especially difficult because ethnobotany is inherently observational rather than experimental. This requires careful selection of a posteriori statistical tests to explore the data. Analysis reveals a significant long-term impact on species composition ($R=0.209$, $p=0.002$). A major driver of this difference was a higher abundance of “indicator” species in ancient forest gardens areas. Ordination is used to investigate the role of edaphic characters. Despite the high population density and intensity of land use, Maya forest gardens allowed the preservation of much of Mesoamerican biodiversity. What remains is a lingering echo of the selective regimes practiced in the ancient forest gardens that is a defining character of the ecosystem we now consider a conservation priority.

Exploding Typological Myths in Paleoethnobotany: The Case for Morphometric Analysis

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Morphometric analysis of paleoethnobotanical proxy systems, e.g., seeds and opal phytoliths, has exposed severe flaws and fundamental errors in typological constructs used pervasively to study the history of cultural botany. Creation of morphotype standards, based on subjective perception, are an inadequate basis for reliable analysis, resulting in inaccurate interpretations of past plant uses. Conversely, quantitative standards based on morphometry promises to provide more precise and accurate results. To present a superior methodology in systematic paleoethnobotanical analysis to replace demonstrably unreliable methods currently employed. Computer assisted measurements of size, shape, fractals, etc., (i.e. morphometry) were used to study the configuration of morphological variation in reference populations of seeds and phytoliths. Distributions of measured morphological variation were plotted, evaluated and compared. Multivariate discriminant functions were used to test automated taxonomic identification of seeds. Morphological variation in natural populations was not normal (Gaussian) as expected, but multimodal (non-parametric). Mean and modal values rarely coincided; and in replicate populations mean values were unpredictable and rarely similar (at 90% level of confidence). Comparisons of conventional types and taxonomic identifications based on assumptions of normality and central tendency (mean values) were often inaccurate and unreliable. Initial automated identifications achieved 90% accuracy at the genus level and 80% accuracy at the species level.

Morphological variation in natural populations is not normal (Gaussian) contrary to expectation, but is multimodal (non-parametric). Mean and modal values rarely coincide; and in replicate populations mean values are unpredictable and rarely similar (at 90% level of confidence). Previously published examples of analytical assessments of seeds and phytoliths based on assumptions of normality and/or central tendency (mean values) are often inaccurate and unreliable. Non parametric analysis of morphometric data should provide significantly enhanced levels of accuracy in paleoethnobotany.

Comparison and Quantitative Determination of Bioactive Components of Essential oil of *Alpinia calcarata* Rhizome and Leaf from South India

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Population growth, urbanization and the unrestricted collection of medicinal plants from the wild have resulted in an over-exploitation of natural resources in India. Therefore, the management of traditional medicinal plant resources has become a matter of urgency. In India many medicinal plants are slow-growing trees, bulbous and tuberous plants, with bark and underground parts as officinal parts. A strategy which would satisfy the requirements of sustainable harvesting, yet simultaneously provide for primary health care needs, would be the substitution of bark or underground parts with leaf of the same plant. A prerequisite for the pursuit of this principle, however, is the evaluation of differences and similarities between various parts of the same plant with respect to chemical composition. We now report the preliminary results of a phytochemical comparison of different parts of an important medicinal plant *Alpinia calcarata* Rosc. (Fam. Zingiberaceae). *A. calcarata* is a medicinal plant found in tropical countries, including Sri Lanka, India, Thailand, and Malaysia. The drugs prepared from the *A. calcarata* are used in the treatment of rheumatism, bronchial catarrh, asthma and in reducing pain. It is used to stimulate digestion, purify blood, improve voice and to treat inflammation. The hydro distilled essential oil from rhizome and leaf of *Alpinia calcarata* (kulanjan) growing in Kerala, India was analyzed by capillary GC and GC-MS methods. The chromatogram and the constituents present in the volatile oils from rhizome and leaf of *Alpinia calcarata* were comparable but some differences were observed in the methanolic extract analyzed by HPLC with diode array detection. The results of HPLC analysis were compared with the HPLC of the methanolic extracts of a closely related species *A. galanga*. The plants materials were collected from herbal garden from Kottakkal, Arya Vaidya Sala, Mallappuram District, Kerala, India and authenticated at the botany division of Center for Medicinal Plants Research, Arya Vaidya Sala, Changavatty, Kerala, India where the voucher specimens are deposited. The results show that the potential for plant part substitution is highly plant specific. A similar chemical composition between the various parts of the same plant is obviously of great importance for a suggestion that healers should substitute the plant parts they traditionally use. Phytochemical investigations nevertheless cannot replace pharmacological investigations as the latter determine the medicinal value of the plant material that is in progress.

Local knowledge of the Biodiversity Among the People of Mandakini Valley of Central Himalaya, India

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The rich plant diversity of the Indian Himalaya is utilized by the native communities in various forms including food and medicine. Conservation of biological as well as cultural diversity is in high priority agenda of the scientist of the all over world. The use of traditional ecological knowledge (TEK) for rapid biodiversity assessment tools has gained much importance in India since past many years. Mandakini valley is rich in plant diversity and also consist a part of protected area known as Kedarnath wildlife sanctuary. The present study contribute to these efforts by involvement of local people in participatory research model to examine the local plant diversity status while also testing the application of traditional ecological knowledge as a rapid method for such planning and conservation initiatives. Evaluation of biodiversity and role of Traditional Ecological Knowledge (TEK) in conservation through ethnobotanical analysis among the people of Mandakini valley. A semi-structured questionnaires survey was conducted among the local people (N=50) of the Mandakini Valley during May, 2005 to June, 2007. For this purpose we have divided people in three groups (Vaidyas, Palsi and others). The main purpose of the survey and group interview techniques was to evaluate the local knowledge of the plant diversity and also

gathered information about the local names of plants and plant parts used for different ethnobotanical uses. Local people identified and predicted local plant diversity richness (a diversity) and vegetation pattern of different regions of the study area. It was observed that 70 % local names and their uses were identified by Vaidyas, Palsi and other groups those were distributed among 208 genera and 91 families, out of which 56.12% were herbs, 19.22% were trees, 15.08% were shrubs and 9.58% others. Some endangered species like *Aconitum heterophyllum* and *Picrorhiza kurrooa* were found in the study area already mentioned in Red Data Book of Indian Plants. These predictions closely related to an index of diversity using species richness. The results have shown the ability and limitations of local people towards ecological knowledge to predict phytodiversity in a part of the Himalayan region. They also help in formulating conservation priorities of different species in the area and suggested local participation is essential to preserve the plant diversity in the region.

The Forest for the Trees: Applying Berlin's General Principles of Ethnobiological Classification to Indigenous Landscape Taxonomies of Amazonia

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Brent Berlin's major contribution to ethnobiology, and more generally to cognitive science, was the recognition of general principles governing the perceptual (which is to say, "natural") basis and hierarchical structuring of ethnobiological classification systems. He developed these theories largely out of his own collaborative studies of folk plant classification among the highland Maya peoples of Chiapas, interpreted in the light of comparable studies in other regions. These fundamental insights have been applied, notwithstanding certain caveats, not only to systems of folk botanical classification throughout the globe but also to diverse systems of folk classification of terrestrial vertebrate animals, fish, insects and mushrooms. This paper presents comparative results from several different studies of indigenous landscape classification in geographically separated regions of Amazon basin, carried out by the author and collaborators as well as independent researchers: the Matsigenka of southern Peru, the Baniwa and Yanomami in the northwest Amazon of Brazil (all studied by the author and collaborators), the Matses of northern Peru (as reported by David Fleck) and preliminary information about the Kayapó (as noted by Darrell Posey). There was no reason to believe, at the outset, that Berlin's "General Principles" would have any relevance to these studies: his theories have been applied to systems of ethnobiological classification involving individual taxonomic groups of organisms, whereas landscape classification involves the discernment of ecological communities composed of different classes of organisms (animals, plants) as well as non-organic components (hydrology, soils, disturbance regimes, etc.). Yet comparison among these five systems of indigenous landscape classification reveal a number of striking structural similarities with Berlin's "General Principles," notably the predominance of generic-level categories: in this case, generic-level tree names modified with specific linguistic markers indicating local abundance are universally used as indicators species of vegetation types. Comparative study also reveal the existence of higher-order taxonomic levels analogous to Berlin's "kingdom" (here, general terms for forest or vegetation cover), "life form" (general habitat categories such as lowlands, uplands, savanna, etc.) and "intermediate" categories, as well as (in more limited examples), lower-order levels of classification analogous to "specific" or "varietal" levels of folk biological classification. As has been shown in numerous organismal ethnobiological investigations, these studies demonstrate indigenous knowledge about the local environment that in some ways rivals or surpasses that of contemporary Western scientists. The clear implication is that Berlin's theories appear to be applicable beyond the organismal level of ethnobiological classification, and therefore may reflect even more fundamental aspects of human cognitive interaction with the biological world than even Berlin himself dared to claim.

Maple Sugar Production of Western Maryland

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A team of six students and faculty from Frostburg State University recently examined the economical and ethnographical logistics of Maple Sugaring in Maryland's only maple sugar producing region, Allegheny and Garrett Counties. The team observed the production process and discussed the industry trends with various sugarers throughout Maryland's Appalachian region. On site interviews at maple camps were recorded in digital video and surveys were administered. The Frostburg students also conducted surveys exploring the public response to increasing the local maple sugar market. Annually, fewer than ten maple sugar production licenses are issued in Maryland. This suggests that a Maryland-based marketing effort would exert a positive influence towards supporting the production, curtailing the export and enhancing the distribution of locally produced maple sugar products. This project will seek to determine the resources available and methods necessary to sustain and promote local maple production and distribution in Maryland. The creation of Maryland maple marketing tools/strategies will also be attempted. Current maple sugar makers and the general public were administered surveys and interviews pertaining to local marketing of Maryland maple products. Two surveys were created, one for each target audience. Digital video records were also obtained from each interview site. A majority of Maryland maple products are exported rather than consumed by the local state population. The current supply in Maryland is a relatively small contribution to the total amount of maple products annually produced in the United States and is seldom considered by Marylander residents as a local product. Many farms that produce maple sugar are multi-operational, also managing cattle or crops, making them liable to other state legislatures and taxation that ensue landowner hardships. Preservation of this natural resource is an important part of Maryland's colonial heritage and has the potential to be both an economically and environmentally beneficial industry. A marketing campaign targeted towards large local food distributors, and local consumers, is possible based on the data collected by the Frostburg State University students. The objective of this campaign will be to increase the virility of the local maple sugar market, and to promote the economic benefits of keeping maple sugar production in Maryland as an important state resource. The creation of a cooperative maple sap boiling facility, managed by surrounding landowners, is also feasible as a community maple reserve.

Method and Theory in Ethnobiology

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Method and Theory in Ethnobiology is a course that explores methodology in the field both as a set of techniques (methods) but also as principles of inquiry (i.e. epistemology). Anatomy, ontogeny and taxonomy of theory are presented through basic and derived conceptual content with a goal towards integration of biophysical and social approaches in the development of a theory of multiple environments. Collection and quantitative analysis of data are undertaken throughout the course. The course acquaints participants with the approaches, methods and analyses used by ethnobiologists who are researching various contemporary issues in biocultural diversity. Particular attention is paid to techniques for collecting ethnobiological data in the field derived from cognitive anthropology.

Effects of Bark Harvest and Other Human Activity on Populations of the African Cherry (*Prunus africana*) on Mount Oku, Cameroon

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The bark of the African cherry, *Prunus africana*, is harvested for the international herbal market due to its effectiveness in the treatment of benign prostatic hyperplasia. The bark is entirely wild collected. The purpose of this study was to examine population structure, growth, survival, and reproduction of *P. africana* in the Kilum-Ijim Forest Preserve, Cameroon. The study began in 1998 but by 2005/06, all plots had been affected by wildfires, *P. africana* bark harvest, and/or domestic animal grazing. Five 50 x 50m

plots were established in 1998. Each tree was individually tagged and was monitored for survival, growth, and reproductive parameters in 1998, 1999, 2007, and 2008. Each plot had 10 subplots to obtain estimates of germinated seedlings for each plot and to estimate seedling survival. Crown area was estimated for each tree. Population structure has been affected compared with the 1998/99 censuses due to mortality of the largest and smallest trees. Harvest and fire have reduced the crown area by 71% since the 1998 census, with a significant difference in crown area between 2007 and the previous two years. Pairwise t-tests showed the reduction in 2007 was the most significant. Subsequent analyses showed that the crowns of the largest trees are particularly susceptible to harvest and fire. Crown reduction has also caused a dramatic decline in fruit production. Grazing by goats and sheep has affected survival rates for seedlings and small saplings. Previous research has shown that the largest trees contribute the most to the population growth rate because they produce the most seeds. Mortalities of these trees and the reduction of their crowns have important implications for future regeneration. In addition, the effect of grazing animals appears to reduce the survival of seedlings. This also has implications for future regeneration. If these five plots can be considered “typical” for the forest, none of these populations exhibit “natural” mortalities or reproduction parameters, which could affect long-term population persistence.

