



The 51st Annual Meeting of the Society for Economic Botany

Agrobiodiversity: lessons for conservation and local development
XALAPA, VERACRUZ, MEXICO - June 6th – 10th, 2010





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Estimados Congresistas:

Sabemos de su decisión de visitar nuestra bella ciudad de Xalapa con motivo de la 51^a Reunión Anual de la prestigiada Sociedad para la Botánica Económica, en el mes de junio del presente año.

Nuestra ciudad les da la más cordial bienvenida y les desea una feliz estancia en ésta, la capital del Estado de Veracruz disfrutando tanto de los importantes simposios y excursiones de su evento, como de la hospitalidad del pueblo xalapeño, de sus museos, su música y de la gastronomía veracruzana.

Espero tener la oportunidad de saludarlos personalmente y desearles mucho éxito en su evento.

Atentamente
Xalapa-Equez. Ver., mayo de 2010

DAVID VELASCO CHEDRAUI
PRESIDENTE MUNICIPAL

Dear friends:

We know of your decision to visit our beautiful Xalapa to attend the 51st Annual Meeting of the prestigious Society for Economic Botany in the month of June this year.

Our City gives you a warm welcome and wish you a pleasant stay in the capital of our state of Veracruz. I wish you to enjoy your symposia of your event, and also the hospitality of the xalapeños, and also our museums, our music, our gardens and our unique cuisine.

I hope to have the opportunity to personally greet you and wish you a very successful stay in our city (also known as Xalapa de las Flores).

Cordially yours

David Velasco Chedraui
Municipal President of Xalapa

Welcome

June 2010

Dear colleagues,

On behalf of the Conference Organizing Committee and the society's officers and council, I am delighted to welcome you all to the 51st annual meeting of the Society for Economic Botany.

We are all very excited that our meeting is an official event for the 2010 International Year of Biodiversity (IYB). We consider the meeting theme of "Agrobiodiversity, lessons for conservation and local development" to be particularly relevant as our society's contribution to the events commemorating the IYB. We are especially honored by the participation of the speakers for the special symposium sponsored by Bioversity International, which will be held as an all-day plenary session on Wednesday, titled "Plant domestication as an on-going process: Implications and applications for conservation and resilience." In addition to this special symposium, the program includes four other sessions with themes related to agricultural biodiversity.

In addition to over 100 oral presentations, including both invited plenary lectures and contributed papers, and over 30 poster presentations, our conference includes specialized workshops, social events, small group meetings,

and numerous field trips. We are also pleased that the 51st SEB meeting is accompanied by the 2nd annual meeting of the Open Science Network in Ethnobiology. We owe great thanks to the help and contributions of our institutional sponsors, the Centro de Investigaciones Tropicales (CITRO) at the Universidad Veracruzana and the Instituto de Ecología, A.C. (INECOL). I would personally like to thank the local organizing committee, and especially Valentina Martinez, for tireless efforts in pulling together this amazing program.

Outside of our full official program, we hope that you will find time to explore and enjoy the local attractions in and around Xalapa, including its many parks, museums, art galleries, universities, and ecological reserves, as well as the gardens, plantations, and cloud forest in the surrounding areas. Many meeting participants will want to visit the herbarium of INECOL, as well as the local botanical gardens, especially the Jardín Botánico Francisco J. Clavijero.

So far, we have over 130 people registered from 16 countries, so this is a genuinely international event. We are very pleased that this participation and the location of this meeting represent part of a trend in which the SEB is becoming ever more international in scope, membership, and participation. This year the society is meeting outside of the USA for the sixth time in 16 years. With new chapters of the

society in the process of being organized in several regions of the world, I am encouraged that this trend toward an international society will continue and even accelerate.

With such an amazing line-up of speakers, events, and local attractions, I wish you all a very enjoyable intercultural experience, as well as a professionally productive conference.

Best wishes,



Eve Emshwiller

**2009-2010 President of the Society
for Economic Botany**

University of Wisconsin–Madison
Madison, Wisconsin, USA

Society for Economic Botany

About the Society for Economic Botany

The Society for Economic Botany (SEB) was established in 1959 to foster and encourage scientific research, education, and related activities on the past, present, and future uses of plants, and the relationship between plants and people, and to make the results of such research available to the scientific community and the general public through meetings and publications.

With more than 1000 members from all 50 U.S. states and more than 64 countries, SEB serves as the world's largest and most-respected professional society for individuals who are concerned with basic botanical, phytochemical and ethnological studies of plants known to be useful or those which may have potential uses so far undeveloped. It is recognized that the field of economic botany includes all or parts of many established disciplines such as: agronomy, anthropology, archaeology, chemistry, economics, ethnobotany, ethnology, forestry, genetic resources, geography, geology, horticulture, medicine, microbiology, nutrition, pharmacognosy, and pharmacology, in addition to the established botanical disciplines.