Earth Healing with Bamboo

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In the tropics the bamboos have a long tradition of more or less pan-tropical use. Temperate bamboos, despite being well valued and utilized in their lands of origin, have been much less broadly investigated and are too seldom considered for applications in other similar or compatible climatic zones. Previously most bamboo was wild collected and whatever species was at hand was what was used, but now identified elite species are increasingly being grown for specific qualities in both plantations and agroforestry type scenarios. The traditional uses of cut bamboo products have been enumerated often and are currently well over 1,000. The “high-tech” potentials are only now beginning to be explored. Many of the ecological services provided by bamboo plantings are well documented if obscure. The authors, with over 45 years of bamboo investigation experience between them, will seek to make a case for the prominent inclusion of temperate bamboos in Earth healing scenarios for U.S.D.A. climatic zones 6-9 (extreme winter lows of -10 degrees Fahrenheit [-23 degrees C] or above). The essential and salient fact is that bamboos can be used in any manner that tree wood can plus a number of additional applications utilizing its unique structure. Bamboos can do this while performing needed ecological services and with an annual yield (after establishment) on a short-rotation cycle of from one to five years depending on end use. From fuel to fiber, from re-bar substitution to dimension lumber (composite) to houses, bamboo can save forests and farms. It can shrink our ecological footprint, ameliorate the impact of our burgeoning organic waste stream, including from C.A.F.O.’s (Confined Animal Feed Operations), and raise the water table while conserving and even quantitatively building new soil. Bamboo can do all this as it calms our spirits and improves rural economics. Perhaps bamboo could even improve national economics. Certainly, its many virtues are worth considering.

Evaluation of In-vivo Wound Healing Activity of *Anthocephalus cadamba* Leaf Extract on Different Wound Model in Rats

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Anthocephalus cadamba (Roxb.) Miq. Syn *A. chinensis* (Lamk) A. Rich (Rubiaceae) is widely distributed throughout the greater part of India and is used as a folk medicine in the treatment of fever, anemia, uterine complaints, blood diseases, skin diseases. leprosy, dysentery as antidiuretic, and for improvement of semen quality, leaves is recommended as a gargle in cases of stomatitis. The major constituents of bark

are triterpenes, tripernoid glycosides, saponins, indole alkaloids cadambine, 3a-dihydrocadambine, cadamine, isocadamine and isodihydrocadambine. The aim of the present study was to investigate the in-vivo wound healing activity of *Anthocephalus cadamba* leaf extract on different wound models in rats. The methanol extract of *Anthocephalus cadamba* leaves were investigated for the evaluation of their wound healing potential on different experimental models of wounds in rats. The methanol extract of leaves in the form of an ointment with two different concentrations (5% and 10% w/w ointment of leaf extract in simple ointment base) was evaluated for wound healing potential in an excision wound model and an incision wound model in rats. Both concentrations of the methanol extract ointment showed significant responses in both the wound types tested when compared with the control group. The effect produced by the extract ointment, in terms of wound contracting ability, wound closure time, regeneration of tissues at wound site, tensile strength of the wound and histopathological characteristics were comparable to those of a standard drug nitrofurazone ointment. From this study it is concluded that the *Anthocephalus cadamba* leaf Extract has a reproducible wound healing potential and thereby justifies its use in.

African Ethnobotanical Heritage for Domestication and New Crop Development

Patrick Van Damme and Celine Termote

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The African continent is rather poor in plant biodiversity when compared to other continents on and around the equator. Nevertheless, lots of useful plant species have been domesticated from Sub-Sahara Africa material. Ethnobotanical research offers the possibility to collect information on use and utility of wild plant species from traditional people often living in or close to a challenging natural environment. This type of information then allows us to find new candidates for domestication and subsequent crop development for income generation and increased food security. Based on literature, and the authors' > 25 years of experience in Africa, the presentation reviews major African botanical species that have entered markets worldwide (coffee, oil palm,...), but also 'new' species that are waiting to be developed as new, niche commodities based on ethnobotanical findings. SWOT analysis of production/market chains, shows problems and potentials that are addressed in the presentation. Based on literature, and the authors' > 25 years of experience in Africa, the presentation reviews major African botanical species that have entered markets worldwide (coffee, oil palm,...), but also 'new' species that are waiting to be developed as new, niche commodities. SWOT analysis shows problems and potentials that are addressed in the presentation. The case of *Gnetum africanum* illustrates the practical implications of developing a lesser-known species, and highlights the institutional problems that go together with niche crop development. The latter are subsequently presented and discussed in extenso, and solutions proposed in a second part of this review text. The presentation defines guiding lines for niche commodity development based on plant species selected through participative ethnobotanical R&D approaches

Education, Medicinal Plant Uses and Traditional Knowledge System in Castilla-La Mancha (Spain) a Monograph

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The treatment of common diseases was customarily addressed in rural areas of Castilla-La Mancha using local remedies within the Traditional Knowledge System (TKS). Urban development, the improvement of health facilities and the dramatic decrease in the number of inhabitants in rural zones led to the near extinction of this TKS. The interruption of the transmission of this knowledge is in part connected with the loss of intergenerational communication linked to the modern educational system. Compiling the state of the art in the research of the medicinal issues in the Traditional Knowledge System in Castilla La

Mancha (Folk Medicine). Focusing on the analysis of emic terms (diseases perceived). - To systematically record / catalogue the role of natural products (plants, animals, minerals and rocks) in the TKS in our community. - Spreading and disseminating that knowledge through the publication of a monograph addressed to the general public and specialists. Ethnobotanical research: open interviews (over 600), starting nearly twenty years ago, with elder people in villages and rural communities. Workshops, talks and folk medicine courses. More than 1000 people were involved in these courses, some of them are specialists of the public health system. • Analysis of published data: medicinal plant books, exhibitions, thesis, local libraries and archives. • Database: organizing the information in fields and comparing the ethnobotanical evidence with reported active compounds and uses in rational phytotherapy. Bias in data collection strongly limits the possibility of properly recording the TKS. As a rule, informants talk only about concepts they are asked. Thus, many aspects are lost in the records. However we recorded 430 species in use, and 53 monographs with exhaustive information on local uses. These are presented systematically in alphabetic / taxonomic order, illustrated with photographs of the products and how they are/were used. The traditional medicinal knowledge is gradually fading in Castilla La Mancha, however, there are still a few elders who still maintain it. The book is, thus, an attempt to put together many experience based or empirical remedies, most remain unexplored as for their novel leading active compounds.

Culture and Agrobiodiversity Persistence among a Group of Immigrant American-Mexican ‘Gringo’ Communities in the Sierra Madre Occidental Mountains of Northern Mexico

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Six interrelated communities in the Sierra Madre Occidental mountains of Northern Mexico are known locally to a greater or lesser extent as “gringo” colonies and are composed largely of the descendants of 19th century immigrants from the United States who intermarried with the local Mexican population. Although the exact details of their immigration are perhaps lost to time, local consensus is that they arrived in Bermudez, a small village in the state of Chihuahua in the Sierra Madre mountains of Northwest Mexico sometime during the 1860s. They took Mexican wives and founded a group of communities including Bermudez and five others included in this study that are still thriving today. The residents of these communities engage in small scale farming and ranching and grow a diversity of folk crop species and varieties. It has often been assumed a priori by agrobiodiversity researchers that economic or ecological considerations are primary reasons that farmers maintain traditional folk crop varieties. This study investigates utilitarian and cultural reasons for the persistence of crop agrobiodiversity and the structure of agrobiodiversity complexes among the six communities. A chain referral strategy was used in the communities to identify knowledgeable individuals based on contacts with key informants that had already been established by long-term work in the region. Semi-structured interviews were conducted with 32 individuals and free list activities were conducted with farmers to identify the number of folk crop varieties that they were growing and to determine their motivations for continuing to save seeds. Twenty-eight folk crop varieties were identified as still being grown and nine varieties had been lost or were no longer being grown. Farmers gave cultural reasons for agrobiodiversity persistence 65.5% of the time and utilitarian reasons for persistence 35.5% of the time. This study shows that although utilitarian reasons for agrobiodiversity maintenance are important, cultural reasons for the persistence of folk crop varieties may be more important from the perspective of farmers themselves. The results indicate that in situ conservation programs for agrobiodiversity should be broadened to include related cultural programs that emphasize traditional memories, tastes, beliefs, attitudes, and culinary practices.

Ethnobotanical Encounters in the Colonial World

Robert Voeks and Charlotte Greene

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Current concerns with inequitable exploitation of ethnobotanical resources and intellectual heritage are deeply rooted in the objectives and outcomes of European colonial enterprise. From the sixteenth through nineteenth centuries, the frenzied quest for ‘green gold’ was second in intensity only to that of precious metals and slaves. Motivated by nationalism, chivalry, competition, profit, and pandemics, colonial entities scoured the torrid zone in search of medicinal spices and herbal remedies. Although much recent historical scholarship addresses the social and political context of these endeavors, the character of the face-to-face, indigenous-European encounters that unearthed these botanical treasures has not been assessed. This paper examines the nature of early bioprospecting efforts by means of first person colonial narratives. To what degree (if any) was botanical intellectual property respected? Did colonial agents disclose their objectives to indigenous collaborators? Were native participants compensated for their disclosures? And to what extent is the current climate of skepticism regarding botanical intellectual property a legacy of colonial misdeeds? Relevant primary and secondary sources at the Huntington Library (US), the Biblioteca Nacional (Brazil), and the Bibliotheque Centrale, Museum National D’Histoire Naturelle (France) were investigated for personal narratives of ethnobotanical ‘discoveries’. These included first and second person accounts of indigenous and enslaved African interactions with colonial British, Spanish, French and Portuguese observers. Agents of European powers perceived ethnobotanical knowledge and genetic material much as they did mythical El Dorado—exotic and ascertainable booty for whoever possessed the requisite guile and courage. Narratives portray five general strategies deployed to encourage informants to ‘share’ their secrets—paternalism, charisma, physical violence, monetary compensation, and manumission. As suggested by personal text, colonial inspiration and justification for ethnobotanical exploration mirrored ongoing bioprospecting rhetoric—scientific curiosity, drug development, fantastic profits, and environmental conservation. Given the legacy of discrimination and deception, the developing world is justifiably suspicious of current ethnobotanical inquiry.

Basic Anthropological Ethnobotany (ANTH 213 Ethnobotany: Plants & Peoples)

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I describe a low-level, no-prerequisite anthropology course that uses ethnobotany to provide a four-field introduction to the field of anthropology. Usually 17-20 students enroll. The course is split between methods (ca. 1/3) and subject matter (ca. 2/3). Subject matter focuses on ethnobotanical issues in cultural, biological, linguistic, and archaeological anthropology. Other topics vary, but often include genetically modified food, biodiversity of crop plants, and ethnoecology. Methods address IRB/human subjects, formulation of hypotheses and interviews, interviewing techniques, following a Style Guide, researching literature, how to annotate, and how to write a hypothesis-driven paper. The class participates in a 4-5-year-long group project.

Botanical Knowledge of South Carolina College Students

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A handful of studies on the botanical knowledge of people, especially children and students, hint that botanically inexpert Americans (and others from industrialized nations) know relatively few of the plants that grow around them compared to experts or people in societies who live close to nature. I report on the first stage of study of the botanical knowledge of college students in South Carolina, USA. Thirty-two college students aged 18-22 were asked to freelist garden flowers, grasses, local domesticated crops, and native/local trees, vines, and wildflowers/weeds. Answers were scored as correct, not native, or inappropriate. Responses were run through ANTHROPAC to examine cultural consensus. Whereas

students could list an average of 9.4 crops and trees, and 6.8 garden flowers, they listed an average of fewer than 3 of the other categories or life forms. The fewest number of wrong or inappropriate answers were given for crop plants, and the highest for grasses and weeds. Similar studies need to elicit knowledge of different categories of plants that take into account their potential significance (and likelihood of knowledge) within that culture. Different forms of eliciting and measuring knowledge will be needed.