Society for Economic Botany Officers

President: **Eve Emshwiller**
University of Wisconsin, Madison, Wisconsin

President-Elect: **Mary Eubanks Duke**
University, Durham, North Carolina

Past-President: **Jim Miller**
New York Botanical Garden, Bronx, New York

Secretary: **Heather McMillen**
University of Hawaii at Manoa, Honolulu, Hawaii

Treasurer: **Sy Sohmer**
Botanical Research Institute
of Texas, Fort Worth, Texas

Members of the Council:
Maria Fadiman (2010),
My Lien Nguyen (2010),
Sarah Khan (2011),
Rainer Bussmann (2011),
Linda Lyon (2012),
Jeanine Pfeiffer (2012),
Laura Shiels (2012),

Editor: **Robert Voeks**,
Book Review Editor: **Dan Austin**,
Newsletter Editor: **Trish Flaster**.

2010 Distinguished Economic Botanist

The Society for Economic Botany is proud to announce Dr. Edelmira Linares and Dr. Robert Bye as the 2010 Distinguished Botanists.

Robert Bye received his Bachelor of Science in Forest Biology from the State University of New York College of Forestry and Environmental Sciences at Syracuse University. Afterwards, he obtained his Ph. D. in Biology at Harvard University. Economic Botany, Ethnobotany, Plant Taxonomy and Systematics of vascular plants and History of Botany are the main themes of his academic interest. Southwestern United States and Mexico have been the geographic focus of his field research. He is an honorary research associate at New York Botanical Garden, Harvard University Herbaria, National Herbarium (Smithsonian Institution) and herbarium of the University of Colorado. His participation in the Society for Economic Botany includes being a member of the Council, member of various committees of the Society, co-organizer of the 35th Annual Meeting in Mexico City (1994) as well as various symposia, and reviewer for the journal, Economic Botany. His publications include 125 articles in the scientific journals, 65 articles of scientific divulgation, and 60 books, book chapters and articles in memoirs of congress.

Edelmira Linares received her undergraduate as well as master degrees in biology from the Faculty of Sciences at National Autonomous University of Mexico where she has completed her doctorate courses. She also studied museography in the masters of science program at the University of Colorado, Boulder. Economic Botany and Ethnobotany, especially of medicinal and edible plants of Mexico, complement her academic activities in public education and botanical science divulgation. Her participation in the Society for Economic Botany includes being member of the Council, co-organizer of the 35th Annual Meeting in Mexico City (1994) as well as symposia, and reviewer for the journal, Economic Botany. Her publications include 41 articles in the scientific journals, 66 articles of scientific divulgation, and 49 books, book chapters and articles in memoirs of congress.

Committee Directory

Organizing committee

Arturo Gómez-Pompa

PhD, Scientific Advisor, CITRO
Chair

Eve Emswiler

PhD, President, SEB
Vice-Chair

Ernesto Rodríguez Luna

MSc, General Coordinator, CITRO
Co-Chair

Martín Aluja-Schunemann

PhD, General Director, INECOL
Co-Chair

Sy Sohmer

PhD, Botanical Research
Institute of Texas
Honorary advisor

Valentina Martínez Valdés

MSc, Citro
Local Committee Coordinator

Edward A. Ellis

PhD CITRO
Chair of the local scientific committee

Local scientific committee members

Luciana Porter-Bolland PhD

Maité Lascurain Rangel PhD

Silvia del Amo Rodríguez PhD

Armando Contreras Hernández PhD

Citlalli López Binnquist PhD

Gonzalo Castillo-Campos PhD

Rosalía Fernández MSc

Simoneta Negrete PhD

Meeting staff

Iván Ortíz Casanova

Vladimir Rivera Jiménez

Guadalupe López Alarcón

Emanuel Solís Pérez

Lilia Ruiz Ruiz

Raúl Zavala Juárez

Roberto Castro Cortés

Mayra Villa Buzo

CITRO Event Coordinator

Araceli Aguilar Meléndez

Special symposium coordinators

David Williams PhD

Bioversity International,
Rome, Italy

Marleni Ramírez PhD

Bioversity International,
Cali, Colombia

Special thanks to:

William Dahl

Trish Flaster

Alexa Lomán Landaverde

Volunteers

Isabel Ruiz Millán

Adolfo de Jesús Rebolledo

Ana Paulina Vázquez Karnstedt

Daniela Vergara Rodríguez

Julieta Ceballos

Beatriz E. Marín Castro

Esli Suárez Zurita

Elías Fernández Gómez

Xalapa

History of Xalapa / Historia de Xalapa

The abundance of flowers in the Xalapa region made Baron von Humboldt, who visited the town on February 10, 1804 baptize Xalapa with the name of “City of Flowers”. Nothing could be truer for a city that still today has interesting greenhouses and is home to an extensive gamut of exotic plants and flowers. Xalapa de Enriquez is a beautiful and picturesque city in which beautiful gardens and plenty of radiant flowers prevail and its unleveled streets and buildings conserve a colonial air.