Social and Ecological Feasibility of *Colophospermum mopane* Seed Commercialization from Namibia

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Commercial marketing of south African-endemic *Colophospermum mopane* seeds could support cultural and ecological conservation efforts in rural northern Namibia. Not only may an addition to the already existing NTFP marketing chain confer additional resilience to that system, but it would provide access to an economic input to even marginalized people lacking land tenure rights. This research explored the following questions: Are there any cultural reasons to not market mopane seeds? What do people use mopane seeds for? Does this vary by culture? Can such uses be translated into marketable products? What is seed production per hectare? How does this vary between sites? Is there temporal variation in seed production? 280 people were interviewed at 20 sites in northern Namibia in 2005 and 2006. At seven sites 141 plots 400 m² each were randomly laid out using a transect system to study seed production and recruitment long term, with local villagers hired to collect the data biweekly after initial training. Moran's test was used to test for spatial autocorrelation between plots and Negative Binomial Regression was performed to analyze the fruit count data. Overwhelming support and not one objection was raised to the marketing of mopane seeds. Reported seed uses were for fragrance, internal and external medicine (including treatment of HIV), and adornment. Owambo people did not report internal consumption of the seeds, in contrast to the other cultural groups interviewed. Average seed production ranged from 2607 to 49,434/ha inside the study sites, which produced fruit (one did not), with significantly lower counts at two of the fruiting sites versus the others ($P < 0.05$). Results indicate that mopane seed sourcing is socially and ecologically feasible from the studied sites. Seed use differences existed between cultural groups, but uses as fragrance and medicine are translatable to global market demands. Seed production levels were high enough at most of the sites to justify marketing the seeds, and data generated from long term monitoring plots will allow assessment of temporal variation in seed production.

Ethnobotany as the Science of Survival: Lessons from Paradigms of Limited Resources

Kawika Winter and Will McClatchey
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'Sustainability' is now a global issue in light of increasing human populations and consumption, diminishing natural resources and other factors. A large part of the problem is the idea of limitless resources, which has historically driven many decision-making systems. However, that is not a concept held by all cultures across the globe. By examining cultures that consciously recognize a limit to natural resources much can be learned about sustainable living. As ethnobotanists, we are in unique positions to translate this wisdom into a language that can be understood by the global community. Extreme examples of very limiting systems are those on island ecosystems. We will examine one system, the 'ahupua'a system of resource management' and how it has for millennia and continues to address sustainability issues under a paradigm/reality of limited resources. We will attempt to translate for the global palate some aspects of the wisdom of an 'ahupua'a system' in the areas of sustainable living.

Designing Collaborative Methods for Ethnobiological Research in Diet and Nutrition: Conceptualizing the “Compleat Maya Diet” in Chiapas and Beyond

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This paper considers the methodological and theoretical contributions of Elois Ann Berlin and Brent Berlin’s research on the ethnobiology of diet and nutrition in Tzeltal and Tzotzil Maya communities in Chiapas as well as other geographical areas. In particular, I examine the development of collaborative, interactive methods for collecting data related to the sociocultural contexts of diet and nutrition practices, with a particular emphasis on the documentation of the “compleat Maya diet.” The influence of this framework on the design of research in southern Belize with Q’eqchi’ Maya communities is described to illustrate its timeliness and applicability across geographic and cultural contexts.

POSTER ABSTRACTS

Hypoglycemic Formulations Used by the Traditional Medicinal Practitioners (Vaidyas) of Bangladesh

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The majority of the population of Bangladesh is rural, who lack access or seldom use modern healthcare facilities. These people depend on traditional medicinal practitioners or “Vaidyas” (experts in herbal medicines) to treat diseases. Diabetes is an affliction affecting more than 2 million people in Bangladesh (1). The rural people use formulations prepared by the Vaidyas to treat diabetes and apparently obtain effective results in controlling blood sugar levels. The purpose of the present study was to interview a cross-section of the Vaidyas throughout the country and collect information on formulations used to treat diabetes. Vaidyas were selected from different villages following information obtained from treated patients as to the efficacy of formulations. Only those Vaidyas were interviewed whose patients reported actual lowering of blood sugar. Extensive interviews were conducted of both Vaidyas and patients. We report here eleven of the most effective formulations. (1) 250 ml of juice extracted from the leaves of *Coccinia cordifolia* to be taken twice daily; (2) inner portion of *Swietenia mahagoni* seed is taken with 200 ml water for 30 days; (3) two teaspoon full of juice from the roots of *Amaranthus spinosus* taken daily; (4) paste of roots of *Aristolochia indica* taken daily; (5) powdered seeds of *Mangifera indica*, *Syzygium cumini* and *Tamarindus indica* mixed in equal proportions and taken with juice from rhizomes of *Zingiber officinale*; (6) bark of *Ficus racemosa* is boiled in water and the decoction taken with a little mustard and honey; (7) roots of *Borassus flabellifer* are boiled in water and the decoction taken each morning with milk and banana; (8) 250g of stems and leaves of *Catharanthus rosea* boiled in 2L water and drunk daily; (9) fruits of *Ficus hispida* taken with *Ipomoea aquatica* whole plant; (10) juice extracted from the leaves of *Nyctanthes arbortristis* taken with a little honey; and (11) roots of *Saccharum spontaneum* chewed daily. Diabetes is a major disorder affecting the population of the whole world. This study shall present details of hypoglycemic formulations used by the Vaidyas. It is expected that modern scientific research can shed more light on their claimed effectiveness.

Wild Plant and Fungi Use in Northern Maine: Traditional Ecological Knowledge and Changing Land Ownership

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This research explores the culturally and economically important non-timber forest products (NTFPs) of the Northern Forest region and the impacts of changing landownership on NTFP gathering. Twenty-five percent of the populations of the Northern Forest states of Maine, New Hampshire, and Vermont currently gather wild plants and fungi for cultural, economic, subsistence and recreational purposes (Robbins, Emery and Rice, 2008). Recent trends in Northern Forest land use, ownership and tenure may affect access to and availability of NTFP resources. At present, systematic baseline information regarding the collection of NTFP species, their uses, and their ecologies does not exist. Even less information exists about the effects of changing landownership on access to NTFP resources. Our study focuses in the St. John River watershed of northern Maine to: (1) identify NTFPs of importance to Northern Forest residents from a variety of cultural backgrounds, including Native Americans, French-Acadians, and Swedish-Americans; (2) document Northern Forest gatherers' traditional ecological knowledge about NTFP species and methods for their sustainable harvest; and (3) characterize and assess forest and land management practices and the regulatory regime matrix within which NTFP gathering occurs. We are currently conducting open-ended interviews and participant observation with NTFP gatherers and land managers in the St. John River watershed. In addition, we use extensive archival research to provide a historical context for NTFP use in northern Maine. Our preliminary archival research shows that at least 65 individual plant and fungi species have been historically used by the people of northern Maine, for food, medicine, and the manufacture of crafts and tools. Initial results highlight the rich historical importance of NTFP use in the St. John River watershed. Forthcoming results of interviews and participant observation will allow us to assess the extent of contemporary NTFP use and the impacts of changing landownership on NTFP gathering in northern Maine.

Fixing a Hole: Archaeobotanical Evidence of Middle Woodland Horticulture in the Etowah River Valley of Northwest Georgia

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Native Americans of the Southeast cultivated a suite of native plant species as early as the Late Archaic period, by the Early Woodland period horticulture played an important part in subsistence, and in the Middle Woodland period incipient maize husbandry emerges. While these patterns are well-documented elsewhere in the Southeast, archaeological evidence is sparse in Georgia. In this poster we examine newly recovered evidence from the Hardin Bridge site (9BR 34) that helps to fill that gap. Our goals are to document and assess the role of cultivated plants in the Middle Woodland subsistence system of the Etowah Valley people using a paleoethnobotanical perspective. We analyzed 90- one to 10 liter flotation samples taken from a total of 52 cultural features and 31 column samples. The recovery of carbonized macroplant remains was excellent. Data were quantified by feature or unit column level, feature class, and as an entire assemblage. We used four comparison ratios (plant food to wood ratios, relative proportions, density, ubiquity) to analyze the data. In addition to seeds, we considered the relative abundance of nutshell. This study confirms that the gardening of traditional seed crops played a significant role in the subsistence strategy of Middle Woodland period residents of the Etowah River Valley in Northwest Georgia. While starchy and oily-seeded "Eastern Tradition" taxa, including goosefoot (*Chenopodium c.f. berlindierib*), erect knotweed (*Polygonum erectum*), maygrass (*Phalaris caroliniana*), little barley (*Hordeum pusillum*), and sunflower (*Helianthus annuus*), plus four potential cultigens or commensals, pigweed (*Amaranthus* spp.), knotweed (*Polygonum* spp.), purslane (*Portulaca* spp.) and maypops indicate the gardening of native domesticated and commensal species, there is no evidence of maize cultivation. Locally harvested nuts including black walnut (*Juglans nigra*), hickory (*Carya* spp.), oak acorn (*Quercus* spp.), and pine seeds (*Pinus* spp.) comprised another dietary staples. Wild fruits and "pot herbs" also contributed to the diet. These data indicate that the Middle Woodland economy of Northwest Georgia is consistent with the greater Southeastern subsistence system of that period, except that there is no evidence

of maize. A diversified subsistence strategy was the rule, based primarily on horticulture and nut mast supplemented with wild collected foods including animal protein.

Meetings without Talks -- Talks without Meetings

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Scientific meetings, such as SEB's annual meeting, are crowded with short presentations. The result is that there is little time for participants to interact. This is unfortunately as many people say that the informal interaction periods are the most valuable part of the meeting. We present an alternative meeting structure that uses current technology and discuss the advantages of this approach.

Botanical Knowledge of South Carolina Elementary School Students

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Compared to people in other societies, Americans are largely ignorant of their local environments. This dearth of environmental knowledge may have negative consequences for conservation efforts and human health (Louv 2006). The status of botanical knowledge among children may be an important indicator of the need for an increased focus on children's interactions with nature. The objectives of this research were to quantify the botanical knowledge of elementary school children in South Carolina and determine whether informal botanical education experiences in a public school setting increase students' interest in and knowledge about plants and their local environment. In a pre-test, fourth- and fifth-grade students (n=11) freelisted plant names and attempted to identify 60 plant photos. Students then spent two hours each week engaged in hands-on activities designed to spark their interest in plants and natural history. After three months, the students were again asked to freelist plant names, identify 60 plant photos, and respond to questions about their experiences. During pre-testing, children freelisted an average of 30.9 ± 12.1 items at different taxonomic levels and were able to identify approximately $33.7\% \pm 6.84\%$ of plant photos. Their ability to identify plants varied with usage categories, suggesting that while American children may not be familiar with native species, they do possess some culturally important botanical knowledge. Post-assessments indicate increases in children's knowledge of plant names, interest in natural history, and awareness of the natural world. Students' knowledge of plants is low, but relatively simple activities, such as planting a garden and learning about the uses of local plants, can have a huge impact on their awareness of and interest in the natural world. This study demonstrates the need for an increased effort to include natural history education in the normal school curriculum.

Inference of Genetic Relations and Intraspecific Variability in Agave Using ISSR Molecular Markers

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The molecular studies have been very useful in the establishment of genetic differences in some species, specially in those where the data base of the DNA is well-known. In particular, in some species of the genus *Agave*, mainly of tropical origin, cultivated by the value of its fibers and the fermented drinks that are obtained from the plants, this information does not exist. The objective was to use markers ISSR with the purpose of evaluating their utility in the establishment of genetic relations between *Agave cocui* Trel. and other species of the same genus, as well as the existing genetic variability between the individuals of the species *A. cocui* Trel., *Agave angustifolia* Haw. and *Agave tequilana* Weber. Individuals of *A. tequilana* Weber, *A. angustifolia* Haw. and *A. cocui* Trel., were obtained from Mexico (CICY) and

Venezuela. Three ISSR primers (Invitrogene) were used to screen genetic variability between and within populations. With Popgene and Arlequin programs the genetic distances, dendrogram and AMOVA were calculated. *A. angustifolia* showed the most polymorphic loci among the individuals, *A. tequilana* was the less polymorphic with *A. cocui* in between. *A. cocui* was the most distant between the three species and the percentage of variation between populations was 56% while within populations was 43%. The primers generated products by means of the amplification by PCR. They were of great utility to determine genetic variability in three species of Agave

Indigenous Treatment of Malaria: An Ethnobotanical Survey of Ewaso-Narok, Laikipia District, Kenya

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In much of rural Africa, the cure and treatment of Malaria relies on traditional herbal medicine and healing practices. Many of these herbal medications have shown promising futures as pharmaceuticals and are currently under investigation both in vitro and in vivo. Ewaso-Narok, a rural community in Kenya has a high incidence of Malaria. Much of the population composed of immigrant members from several tribes still use traditional herbal medicine to treat malaria. To identify botanical species used in the treatment of malaria in a rural community in Kenya. Further, to highlight species belonging to plant families that have been frequently identified in other ethnobotanical studies as treatments for malaria. We conducted twenty-four household interviews and three key informant interviews about various remedies and species used. We conducted a market survey to examine the availability of antimalarial remedies. A vegetation survey was conducted to examine availability and population status of herbal raw materials and species at harvest sites. The community in Laikipia uses 30 different species used for treating malaria. Most remedies were consumed as teas either alone or in conjunction with other medicinal species or allopathic medications. While some remedies and purchased from the markets, many are harvested from the wild. At least eight species have proven efficacy or a projected efficacy from phytochemical trends within botanical families. Several of the species in use suggest potential therapeutic properties against malaria rather than a mere placebo effect. Indigenous methods of malaria treatment should be further investigated using bioassays. They may have potential for further pharmaceutical investigation for novel compounds.

Ethnomedical Search for Anti-Tuberculosis Compounds from Lao Palm Leaf Manuscripts

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Tuberculosis has been present in Southeast Asia since at least the Iron Age¹. Because Buddhist monks in the Lao PDR have been community healers in the past, and because they have recorded many of their herbal disease treatments in palm leaf manuscripts, some of these manuscripts were scanned for indications of plants that may have been used to treat tuberculosis. This research is an attempt to discover a link between plants named in palm leaf manuscripts to treat cough and those cited by contemporary traditional healers with anti-tuberculosis activity, and to isolate and identify the active compounds from the plants that do show anti-TB activity. With the help of translators, palm leaf manuscripts were scanned for entries about herbal remedies to treat cough, and a list of plants was compiled. Simultaneously, interviews were conducted with contemporary healers to acquire data on plants currently being prescribed to treat cough. Plants cited in the manuscripts and/or mentioned by a healer were collected and submitted to a primary biological evaluation against *Mycobacterium tuberculosis* H37Rv. 59 entries on cough were translated from medical palm leaf manuscripts and 21 interviews with

contemporary healers from three provinces in two regions were conducted, giving a list of 207 plants based on their local names. 14 plants cited in the manuscripts and 60 plants named by traditional healers were collected; 8 of these were both found in the palm leaf manuscripts and named by a healer. Of the 66 total plants collected, 54 were identified to the species level. Upon submission to the TB bioassay, 4 plants showed percent inhibition above 90% and 3 showed percent inhibition above 80%. While some interesting plants were cited in the manuscripts or cited by contemporary healers, there were no plants that were both mentioned in the manuscripts and by healers having greater than 80% inhibition of *M. tuberculosis*. However, we believe that a deeper search of more manuscripts, along with more interviews with contemporary healers, will provide more conclusive results.

Rainforest Conservation through Use in Northwestern Ecuador

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This study looks at the use of a vine-like plant, piquigua (*Heteropsis ecuadorensis*) (Araceae) in terms of conservation in the Mache-Chindul Ecological Reserve, Ecuador.

To look at how people utilize the local flora, and to see if this use can act as an incentive to conserve the natural ecosystem in which the resource grows. 26 families were interviewed over a one year period, using semistructured interviews and participant observation. Voucher specimens were collected and housed at the National Herbarium, Quito. Because of people's use of *Piquigua*, *Heteropsis ecuadorensis* (Araceae), some people do preserve parts of the forest where the plant grows. The reason cited for preservation, is because the plant needs the undisturbed forest in order to grow. Plants play an important role in the locals' lives, which acts as an incentive to not cut down forest where an important plant grows.

The Green Belt Legacy of the Midzichenda Makaya: A Case Study at Kaya Fungo Investigating the Role of Apiculture in Forest Conservation

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The Giriama, a sub-tribe of the Midzichenda speaking Kigiriama, have inhabited a sacred forest area, 'Kaya Fungo', in coastal Kenya since the 8th Century. This sub-tribe, estimated at 35,000 people, subsists on hunting, gathering, agriculture, and agro-pastoralism- considerably apiculture. Giriama apicultural traditions have maintained Kaya Fungo's floral pollination with cultivated honeybees that have a commensal relationship with non-cultivated bees. Across encroaching semiarid deserts and Kaya Fungo's "sacred grove", beekeeping has helped preserve one of Kenya's richest sources of biodiversity. To understand the cultural and botanical significance of forest conservation and apiculture and to understand which plants bees visit to make honey, the roles of these plants harvested by people from the forest, the recent local prevalence of honey products, and the factors affecting the livelihood of beekeepers according to the Kaya Fungo community. With prior informed consent, J.F. lived in Kaya Fungo district, Kenya and issued questionnaires to members of local apiculture societies, the general public, and the Kambi elder society who traditionally guard the Kaya. Plants were collected and photographed in semiarid desert and Kaya Fungo's forest areas. Formal identification of these plants continued at the National Museums of Kenya. Questionnaires report that honeybees visit at least 83 vascular plants and 36 of these are used in traditional Giriama medicine. The majority of informants agree that the availability of honey products are decreasing, that the plant species associated with honey production are increasingly collected for building material and firewood within a growing population without electricity and running water. Informants also suggest that drought and the increasing demand for building materials is negatively affecting the livelihood of apiculture. The latter results are in an overall ecological context of climate change and are affecting the survival of bees, the regional flora, and apiculture.

Anti-inflammatory Activity of *Andropogon muricatus* Extract

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Andropogon muricatus Retz. is a perennial aromatic grass and belongs to the family Poaceae. Various parts of this plant have been used in traditional medicine to treat different diseases with some reported activities for gastrointestinal and cardiovascular disorders^{1, 2}. Considering the fact that there is no information available to the author's knowledge regarding the anti-inflammatory property of *A. muricatus*, we have undertaken the present investigation to evaluate the anti-inflammatory activity of *A. muricatus* aerial parts extract and its possible mechanism(s). The *A. muricatus* extract was evaluated for its anti-inflammatory property using carrageenan, histamine, serotonin and prostaglandin E₂-induced paw edema in rats using plethysmometer³. Either sex of Sprague Dawley rats (120-180 g) provided by the animal house of the Aga Khan University, Karachi were used for this study. Data obtained from the carrageenan-induced rat paw edema test showed that the oral treatment of *A. muricatus* extract (50 - 400 mg/kg) showed dose dependent inhibition of edema between 2nd - 4th hours of edema induction and the magnitude of edema inhibition remained unchanged till 4th hour of observations (IC₅₀ = 181 ± 4.2 mg/Kg; mean ± SE; n = 5). Our experimental findings suggest that the *A. muricatus* extract possesses antiinflammatory property by inhibiting the serotonin, histamine and prostaglandin biosynthesis synthesis. Bioassay-directed fractionation is in process to identify the active principle(s).

Novel Synergistic and/or Side-effects Neutralizing Combinations in Botanicals

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Medicinal plants have been the main source of healthcare throughout the development of civilizations. The development of pharmaceutical industry in the 19th century, which has vested interest in the chemical patentable drugs, pushed away the healing role of botanicals. However, due to high cost of chemical drugs with multiple side effects, there is a revival of interest in botanicals, which are considered relatively safe with synergistic combinations, though sufficient scientific support is lacking. To identify the novel combinations of activities with synergistic and/or side effects neutralizing potential in medicinal plants to validate the effective and safe use of botanicals. Both in-vivo and in-vitro techniques were used to assess the antihypertensive, anti-asthmatic, anti-Alzheimer and laxative activities of the plant extracts and their constituents for the presence of desired activities through multiple site of actions with opposing effects in other body functions. It was observed that medicinal plants are relatively rich in their contents of calcium channel blockers (CCB), which co-exist in nature usually in novel combinations. For example, *Withania somnifera*, turmeric, ginger, St. John's Wort, *Hyoscyamus niger* and *Carum copticum* contains CCBs with different combinations, such as with cholinesterase inhibitors, phosphodiesterase inhibitors or anticholinergics and cholinergic agonists thus showing therapeutic potential in Alzheimer's disease, asthma and hypertension respectively. Interestingly, such combinations have their pharmacological actions in opposite directions on most of the other body functions (non-desired sites of action). Thus botanicals contain unique combinations of activities with "effect-enhancing and/or side effects neutralizing" potential, which may explain their efficacy and safety profile.

Studies on Spasmolytic and Anti-diarrheal Effects of *Valeriana hardwickii*

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Valeriana hardwickii (valerian) is a well known medicinal herb frequently used internally to relieve abdominal cramps, irritable bowel syndrome and diarrhea. This study was undertaken to evaluate the

antispasmodic and anti-diarrhea effects of valerian to rationalize its ethnobotanical use in the respective gut disorders. The crude aqueous-methanolic extract of *Valeriana hardwickii* root (Vh.Cr) was studied for its possible spasmolytic and anti-diarrhea effects on isolated rabbit jejunum and castor oil induced diarrhea in mice respectively. In rabbit jejunum, Vh.Cr caused a concentration-dependent (0.01-1.0 mg/mL) relaxation of spontaneous contractions. When tested against high K⁺ (80 mM)-induced contractions, Vh.Cr caused inhibition (0.01-0.3 mg/mL) similar to verapamil, suggestive of calcium channel blockade (CCB). The CCB effect was confirmed when pretreatment of the jejunum preparations with Vh.Cr produced a dose-dependent rightward shift in the Ca⁺⁺ dose-response curves like that produced by verapamil. In castor oil treated mice, Vh.Cr provided protection against diarrhea in a dose-dependent (100-300 mg/mL) manner. These data indicate that the crude extract of *Valeriana hardwickii* root possesses spasmolytic and anti-diarrhea activities mediating possibly through calcium channel blocking mechanism and this study provides a scientific base for its ethnobotanical use in abdominal cramps and diarrhea.

Ethnobotanical Survey of Medicinal Plants Used Against Gastrointestinal Disorders by Various Tribes of Bangladesh

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The tribal population of Bangladesh is diverse and resides in several regions of the country. The tribal people mostly rely on their traditional medical practitioners or healers to deal with various diseases. Diarrhea diseases are prevalent amongst the tribal population (1). A study aimed at identifying plant species used for the treatment of gastrointestinal disorders by various tribes (Santal, Khasia, Garo and Chakma) of Bangladesh was carried out. Ethnobotanical methods using semi-structured interviews were employed and medicinal plants collected from tribal traditional medicine practitioners, followed by identification of the collected species by the National Herbarium. Amongst the tribal people, it was observed that the Santal tribe use whole plant or plant parts of *Acorus calamus*, *Asparagus racemosus*, *Calotropis gigantea*, *Clerodendrum serratum*, *Coccinia cordifolia*, *Datura metel*, *Holarrhena antidysenterica*, *Jatropha curcas*, *Lagerstroemia speciosa* and *Paederia foetida*, while the Khasia tribe use *Acorus calamus*, *Aegle marmelos*, *Aristolochia indica*, *Carica papaya*, *Curcuma xanthorrhiza*, *Hibiscus rosa chinensis*, *Kalanchoe pinnata*, *Leucas aspera*, *Ocimum sanctum* and *Scoparia dulcis* for treatment of gastrointestinal disorders. The Garos use *Ipomoea reptans* for the same purpose. The Chakma tribal people use *Aegle marmelos*, *Alstonia scholaris*, *Ananas comosus*, *Centella asiatica*, *Clerodendrum viscosum*, *Crinum asiaticum*, *Dentella repens*, *Heterophragma adenophyllum*, *Hodgsonia macrocarpa*, *Ipomoea fistulosa*, *Lannea coromandelica*, *Mangifera longipes*, *Pterospermum semisagittatum*, *Tabernaemontana pandacaqui*, *Terminalia arjuna*, *Vernon iapatula* and *Zizyphus oenoplea* for treatment of gastrointestinal disorders. A total of 36 plant species are used by four tribal groups in Bangladesh for treatment of diarrhea, dysentery, blood dysentery, constipation, indigestion and other gastrointestinal disorders.

Assessing *Serenoa repens* (Arecaceae) Quality at the Retail Level Using Spectroscopic and Chemometric Methods

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Quality control and authenticity of medicinal plant products is critical. The extract of *Serenoa repens* (Arecaceae) is an important herbal treatment for benign prostatic hyperplasia. Typically it is obtained via extraction with hexane or supercritical carbon dioxide. Some retail samples of *S. repens* contain olive oil as vehicle. To analyze retail samples of *Serenoa repens* in such a way as to gain insight to their origin,

composition and quality. NMR and IR spectra of 16 retail samples of *Serenoa repens* were recorded, along with spectra of evening primrose oil and olive oil as outliers. The spectra were analyzed using multivariate chemometric methods such as classical PCA and robust PCA, using the open source computing environment R. Analysis of the collected spectra allows one to clearly differentiate the outliers from the authentic samples. Among the authentic samples, some products are readily seen as different in composition. There are noteworthy differences between the classical and robust statistical methods. Certain peaks in the NMR and IR spectra are particularly informative. Chemometrics methods are well-suited to quality analysis of retail samples of *Serenoa repens*. These methods are general and can be applied to other types of medicinal plant products.