The city stands out mainly for its cultural level, since it is host to great artistic manifestations. Also, this place marks memorable episodes in Mexican history: it was the initial point of conquest and invasions, a land where many heroes gave their lives in honor of national glory.

During the sixteenth century four indigenous groups established themselves in the territory currently known as the city of Xalapa, although it is not known exactly who these first settlers were. It is believed that the Totonacas were the first to establish themselves in the northern part of the region, in the skirts of Macuítetl, founded as the village of Xallitic. But there are differences and some historians believe that it was the Toltecs who arrived and settled in the area during their

pilgrimage towards the Yucatan Peninsula and Central America. But whatever the theory, it is known that 3 settlements more were founded after Xallitic by other indigenous groups: Techacapan in the east by the Chichimecas; Tecuanapan in the northeast by the Toltecs and, finally, Tlanecapan in the southwest by the Teochichimecas. As time went by, these four settlements grew to the point of unifying, forming one population that was named Xallapan.

It is interesting to observe that the settlements that gave origin to Xalapa constituted the current neighborhoods of the city that conserve their ancient names. The Spaniards arrived at the Vera Cruzan shores: Hernan Cortes and his soldiers brought with them the collision of two worlds and they arrived to the settlement on August 17th of 1519. This marked the stage of conquest. When the Spaniards arrived, Xalapa was scarcely populated. After the conquest, the population increased due to its geographic location, since it constituted a stop in the road from Mexico City to Veracruz. The opening of the route Mexico City-Orizaba-Veracruz took away importance of the city as a place of transit. That standstill changed after the first celebration of the “Xalapa Fair” in 1720, triggering its commercial and cultural growth. In 1824 Xalapa was declared capital of the State of Veracruz and on November 29, 1830 it was elevated to the category of city by decree. Don Antonio Maria de Rivera founded the

National School of Xalapa in 1843, (currently the Preparatory School), the oldest of its kind in the country. On November 1862, during the French invasion, the enemy occupied the city. The emperor Maximilian of Hapsburg stayed there on his way to Mexico City from Veracruz; and ironically, his body would eventually arrive there on November 27th of 1867 before being transferred to Veracruz for his shipment on the Austrian frigate “Novara” accompanied by his wife Carlota.

By 1885 General Juan de la Luz Enriquez, governor of the entity, transferred the powers of the State to Xalapa and one year later, according to the Swiss professor Enrique C. Rebsamen, founded the Teacher’s College, the first school of its kind in the country. In 1888 the Graphic Workshops of the State were inaugurated and in June 1890 the first locomotive for the Xalapa-Coatepec-Teocelo railway arrived. The inauguration of the Teacher’s College, construction of the Preparatory School and the later inauguration of other schools, earned Xalapa its cultural recognition. The architecture that predominates in the place is of neoclassic and discrete baroque cut, such as the cathedral.

Xalapa also has notable buildings: the Government Palace, the Preparatory School, the Anthropology Museum, among others, all with the peculiarity of being surrounded by the ancient buildings with roofs colored in bright

red. We can also find different artificial lakes formed with the waters of the Santiago river, where there are piers for smaller vessels, as well as interesting recreational centers and pleasant promenades such as the Clavijero Botanical Garden, Paseo de los Lagos, Macuiltepetl Park and many others.

Places to visit

Gallery of Contemporary Art

Local and national artists with international recognition are exhibited in its two rooms. The Gallery of Contemporary Art of Xalapa houses the head office of the Instituto Veracruzano de Cultura (IVEC). Its two rooms display works of local artists, national and international stature. There are also a cinema, a cafeteria and a central courtyard turned into an open forum where performances take place in theater and regional dance.

Open Tuesday to Sunday from 10:00 to 19:00 hrs.

Pinacoteca Diego Rivera (Art Gallery)

The Pinacoteca Diego Rivera is aside of the Parque Juarez and the Museo Casa de Xalapa (MUXA). Its modern facilities house the collection Diego Rivera composed of thirty-six works carried out during the different stages of the painter's work, from their initial training until his time as an artist enshrined. Its mission is to contribute to the cultural activity of the State to promote and spread the work of

important quality of contemporary artists from the visual arts. It has three rooms: the Main Hall where you can appreciate the collection Diego Rivera and the halls of Jorge Cuesta and Teodoro Adehesa which are spaces opened to the work of talented artists wishing to exhibit their work.