A Survey of Medicinal Plants used by the Marmas of Bangladesh

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The Marmas form the second largest ethnic minority group of Bangladesh inhabiting the three hill districts of Rangamati, Bandarban and Khagrachari. Their present population is roughly a little more than 150,000 people. Fever, diarrheal diseases, and malaria are the three most common illnesses reported amongst the Marmas (1). A study aimed at identifying plant species used for the treatment of various disorders by the Marmas of Bangladesh was carried out. Ethnobotanical methods using detailed interviews and information collection were employed. Medicinal plants were collected from the fields and forested areas as pointed out by Marma traditional medicine practitioners, followed by identification of the collected species by the National Herbarium of Bangladesh. Our survey showed that 16 floral species are used by the Marma traditional medicinal practitioners for treatment of skin disorders (itches, scabies, eczema, boils), 15 for gastrointestinal disorders (diarrhea, stomach acidity), 17 plants for colds, coughs, fevers and respiratory problems, 6 plants for urinary tract infections, five for rheumatism, 3 plants as anthelmintic, 6 plants as sex stimulant or for impotency, 2 plants for diabetes, 4 plants to treat jaundice, and 2 plants to stop bleeding. Other diseases that are treated by the Marma traditional medicinal practitioners include weakness, insect bites, cataract, elephantiasis, leprosy, malaria, toothache, oral lesions, and pus forming in the ears. The Marmas also use plants as abortifacients. Twenty two plants are used to treat multiple disorders. *Acanthus ilicifolius* and *Alstonia scholaris* are two of the most widely used plants. The roots of *Acanthus ilicifolius* is used as a sexual stimulant as well as for rheumatism, and cloudy urination in women. The bark of *Alstonia scholaris* is used to treat cold sores, fevers, and diabetes. A total of 68 plant species distributed into 41 families are used by the Marma traditional medicinal practitioners to treat various disorders. It appears that skin disorders, gastrointestinal disorders and respiratory problems including cold, cough, fevers and asthma are sicknesses that are more prevalent amongst the Marmas.

Medicinal Plants Used by the Chakma Tribe of Bangladesh for Treatment of Various Diseases

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The Chakmas inhabit the hilly southeastern forest region (Chittagong Hill Tracts) of Bangladesh (1) and form the largest tribal group within the country. They rely on their own medicinal healers for treatment of various diseases. Since the region is rich in floral species, it is important to gather knowledge about use of medicinal plants by the Chakmas, more so, because such knowledge is virtually unknown outside the Chakma tribe. The objective of the present study was to conduct an ethnobotanical survey to gather information on medicinal plants used by the Chakmas. Interviews were conducted amongst the Chakma traditional medicine practitioners using a semi-structured questionnaire along with extensive information gathering by staying with them and observing their practices. The medicinal plants were personally

identified by the practitioners, collected and later brought to the National Herbarium, Bangladesh for complete identification. A total of 92 plants belonging to 49 families were identified as to being used by the Chakma traditional healers. Of them eight plants belong to the Leguminosae family; four plants each to Asteraceae, Combretaceae, Compositae, Euphorbiaceae and Malvaceae families; three plants each to Acanthaceae, Anacardiaceae, Apocynaceae, Cucurbitaceae, Fabaceae and Verbenaceae families; two plants each to Adiantaceae, Bignoniaceae, Convolvulaceae, Graminaceae, Liliaceae, Meliaceae, Polypodiaceae, Rubiaceae and Rutaceae families; and one plant each to Amaranthaceae, Amaryllidaceae, Araceae, Asclepiadaceae, Bombacaceae, Bromeliaceae, Casuarinaceae, Costaceae, Cuscutaceae, Hauraceae, Labiatae, Lamiaceae, Lauraceae, Melastomaceae, Menispermaceae, Myrtaceae, Nyctentaceae, Nymphaeaceae, Piperaceae, Polygonaceae, Rhamnaceae, Sapotaceae, Scrophularaceae, Solanaceae, Sterculiaceae, Umbelliferae, Urticaceae and Zingiberaceae families. The various diseases treated with who le plant(s) or plant parts included asthma, coughs, pneumonia, fever, arrhythmia, jaundice, dysentery, blood dysentery, indigestion, helminthic infections, gastric ulcer, piles, acidity, urinary tract infections, edema, kidney/gall bladder stones, impotency, syphilis, leucorrhoea, excessive menstrual bleeding, angular stomatitis, malaria, pain and swelling, rheumatism, malaria, kala azar, cholera, animal bites, rabies, and diabetes. The Chakmas use a diverse group of plants to treat various diseases. Their traditional medicinal practitioners claim that the plants are proven effective remedies, so much so, that very few Chakmas visit modern medical practitioners or clinics. Taken together, the plants have considerable potential for isolation of novel compounds, which can be utilized for development of efficient drugs.

Laying the Foundation for In Situ Conservation of Teosinte (*Zea mays* ssp. *parviglumis* Iltis & Doebley), the Wild Progenitor of Maize

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Teosinte is quickly disappearing from Mexico, its center of biodiversity, due to cattle grazing and replacement of traditional forms of agriculture with industrial agriculture that utilizes broad-spectrum herbicides. As teosinte is lost, innumerable genes with global importance for the continued improvement of maize also vanish. Although there is a short window of opportunity to prevent the destruction of what remains of teosinte populations, little has been done to protect this important resource. The overarching goal of this project is to provide information necessary for a comprehensive teosinte conservation strategy. Our primary objectives are as follows: 1. Assess the historic and current extent and importance of teosinte populations with GIS mapping and landholder interviews; 2. Investigate genetic and ecological consequences of teosinte habitat fragmentation using microsatellite molecular markers and a common garden experiment; 3. Suggest appropriate conservation measures for the teosinte populations based on mapping, landholder interviews, laboratory and field experiments, and output of ecological models.

Linking Education, Research and Development: A Case Study on Developing Quality Control Standards of *Voacanga africana* Seeds

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An important strategy to reduce poverty in Sub-Saharan Africa is through income generation by developing the natural plant product sector. A model of natural plant products introduction in the marketplace includes a science-based approach to assess their chemistry and quality. *Voacanga africana* (Apocynaceae) is a small tree that inhabits the understory of secondary forests in Ghana. The voacanga seeds contain alkaloids of commercial pharmacological use, the study of the chemistry and quality of this plant-derived product are key strategies to increase interest and facilitate their market access. This research was conducted to develop quality control standards for *Voacanga africana* seeds, since at present,

there are no national or international standards. This study was also used as a vehicle to involve undergraduate students in research and development activities. Quality control procedures were conducted to assess the quality of voacanga seeds from different locations (Ghana), including color, density, presence of seed clusters, broken seeds, moisture, ashes and total alkaloids (Sreevidya and Mehrotra, 2003). The results showed that the voacanga seeds collected from mature fruits were brown/dark brown, contained no seed clusters, and showed higher densities. This study suggested that those seeds that were gray/light gray, showed the presence of seed clusters and had lower densities, were collected from immature fruits. The total alkaloids content in voacanga seeds that ranged from 0.2% to 1.5%, showed no clear relationship with a given condition of the seed (e.g. color, presence of seed clusters, and density). Some of the seeds were heavily contaminated with sand and showed high levels of moisture. Our results suggested that the best postharvest handling method for voacanga seeds is simply to use the seeds from mature pods, to avoid formation of seed clusters, and subsequent fermentation that lead to seed deterioration. To better assess voacanga seed quality, we proposed additional standards, such as percent of clusters, density, ashes and total alkaloids. The results of these study were submitted to the Ghanaian Standard Board, and contributed to improve harvesting conditions and post-harvest handling methods for voacanga seeds to produce better quality seeds for the international markets.

Linking Education, Research and Development: Organoleptic and Chemical Profile of Plant-derived Oils from Zambia

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The natural product industry is beginning to realize the importance of using natural and exotic plant oils and fats in cosmetics and toiletries. The seed oils from Mungongo (*Schinziophyton rautanenii*) and Parinari (*Parinari curatellifolia*) have potential applications in these industries. An aspect that is limiting their commercialization of these indigenous products is the lack of information on product quality and chemistry. The application of a science-based model for studying the chemistry and identifying new uses and applications can positively impact those rural communities involved in sourcing and producing natural plant products. The objectives of this paper were to assess the organoleptic, physicochemical, and chemical properties of Mungongo and Parinari seed oils, and to discuss their potential uses in the cosmetics industry. This project was also an avenue to engage upper division undergraduate students in research and development. The procedures to evaluate the organoleptic (color and aroma), physicochemical (refractive index, density, solidification point), and chemical properties (acid value, peroxide value, and fatty acid composition) were conducted in mungongo and parinari seed oils from Zambia (Anonymous, 1996). The mungongo and parinari oils showed a similar golden yellow color. The mungongo oil had an aroma similar to but slightly more pungent than canola oil, while the Parinari oil was much stronger in odor and had a faintly fishy aroma. The density, refractive index and solidification point were similar in both oils suggesting a similar chemical composition. The chemical analysis showed that both oils were rich in linolenic acid (40-24% for mungongo and parinari, respectively), and eleostearic acid (16% and 30%), and low in oleic (14-16%), palmitic (9-5%) and stearic acids (7-5%). This preliminary research showed that mungongo oil due to its organoleptic (color and aroma) and chemical properties (high in unsaturated fatty acids), can have their own niche in the cosmetics and skin care industries. Parinari oil, with its unpleasant odor, may limit its use in the cosmetics industry, however, it may have applications in soap and cleanser industries.

Linking Education, Research and Development: Chemistry and Quality of Herbal Teas and Spices from Africa

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The development of the natural plant product sector in Sub-Saharan Africa is one strategy for income generation, poverty reduction and a vehicle to improve community health and nutrition. A model of introduction of plant products in the marketplace includes a science-based approach to study the chemistry and quality of herbal teas and spices. Assessment of their effectiveness (in terms of active principle content) and safety are key strategies to both maximize the products health benefits and facilitate market access. The objectives of this study were to assess the elemental composition, proximate analysis and quality of the herbal teas (*Lippia*, lemongrass, kinkeliba, rooibos, honeybush and hibiscus) and spices from sub-Saharan countries (Ghana, Senegal, Zambia and South Africa), and to establish procedures to develop in-country programs for evaluating product quality. This study was also used as a vehicle to involve undergraduate students in research and development activities. The organoleptic properties, cleanliness, proximate and elemental analysis were performed on the dry leaves of the teas and spices (Juliani et al., 2006). The dry leaves of the different teas exhibited their characteristic colors and aromas. Foreign matter and acid insoluble ashes showed that the teas were clean. The dry leaves can provide significant sources of polyphenolics components ranging from 15% in kinkeliba to 2% in hibiscus. The spices paprika and birds eye chilly showed lower percentages of moisture, while the amount of acid insoluble ashes suggested the spices were clean. Paprika had a sweet taste and high amounts of total carotenoids, while African Birds Eye Chili was spicy and very high in capsaicin. The results showed that these African teas and spices can have functional properties because of their significant amount of polyphenols, antioxidants and minerals in the teas and carotenoids and capsaicins in spices. This project helped to support the commercialization of the “Mpuntu” a brand of African teas and spices in the US market, for income generation in Sub-Saharan countries and provided insight into parameters of quality for our undergraduate students.

Comparison of Alkaloid Content among Three Closely Related Medicinal Species

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Coptis trifolia (American goldthread), *Coptis chinensis* (Chinese goldthread) and *Hydrastis canadensis* (Goldenseal) are closely related species that are important to various ethnopharmacopoeia. Though *H. canadensis* and *C. chinensis* are currently harvested and even cultivated as resources for the herbal pharmaceutical industry, the commercial potential of *C. trifolia* is yet to be realized. A mixture of alkaloids present in the rhizomes of these species imbues them with antipathogenic activities. A comparison of concentrations of individual alkaloids in the three species will provide an insight into which species might be most commercially desirable with respect to alkaloid content. To compare content of berberine, a yellow benzyloquinoline alkaloid, in three closely related medicinally important species. Twenty rhizomes each of *H. canadensis* and *C. chinensis* were acquired from commercial suppliers. Twenty rhizomes of *C. trifolia* were gathered from populations in the St. Lawrence River Valley, Northern New York. The rhizomes were dried, pulverized and alkaloids in the resulting powder were extracted with a solvent. We used microwave assisted extraction followed by HPLC analysis of the alkaloids on a reverse phase-C18 column to quantify the berberine content in each rhizome sample. A one way analysis of variance was used to determine significant differences in berberine content among the three species. *H. canadensis* had significantly greater ($p < 0.001$) berberine content per unit biomass than *C. trifolia* and *C. chinensis*. The berberine content analysis indicates that *H. canadensis* might be most suitable for commercial purposes. However, it is suggested that other key alkaloids (e.g., palmatine and coptisine) contained in the rhizomes also be studied to further evaluate alkaloid yield from rhizomes of each species.

Trade in Agroforestry Products: Insights from Rattan and Pineapple Trade in Sabah, Malaysia.

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Sabah, Malaysia on the island of Borneo is a curious confluence of several indigenous, mainstream and migrant Southeast Asian cultures. Historically, the arrival of these cultures on the island can be traced both in pre colonial and colonial times to the trade of forest and agroforestry products. While harvest of raw materials occurs in indigenous villages, processing and value addition occurs in industrial centers influenced by other ethnic or migrant groups. The sale of these products to consumers occurs in traditional *tamus* (local markets) and the more modernized tourist handicraft centers. The use and marketing of different agroforestry products - both introduced as well as indigenous, influence the local economy. To examine the trade and marketing of rattan (an indigenous, traditional resource) and pineapples (a recently introduced crop), two important agroforestry products in the Malaysian state of Sabah in Borneo. We conducted market surveys and semi structured interviews in six local *tamus* and six handicraft centers located mainly in Kota Kinabalu and around Ranau, Northern Sabah that focused on the trade of rattan and pineapples at these nodal markets. We also visited a Dusun village to examine the cultivation and processing patterns prevalent amongst the indigenous communities. We found that the sale and trade of rattan, an indigenous forest product, depends chiefly on tourism and is impacted by local trade to a much lesser degree than hypothesized. We also found that the sale and trade of pineapples, an introduced crop, occurs almost exclusively in the local *tamus*. There is diversification in rattan products, with an emphasis on handicrafts and souvenirs being made for the tourists. The price for many of these products has held steady over time with a lucrative profit. However, a glut of pineapples has resulted in crashing prices for this product. Examining and understanding the trade and market tendencies of these agroforestry products highlights the importance of monitoring local markets (*tamus*) so as to better direct efforts towards conservation and microeconomic development. Further studies need to be conducted to understand both the socioeconomic and environmental implications of large scale pineapple cultivation.

A Spatial Database of Ethnoveterinary Medicinal Plant Use in and around the Greater Limpopo Transfrontier Conservation Area

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Locally available plant material is commonly used in traditional medical practices. The future sustainability of this important health system is highly dependent on the conservation and management of these natural resources. Important considerations in a resource management program are to determine how levels and methods of plant harvesting and use correlate with species abundance, distribution, reproduction and growth. This is also important information for assessing the impact of habitat destruction through urbanization, overuse, and climate change, as well as changes in use driven by migration of different cultural groups. 1. Develop a spatial database of documented plants used for traditional ethnoveterinary medicine by communities in and around the Greater Limpopo Transfrontier Conservation Area. 2. Document ethnoveterinary knowledge, including the beliefs and customs shared by different cultural groups in treating their livestock and other animals. A relational database was developed using the commercially available software program Access® (Microsoft Corporation, Redmond, WA). Fields were included for the scientific plant name, digital plant images, voucher reference, location (coordinates and physical description), method of collection, storage, preparation, dosing method and dosage, type of condition treated (using conventional western nomenclature) and the species of animal treated. Cultural aspects of the use were also captured, including the language spoken by the studied community, local name of the plant and indigenous name of the condition treated, and the perceived basis or mechanism of action. At completion of the project, we will have a spatial database of the currently documented medicinal plant use for ethnoveterinary purposes. A Geographical Information System (GIS) will be used for cross-cultural and regional analysis of the distribution and extent of use of important

plant species. There is a paucity of data for certain areas and further research is needed to document patterns and levels of usage throughout the conservation area. This spatial database will be an important tool to collate the available data and collect new information about ethnoveterinary plant use for mapping, environmental impact assessments and resource management planning. The collection of plant use is one step towards understanding different cultures' conceptualization of their environment.

Investigation of the Bio-active Phytochemical Constituents of Highbush Blueberry Fruit

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Previous studies have shown that blueberries possess anti-angiogenic, anti-infective, anti-inflammatory, anti-carcinogenic, and anti-Alzheimer's properties (Bagchi et al. 2004, Joseph et al. 2003). Whole blueberry extract (WBE) was prepared from *Vaccinium corymbosum* L. Bluecrop, by macerating the whole crushed blueberries in 80% acetone/ water. The above WBE fraction was lyophilized and tested using the Enzyme Linked Immuno-Sorbent Assay (ELISA) for VEGF in U937 and Eahy926 cell lines. The WBE fraction of *Vaccinium corymbosum* L. bluecrop was found to inhibit VEGF in both the cell lines and the inhibitory activity was proportional to its concentration. These observations indicate that whole blueberry extract possesses potent inhibitory activity on VEGF that results in anti-angiogenic property, which helps in the protective action against certain cancers. Cytotoxicity studies were also performed on these cell lines for the effective inhibitory concentrations of the WBE fraction and were found to be non toxic. The above WBE fraction was further fractionated into different polyphenolic fractions and was tested for the highest potent active constituent in the whole extract in relation to the anti-oxidant values of individual fractions. To optimize separation of the polyphenolic fraction from whole blueberry fruit and to study the purified polyphenolic fractions for anti-angiogenic and bacterial anti-adhesion bioactivities against a known available standard. Schematic separation of fractions of blueberry and followed by the following assays Blue Alamar assay U937 and Eahy926 cells were seeded at several densities from 0.5×10^6 to 1.5×10^6 cells per well in a 6-well plate in regular medium with blueberry extracts for 24 hrs. Then the cells were changed to the minimal essential medium with 10% (20 μ L) Alamar Blue added. The plate was incubated under standard conditions of 37 °C and 5% CO₂ in a humidified atmosphere and fluorescent measurements were read 3hrs later. VEGF Inhibition assay Cells with known density were seeded in 6 well plates with their regular serum media. After 24 hrs, the growth medium was changed to serum free RPMI or DMEM combined with different dilutions of berry extracts. The cells were centrifuged and the medium was collected for ELISA (Enzyme Linked Immuno-Sorbent Assay). The samples were collected after use of the assay and the optical densities (OD) were measured at 490nm. A standard graph was plotted using the OD vs. concentration of the VEGF standard. Thus the activities of the extracts were compared to the standard graph and their efficiency was determined. Our study was mainly focused on the local New Jersey variety *Vaccinium corymbosum* L. bluecrop based on its availability for different experiments. These whole lyophilized blueberries were macerated in 80% acetone/water and the whole blueberry extract (WBE) was extracted. This fraction was tested on the thin layer chromatography to see the different polyphenolic fractions. The WBE fraction was further fractionated into different polyphenolic fractions such as anthocyanins, flavonoids and proanthocyanidins by using the extraction procedure detailed in Scheme 1. These fractions were lyophilized and stored for further activity testing. The lyophilized WBE fraction was tested for the toxicity in Eahy926 and U937 cells to establish the toxic concentrations and the non toxic concentrations that can be used for the VEGF inhibition assay. The blueberry whole extract was found to be active in inhibiting VEGF in different cell lines. However, a significant inhibition was noted in U937 cell line. All the fractions are to be tested for the activity and fully characterized chemically. These findings are compared to their antioxidant status to further establish a thorough understanding and provide a valid bioassay directed fractionation.

Evidence for Maize (*Zea mays* subsp. *mays*) x Teosinte (*Z.m.* subsp. *mexicana*) Introgression from Central Mexico

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Although maize has long been known to be interfertile with its closest extant relatives- its congeners, the teosintes- evidence for introgression has been controversial. (1) To use a population genetics approach to estimate the rate of gene flow between maize and teosinte (*Z.m.* subsp. *mexicana*). (2) To test the relationships among sympatric and allopatric populations of the crop and its wild relative. Isozyme markers were screened to test for relationships, allelic diversity, and gene flow estimates. Allelic composition was analyzed with STRUCTURE software. Populations of sympatric maize/teosinte were found to be more similar in allelic composition than were allopatric populations of the same taxa. These results suggest that gene flow, however limited, does occur between maize and teosinte. Even low levels of gene flow may have significant consequences, like the evolution of crop mimicry.

Assessment of the Potential and Conservation Priorities of Indian Thar Medicinal Plants: An Ecological Approach

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Thar Desert is useful for the welfare of human beings and domestic animals for food, fuel, fodder, medicines and other requirement. Medicinal plants of the arid region are well known and mostly used in crude form. The population of the Indian desert is predominantly rural. The main tribal communities are Kalbelia, Banwaria, Raika, Nut, Mina and Bhil and these communities having constant association with the desert environment and acquired considerable knowledge of plants and their utility especially for medicinal purpose. In present situation, market and public demands of medicinal plants and raw products of herbal medicine have been increasing and consequently it produces greater negative impact on many natural populations of medicinal plants. Therefore, this increasing demand of plants, a vastly increasing human population and extensive destruction of plant habitat are enhancing the rate of extinction of biodiversity and medicinal plants as well. It has been estimated that the average background rate of extinction has been roughly one in every one and one- ninth years. The red data book of India listed 10 species in 1980 that has increased to 35 and all are of medicinal value. Marketing of medicinal plants is done in a rudimentary and opportunistic way. The problems is further compounded by unsustainable harvesting and marketing of plants that adversely affect the livelihood of million of people depends on collection and processing of medicinal plants. In arid zones, due to over exploitation, a fair number of taxa have vanished and many have dwindled in number. The conservation of desert medicinal plant species is not an easy task. Thus agro-technologies for each vulnerable species have to be developed so that they can be practiced during need of the hour. From Thar Desert most of the scientific information about the medicinal plants are related with their medicinal uses and cultivation practices, however the comparative uses of various medicinal plants for various systems are still very rare. Further, it's evident that various herbal drug producers use various combinations of plants for the treatment of specific diseases. The world herbal markets are still dominated by America and China with their lab to field tendency therefore in India to cope of the various constraints in medicinal plant sector the holistic approaches should be taken. (1) To find out the relative importance of medicinal plants of the Thar Desert. (2) Assess the need of urgency regarding the conservation priorities of each plant based on their importance value, agro-techniques and trading facilities. (3) Produce the comparative systematic data based on the medicinal properties of each plants. Present study was done based on registered information's of Thar Desert medicinal plants. The information obtained were pertaining most uses of the 136 medicinal plants, their agro technology and trading facilities. A cluster analysis was performed to group the plants by medicinal use obtained in the current literature. The relative importance values for each medicinal plant were calculated accordingly Bennett and Prance 2000. Further the needs of future

research of these plants were assessed with the availability of their agro-technology and their trading facilities and literature search. The relationships among plants were quantified by Agglomerative Hierarchical cluster with unweighted pair group average (UPGA) method. The recent increase in the commercialization of medicinal species has led to a more intensive harvesting of wild plants; a constant pressure is created on existing resources, leading to continuous depletion of some of the species from its original habitat. Therefore it is essential to develop a plant list on the basis of their medicinal importance and their status in terms of conservation through propagation and market availability. Present study revealed that *Achyranthes aspera*, *Boerhavia diffusa*, *Abutilon indicum*, and *Abrus precatorious* plants are the most vulnerable species with the high RI values and unavailability of agro-techniques. Further, the medicinal uses for the treatment of various ailments clearly indicate the richness of phytochemical constituents in 136-studied plants, which need to be quantified and characterized.

Methodological Approaches to Studying Eggplant Varieties Used for Medicinal and Culinary Purposes__

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Eggplants are native to Asia and come in hundreds of varieties with a range of medicinal and culinary uses. This diversity is a product of selective pressures applied by different indigenous groups as this crop advanced throughout Asia. In order to better understand the modification of this crop since its domestication, we must explore the relationship among the varieties and the wild ancestor in the context of its ethnobotanical use. We are testing methods to understand the diversity and the ethnobotanical uses of Asian heirloom eggplants. These methods intertwine ethnobotanical data with population genetics, genomics, and phytochemistry. Our hypothesis is that there is correlation between ethnobotanical and agricultural practices, phenolic concentrations (specifically hydrocinnamic acid amide conjugates, a class of medicinally potent compounds), gene expression for enzymes in the phenolic pathway, and intensity of selection on that variety. Twenty Asian heirloom eggplant varieties obtained from preliminary fieldwork and various seed companies are being used for this study. To address the relatedness of Asian eggplant varieties and their genetic distance from wild relatives and the wild progenitor, *S. melongena* subsp. *cumingii* (Dr. Michael Nee, pers. comm.), a combination of sequence data for 15 genes and AFLPs are used to generate a phylogeographic tree. Five of these genes code for non-domestication related proteins. The remaining 10 genes are key enzymes within the phenolic pathway. Expression profiling of these 10 genes using qRT-PCR is compared with phenolic profiles of different eggplant varieties. We are generating profiles for 14 phenolic compounds using HPLC, and with a 2,2-Diphenyl-1-Picrylhydrazyl assay of phenolic partitions versus crude extract. Significant differences exist in phytochemical and molecular data generated for eggplant varieties, which in turn allow us to make inferences about portions of the phenolic pathway that are linked with specific uses. Intron regions of gene sequences are dynamic across varieties and outgroup species, indicating their usefulness in phylogeographic analysis. Interpreting the data gathered from these studies allows us to view the history of selection processes eggplants have undergone. These methods can be used to address how ethnic groups have modified the genomes of crops. Our work will be expanded once ethnobotanical fieldwork is completed to include a larger sampled set.

Variation in Alkaloid Content of the Medicinal Species *Coptis trifolia* in Old and Secondary Growth Forests of Northern New York.

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Coptis trifolia (American goldthread) is an understory herb found in old and secondary growth hardwood

and coniferous forests of Northeastern USA. Its alkaloid rich rhizome is used in Iroquois ethnopharmacopoeia and the species was even traded as a popular medicinal in the Boston markets in the early nineteenth century. We hypothesized that alkaloid content of rhizomes in *C. trifolia* populations may vary with either successional stage or microenvironment conditions (i.e., light, edaphic conditions, etc.) at a forest site. To compare content of berberine and coptisine, two benzyloquinoline alkaloids, among *C. trifolia* populations in old and secondary growth forests of Northern New York. We sampled 36 populations of *C. trifolia* in three old and three secondary growth forests in northern New York. Five rhizomes were randomly sampled and harvested from each population. The rhizomes were dried, weighed and subjected to microwave assisted extraction followed by HPLC analysis to quantify berberine and coptisine content. A multivariate analysis of variance was used to determine significant differences in berberine and coptisine content among the different populations. There is no significant ($P > 0.05$) difference in berberine and coptisine content of *C. trifolia* rhizomes harvested from old and secondary growth forests. There is also no significant ($P > 0.05$) difference in berberine and coptisine content of *C. trifolia* rhizomes harvested from populations within a forest site. However, there is a significant ($P < 0.001$) difference in berberine and coptisine content among forest sites. There is also a significant ($P < 0.001$) forest site _ succession stage and population _ forest site interaction. Berberine and coptisine content of *C. trifolia* rhizomes do not vary with the successional stage of a forest but vary with forest site. However alkaloid content of populations located within a forest is often homogenous. The results suggest that alkaloid content of *C. trifolia* rhizomes differs with microenvironment conditions present at the different forest sites. Further studies should examine variation content with respect to microenvironment conditions.

The Experience of Integration of Ethnobotany as Cross-curricular Material in Secondary Education (Instituto Los Olmos, Albacete, Spain)

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Starting fifteen years ago, this team has been studying the Traditional Knowledge System in Castilla-La Mancha (Spain). We have focused our fieldwork mainly on ethnobotany. We are also teaching different subjects in a secondary school and we have introduced this topic into the educational curricula. As a result of that research, we have been working on a project funded by the local government focused on integrating the ethnobotany as a cross-curricular subject. Objectives: To gather the TKS among our community. To integrate ethnobotany into the curricula of different subjects as Maths, Physics and Chemistry, History, etc. To serve as a feedback tool between the TKS and our students. To spread and disseminate that knowledge by publishing our results and linking them to different education levels as teaching materials. Ethnobotanical research: open interviews with elderly people in villages and rural communities. Preliminary meetings with the teachers of each department to coordinate and select the activities. Each teacher does the activity in a practical way following instructions in a file provided by us. The use of these files with the students will help us to improve it for the next years. Compile these files in four didactic units. We have compiled the TKS in our community for twenty years, so we have ample information about that. This raw material serves us as a broad base to apply it to the curricula. We have made more than twenty files of which we will make five units. More than one hundred students of the different levels and fifteen teachers are participating in this project. This methodology helps the preservation of the TKS inside the community and plays a role instead of the oral transmission system, now in disuse, in the local population. In this way our students are engaged on local culture and linked to nature. This work may provide in the near future a didactic tool for the educational community

Hypoglycaemic and Hypolipidaemic Effect of *Treculia Africana* Decne. Moraceae and *Bryophyllum pinnatum* Lam. Crassulaceae Ethanolic Extracts Streptozotocin (STZ) – induced Diabetic Rats
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Extracts of *Treculia africana* Decne. Moraceae and *Bryophyllum pinnatum*. Lam. Crassulaceae are used ethnobotanically for treatment of high blood sugar and heart diseases. Diabetes mellitus is usually characterized by hyperglycaemia and hyperlipidaemia leading to increased risks of atherosclerosis and other cardiovascular diseases. The glycaemic status and serum lipid profile of normal and streptozotocin-induced diabetic rats was studied with a view to elucidate the possible effect of ethanolic extracts of *Treculia africana* leaves and *Bryophyllum pinnatum* whole plant. Eight groups of Streptozotocin (50 mg/kg, ip) induced diabetic rats were given 500mg/kg of the extracts which produced significant ($p < 0.05$) reduction in blood glucose and triglyceride levels and an increase in High Density Lipoprotein (HDL) level. This finding supports the scientific basis for the herbal use of *Treculia africana* *Bryophyllum pinnatum* in the management of diabetes and heart diseases.

Ethnopharmacy of Chunchi

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This paper investigates the traditional plants used in Chunchi Ecuador for medicinal purposes and the people who live in the United States (Eastern region) that still follow and used these plants. These plants were identified by their scientific names, plant state, parts used from the plant, preparation and mode of use and finally their therapeutic applications. Twenty-three plants were researched and acquired from Ecuadorian markets. These plants were identified by their scientific names, plant state, parts used from the plant, preparation and mode of use and finally their therapeutic applications. Families from various cantons--- including Chunchi--- of Chimborazo province were interview. Plants are used to cure respiratory disorders (8), problems of the urinary tract (12), Fever/Malaria (5), Rheumatism (14), nervous system problems (4), Stomach/intestine problems (10), Heart illnesses (3), Cancer (2) worms (3), and even anti-aging and obesity (4). Families from various cantons--- including Chunchi--- of Chimborazo province were interview. Furthermore, as families of first generation immigrants showed knowledge of these plants, two to three generations later these families continue to pass down the traditional practice and usage of these herbs. Some families use herbal medicine not only because it is a tradition but also because western medicine can be expensive.

Ethnobotanical Survey of Medicinal Plants Used by the Santal Tribe of Bangladesh

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The Santals are a tribal community in northern Bangladesh and India (1). According to the Santals, a disease-free life is possible if a harmonious relationship is present between human beings, nature and supernatural beings. The actual medical practitioner is known as an "ohja", who in one person combines the diviner, exorcist and the expert in herbal medicine. The purpose of the present study was to gather information from the ohjas regarding medicinal plant usage in various diseases. Interviews were conducted amongst the ohjas by staying with them for extended periods of time, collecting medicinal plants as pointed out by the ohjas, mode of use of plants collected, and diseases treated by any particular plant or combination of plants. The collected medicinal plants were later brought to the National Herbarium, Bangladesh for scientific identification and provision of accession numbers. A total of 73 plants distributed into 44 families were identified by the ohjas as to their being used to cure various diseases. The plant families were Acanthaceae, Amaranthaceae, Amaryllidaceae, Anacardiaceae, Apocynaceae, Araceae, Asclepiadaceae, Aristolochiaceae, Asteraceae, Berberidaceae, Cannabinaceae, Chenopodiaceae, Combretaceae, Compositae, Cryphaeaceae, Cucurbitaceae, Cyperaceae, Dilleniaceae,

Euphorbiaceae, Fabaceae, Gramineae, Heliotropiaceae, Hypoxidaceae, Labiatae, Lamiaceae, Lauraceae, Leguminosae, Liliaceae, Lygodiaceae, Lythraceae, Malvaceae, Menispermaceae, Piperaceae, Plumbaginaceae, Polygonaceae, Rubiaceae, Ruliaceae, Rutaceae, Solanaceae, Stemonaceae, Sterculiaceae, Verbenaceae, Vitaceae, and Zingiberaceae. 36 plants were used to treat multiple disorders, 10 plants for skin disorders, 13 plants for coughs and respiratory disorders, 17 plants for gastrointestinal disorders, 4 plants for insect bites, 6 plants for diabetes, 2 plants as anthelmintic, and 2 plants for birth control. Other diseases treated were hypertension, kidney disorders, migraine, cardiovascular disorders and loss of calcium in elderly persons. Other than the Chakma tribe of Bangladesh, the Santal tribe has the widest number of plants used for treatment of various diseases. Thus far any systematic study of medicinal plants used by the Santals of Bangladesh is absent. It is expected that the plants used by the Santals can provide lead compounds for novel drug discoveries.

Maple Sugar Production in Western Maryland

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Maple sugar production in western Maryland is a traditional non-timber forest product. Only two counties in Maryland, Garrett and Allegany, are current producers of maple sugar products. The limited production, not monitored by the USDA, ranges from family businesses to hobbyist. Support of small maple producers could increase the appreciation and value of forested land in counties experiencing development pressure. Several objectives are desired to be explored within the research of western Maryland maple sugar producers. The objectives include additional support of local farmers of western Maryland, as well as the support of local food movements. To encourage sustainability and preservation of the land the sugar camps are on, with the hopes of incorporating government easements and protection. Also to understand and pinpoint hardships and struggles that sugar maple syrup producers live and strive against, and to assist the farmers with the information of advertising goods as Maryland products. The methods used to research maple syrup production in Maryland included interviews, tours, and surveys. Maple sugar producers were interviewed formally and informally, as well as surveyed. Tours of several sugar camps, varying in size and methods were experienced. Over 150 students were surveyed to determine awareness and interest in Maryland sugar production. The results formulated from this study include the need for more local awareness and support of Maryland maple sugar producers in many different ways. Hardships include the struggle to “stay above the water” with rising cost of materials, fossil fuels, permitting, and other aspects of independent limited production facilities. Some producers are interested in more green efforts, like biodiesel, and most producers are interested in government easements and protections on the land that provides them livelihood. Western Maryland maple sugar producers could be offered more and enhanced security in order to maintain locality, pride, traditional knowledge, and support in non-timber forest products. This could be reached through local support, government programs, and a stressed importance in consumers to buy local products. An economic feasibility study could aid current landowners considering maple syrup production.

Study of Medicinal plants in Nepalese community of Hawai'i

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The present ethnobotanical study was done on the traditional medicinal plant used by Nepalese communities on the islands of Oahu and Maui. Nepal being the developing country majority of the people depend local herbal remedies for the basic healthcare needs. But there is certainly a big difference between those people and the people who have been living abroad in terms of their access, choice and use of various traditional medicinal plants. But I assume that people still practice some of the medicinal plants

for their healthcare purpose. To identify the diversity, methods and uses of the medicinal plants being used by Nepalese people. The research methods like semi-structured interviews, surveys, free listing for the data collection were used with all the interviewees. About 100 species were used for the medicinal purpose and about 60 percent of the local uses of the medicinal plants were used by this community were only used in Nepal and the rest 40 percent were new uses incorporated in the culture. The vernacular name, parts used, methods of preparation of herbal remedies, the ways to obtain the medicinal plants, storage method were all addressed. The study showed the traditional use of medicinal plants in the Nepalese community living abroad. Medicinal plants are still in use for healthcare reasons.

Ethnomedical Field Research in Cayo District, Belize, 2006-2008

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Several authors studied medicinal plant use by the Maya in the Cayo District of western Belize, Central America, in the late 20th century. Healers retained many traditions from earlier generations. Authors predicted that plant knowledge of traditional healers like Elijo Panti (1893 – 1996) would be lost to future generations. Our goal in this study was to determine if the current generation of Maya continues traditions of medicinal plant use a decade after the death of Mr. Panti. We made two trips to Belize totaling 42 days. We interviewed six (four men, two women) self-identified healers from Calla Creek, San Antonio and Succotz villages. Interviews were semi-structured. We photographed plant samples shown by healers for tentative identification. Each healer used a large variety of plants (~20-40 species) for healing. Plants, uses and traditions generally matched those of previous generations as reported in the literature. Predictions from the late 20th century that loss of indigenous knowledge of medicinal plant use by the Maya of western Belize was imminent have not come to pass. Traditional medicine remains important in the Cayo district, alongside modern medicine. We are optimistic that at least some of the plant use traditions of the 20th century will persist into the 21st.

An Evaluation of Rapid Assessment Protocols in terms of Species Richness and Stand Structure in a Permanent Plot in Palanan, Isabela, Philippines

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Rapid assessments of biodiversity are necessary for management and conservation policies to be made quickly. In an earlier study, two rapid assessment protocols (strip and variable transect methods) were evaluated in terms of their abilities to approximate species richness and diversity by comparing and testing against census data in a 16-ha plot. Both protocols grossly underestimated true species richness, but the variable transect method closely approximated the census Fisher's alpha diversity index. In this study, species composition and stand structure yielded by the transect methods were considered and compared to census data. The 16-ha plot was censused for all stems ≥ 1 cm diameter at breast height (dbh). The strip transect method employed ten random 50m x 2m samples for a total area of 0.1 ha per replicate, noting all tree species ≥ 1 cm dbh. For the variable transect, trees encountered were noted until 50 individuals belonging to each diameter class were recorded. The variable transect method used 3 diameter classes with varying widths for each class. The diameter classes included trees with 2.5-9.9, 10-20 and > 20 cm dbh. Relative abundance and relative basal area were computed for all species encountered in the 16-ha plot, as well as those encountered in the transect methods. Percent similarity was used to compare composition and structure between the transect methods and census data. The strip transect method performed well, yielding similarities of 88.4 and 88.6% to census values for relative abundance and relative basal area, respectively. The strip transect protocol also produced similar relative abundance of stems per diameter class as the census data. The variable transect method yielded lower similarities to census data. The strip transect method, though inferior to the variable transect method in

terms of estimating species diversity, was able to approximate actual species composition and structure better, and must be considered in rapid assessments of sites.

Ethnomedicinal Survey of the Garo Tribe, Bangladesh

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The Garos belong to the Bodo group of Mongoloids and live in different forest regions of Bangladesh. There are some similarities between the Chinese and the Garos. The Garos have their own traditional medicinal practitioners known as khamal, who are knowledgeable in medicinal plants and combine their medical practice with arranging festivals and organizing vows. The present study was conducted to find out medicinal plants used by the Garos since such studies are absent. Ethnobotanical methods including interviews with Garo traditional medicinal practitioners were conducted in Sherpur district, Bangladesh. These included collection of medicinal plants and meticulously noting down ailments for which the plants are used, medicinal preparation and dosage. Plant specimens were collected and identified at the National Herbarium, Bangladesh. A total of 34 plant species belonging to 26 different families were identified as to their being used by Garo traditional medicinal practitioners. The various ailments for which these plants or plant parts are used include burns, bone fracture, muscle ache, jaundice, rabies, anemia, cardiac arrhythmia, impotency, tooth ache, weakness, diabetes, colds, coughs, fevers, edema, hypertension and piles. It appeared from the present study that cardiac arrhythmia, jaundice and impotency are quite prevalent amongst the Garos and they use multiple plant species for these disorders. It was also observed that the Garo patients (who were separately interviewed) claimed relief from their disorders following partaking of the medicinal plant(s) administered. To our knowledge there has been only one previous ethnobotanical survey of the Garo tribe of Bangladesh but in a different region of Bangladesh than the present study (1). Apparently, the Garos of different regions of Bangladesh vary somewhat in their use of plant species, probably because of availability. Proper scientific analysis of the medicinal plants used by the Garos is important for its potential of discovering novel compounds with pharmacological activities. Use of these medicinal plants (if they prove to be efficacious in scientific analysis) is also important to alleviate the cost of treatment with modern drugs, a cost that is ill afforded by the Garos.

Medicinal Plants Used by the Khasia Tribe of Bangladesh to Treat Diabetes, Hypertension and Cardiovascular Disorders

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The Khasias (Mongolite ethnic group) are a tribal group inhabiting the northeastern forest regions of Bangladesh. They number only about 12,000 persons. They are strongly attached to their tribal origin and culture and have their own traditional medicinal practitioners. To identify plant species used by the Khasia healers to treat diabetes, hypertension and cardiovascular disorders. Information on medicinal plants was collected through extensive interviews and observation of medical practices of Khasia healers over a period of more than twelve months. The plants, dosages and patient satisfaction were cross-checked during separate interviews conducted with patients. All plants were identified at the National Herbarium, Bangladesh. For treatment of diabetes, the Khasias take (i) roots of *Amaranthus spinosus*, (ii) combination of seeds of *Mangifera indica*, *Syzygium cumini* and *Tamarindus indica* along with rhizomes of *Zingiber officinalis*, (iii) leaves of *Coccinia cordifolia*, (iv) whole plant of *Cassia fistula*, (v) seeds of *Swietenia mahagoni*, (vi) fruit of *Ficus hispida*, or (g) fresh leaves of *Abroma augusta*. Juice from the roots of *Rauwolfia serpentina* is taken to treat hypertension, and the bark of *Terminalia arjuna* is boiled in water followed by drinking of the water for all sorts of cardiovascular disorders. *Rauwolfia serpentina* and *Terminalia arjuna* has already been identified by modern science as to containing pharmacologically

active compounds for treatment of hypertension and cardiovascular disorders, respectively (1, 2). The other plants or plant parts need to be studied to determine their efficacy for treatment of diabetes.

A Survey of Medicinal Plants available in the St. Martin's Island, Bangladesh

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St. Martin's Island (the only coral island in Bangladesh) is a small island in the northeast part of the Bay of Bengal, about 9 km south of the tip of the Cox's Bazar-Teknaf peninsula, and forming the southernmost part of Bangladesh. The Island is a rich source of various types of fish, turtles, corals, and many more. One hundred eighty-two species of wildlife are recorded from the island. To identify plant species of St. Martin's Island, which can use for curing various types of diseases. Information on salt tolerant medicinal plants was collected through interviews of local people and plant samples were collected over a period of one month. All plants were identified at the National Herbarium, Bangladesh. A total of 6 plant species belonging to 6 different families were identified, which were not reported before from this island. *Ipomoea pescaprea* (L) R.Br. can use for gastrointestinal disorders, *Vitex trifolia* (Simpleleaf chastetree) can use for cough, asthma, eye diseases, inflammatory, and rheumatic swellings, ulcers, skin diseases, nervous disorders and leprosy. Again, *Vernonia patula* (Dryand) Merr. can use for coughs, flatulence, colic, and dysmia. skin diseases, conjunctivitis, fever and rheumatism. *Clerodendrum inerme* (L.) possess anti fungal properties (Asolkas et al, 1992; Rastigi & Mehrotra, 1991, 1993, Rastogi, 1998). On the other hand, *Leucus zeylamaca* used in the treatment of fevers ,scabies and other skin diseases , headache, toothache and colds (Chopra et al. 1956). Another plant species *Phyllanthus reticulates* (Poir). has anti diabetic activity (Kumar et al.). To our knowledge there has no reported survey on the medicinal plants of St. Martin's Island and their uses by the local people. Interestingly, more survey should conducted for discovering new plant species from this Island.

Challenges and Opportunities Concerning Exotic Invasive Plants in Appalachia

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This research paper will focus on the phenomenon of exotic invasive plants. The specific focus will include the Appalachian Region with a particular focus on the North Carolinian portion. The initial goal is to define exotic invasive plants and understand how they have come to be a problem. Subsequently, the paper will reflect on the methods used to control the exotic invasive problem. Ultimately, holistic cost effective solutions are desired that will also have the least detrimental effect on the environment. A review of the literature will help define the exotic invasive problem and current control methodologies. A review of the ethnobotanical literature will help to underpin the opportunities to use these plants and effectively make use of a problem by turning it into a resource. To understand the issues around exotic invasive plants in Appalachia and cost effective, environmentally benign means of control for these pests. Review of literature from invasive ecology, land management, and edible and medicinal uses of wild plants. Many plants that are considered exotic invasive in other parts of the Southeastern region have yet to be recognized as such in North Carolina. North Carolina can benefit from a thorough review of what plants that it considers exotic invasives. These plants need to be regulated more. One underutilized means of controlling exotic invasive plants both recognized and not is to use them for a variety on novel industries.

Uses of Medicinal Plants by the Inhabitants of Ziarat, Pakistan

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Ziarat, the world's second largest Juniper forest is a beautiful hill station of Balochistan. Ziarat has a rich floral diversity including medicinal plants. As Ziarat is a mountainous, remote area, 7500 feet above sea level therefore much health facilities are not available. The local people rely on traditional methods and use plants for their living and health purposes. To discover the use of natural resources/medicinal plants of the area used for the treatment of different diseases. Plants famous for their medicinal uses were collected through regular surveys. These were identified and methods for their preparation and usage were inquired from the local inhabitants. Thirty five medicinal plants belonging to 20 different families were identified. These plants were commonly used for gastrointestinal, cardiac diseases, hypertension, cancer, respiratory and all kinds of disorders. These plants are used by different methods, older women were found to be the experts of the recipe. Through literature survey these plants were found to be containing natural chemical compounds including antibiotics, steroids, alkaloids or some other biologically active compounds (Mansoor et al 2000, Zaidi and Crow 2004). Therefore they show some biological activity against different disease and provide relief to the patient.

Sacred Giants: Ethnobotany of the Bombacaceae by the Southern Lowland Maya

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The interpretation of ceramics, including glyphs and figural depictions, has been at the forefront of Maya scholarship for decades (Reents-Budet 1994). Since most Maya codices (texts) were burned by European religious zealots as anti-Christian doctrine in the 1500's, little from the Maya culture remains to enlighten modern Maya scholars as to the life of this once thriving pre-Columbian people. Archaeologists and epigraphers have used stone stelae, architectural carvings and ceramics to learn more of their political structure, religion, language and utilization of their environment. The goal of this study is to examine ceramic iconography to elucidate the cultural significance of plants in the family Bombacaceae to the ancient Maya people. Plants in the Bombacaceae family were significant to the ancient Maya culturally, ritualistically, economically, and ecologically (Schele and Freidel 1990). Pictorial and sculptured images of species of Bombacaceae are represented commonly on Maya ceramics (Schele and Freidel 1990), and are able to be identified, because of the distinctive morphological features of this plant group. Despite common depictions of flowers and trunk thorns of the ceiba tree (*Ceiba pentandra*), only minimal explanation exist in the literature about the interpretation of botanical motifs on ancient Maya polychrome ceramics, censurs, and burial urns. Plants in the Bombacaceae were selected as a focus for this study, because of their common representation on Maya ceramics, ease of identification, suspected importance to the Maya in ancient times, and known importance they have to the Maya in modern times (Schele and Freidel 1990). The primary objective of this investigation is to document examples of Bombacaceae depicted on Maya ceramics through the late Classic Period (250 A.D. – 600 A.D.), to identify the plants depicted, and to elucidate the ritualistic significance of these plant images to the ancient Maya. This study is focused on the Southern Lowland region of the Maya, which is located in the modern countries of Belize, Guatemala, and Mexico. Scientific plant names and information concerning taxonomic synonyms were established using the online databases International Plants Names Index (IPNI) () and the Integrated Taxonomic Information System (ITIS). Determination of plants in the Bombacaceae family native to the southern highland region of the Maya were based on floristic treatments and checklists (e.g., Standley and Steyermark 1949, Balick, et al. 2000), and the research literature (e.g., Lentz, et al. 1996, Arvigo and Balick 1998, Schlesinger 2001). Plant images on Maya ceramics were identified to the 'Bombacaceae' based on the distinctive morphological features of palmately-compound leaves, trunk thorns, 5-parted flowers, and numerous stamens that characterize many genera in this group of plants. When depictions were naturalistic, plants were identified to genus and species by comparison to plant descriptions (e.g., Standley 1930) and/or images (e.g., USDA Plants Database, Dave's Garden 2006) of plants native to the southern lowlands region of the Maya. Approximately 2,638 images were examined for depictions of Bombacaceae on Maya ceramics. Numerous references also were consulted (e.g., Schele and Miller 1992,

Schmidt 1998). At least six species of Bombacaceae in five genera are represented on Maya ceramics. Whether used in daily or ceremonial life, bombacs continue to this day as one of the most dominant trees in the Central American rainforest, a testament to centuries of reverence by the ancient and modern Maya alike. Bombacaceae had an important impact on ancient Maya material culture. Objects representing ceiba trunk spikes are found on burial urns and incensarios. Bombac flowers can be seen on polychrome ceramics, primarily on cylindrical cacao pots. The relative frequency of depiction of plants from this family on Maya artifacts indicate that Bombacaceae were of great importance to the Maya for culinary, medicinal, ceremonial, and economical purposes.