Services: Conferences and Guided Tours. Opened Tuesday to Sunday from 10:00 hrs. to 19:00 hrs. Free Admission

Ágora de la Ciudad

The Agora of the city of Xalapa is on the basement of the Parque Juarez. It is the most important Cultural Center of the State of Veracruz and one of the best in Mexico. Since its inauguration on August 11, 1979, this cultural space has managed to maintain an intense cultural and artistic activity and of entertainment. Its modern facilities include Art Galleries, Film Arts Hall, Auditorium, Open Forum, library and two Cafes with terraces offering a pleasant view of the city of Xalapa. The Agora have ramps for disabled leading to all facilities. **Open Tuesday to Sunday from 10:00 to 22:00 hrs.**

Callejón del Diamante

One of the most traditional alleyways. Located in the heart of Xalapa, the Callejon del Diamante is one of the more traditional alleys of Xalapa. Its name comes from a legend in which a young woman, wife of a businessman gems, deceive her husband. The merchant killed her and left on the corpse a diamond ring that he had given to her. Today, this small passage is the ideal place to get craft items of jewelry and souvenirs in their

various stands. It also has shops, bookstores, traditional restaurants and cafes from which you can appreciate the back and forth of the hundreds of passersby.

Catedral de la Inmaculada Concepción (Cathedral)

The facade of Xalapa's Cathedral.

The Metropolitan Cathedral of Xalapa was originally built in 1641 in the style of the Franciscan churches but has undergone many changes since then that there is not much left to say that its current style is eclectic with Baroque dominant. It has two towers, an incomplete one and another with a clock brought especially from England. The popular legend points out that the construction was interrupted because the tunnels emerging from the basilica could not bear the floor of the new building. It is the most important cathedral of the State of Veracruz.

Iglesia de San José (Church)

The colonial construction in Baroque style.

The San Jose Church was built in 1535 and modified between 1768 and 1770. In the interior of this beautiful building of colonial baroque style we have can be seen three naves, an atrium, a beautiful wooden altarpiece and several elements of strong reminiscent Mudejar with columns that support arches in the form of horseshoe. The temple is located at the end of the alley "Jesus te ampare", being one of the best-preserved monuments representing the time of the colonial era.

Social Events

Museo Casa de Xalapa (Museum)

The pre-Hispanic Xalapa exhibit room.

The House-Museum of Xalapa, commonly called the Museum of the City or MUXA is located next to the Art Gallery Diego Rivera inside a house built in the late eighteenth century. This house was renovated by the city council of Xalapa in order to carry out temporary exhibitions related to the past, present and future of the city. Through its seven rooms this virtual museum offers a tour of about an hour and a half to learn the history of Xalapa and know everything that holds in its history. Here, the central protagonist is the inhabitant of Xalapa.

Open Tuesday to Sunday from 10 hrs to 19 hrs.

Museo de Antropología de Xalapa (Anthropology Museum)

The Museum of Anthropology of Xalapa (MAX) is the second most important in Mexico. This modern space opened on October 30, 1896, has the largest collection of archaeological pieces of the cultures of the Gulf of Mexico. Its exhibition area covers about 9 thousand square meters divided into 18 drops, 6 rooms and 3 patios covered and surrounded by a magnificent vegetation. Nearly 1500 artifacts can be seen created by pre-Hispanic cultures that settled all over the state of Veracruz: Huasteca, Totonaca and Olmec Cultures. Other Museum Services are: guided tour with Headphones, Auditorium, room for temporary exhibitions, library and cafeteria. **Open: Tuesday through Sunday from 9:00 to 17:00 hrs.**

Palacio Municipal

The Palacio Municipal de Xalapa (Municipal Palace) was originally in the building of the Government Palace. During the period 1936-1940 was finally demolished and moved to Casa de los Leones (on Lucio street, aside of the Metropolitan Cathedral). The existing building was inaugurated on August 13, 1956 located in front of the Parque Juárez, only a few steps from the Metropolitan Cathedral and the Government Palace of Xalapa. In 1985 a third floor was added to house other municipal units. This place protects magnificent contemporary murals relating to the history of Mexico.

Paseo de Los Lagos

El Paseo de Los Lagos is a scenic set composed of three lakes surrounded by gardens, paths and a wooded area. It is a quiet and pleasant path visited by families, couples, athletes and people of all ages, both local and tourists. The area is surrounded by La Zona Universitaria Veracruzana, the Olympic Stadium of Xalapa and the Los Lagos Cultural Centre (Previously House of Crafts).

<http://www.travelbymexico.com/xalapa/index2.php>

Opening reception at the Museum of Anthropology

Beverages and local food samples

The opening reception will be held in the Museum of Anthropology in Xalapa. The museum houses the largest collection of artifacts from Mexican Gulf Coast cultures such as the Olmec, the Huastec and the Totonac with more than 2,500 pieces. The most notable pieces in the museum are the giant Olmec heads and the smaller Totonac ones, which are called "caritas sonrientes" (little smiling faces) in Spanish. The museum also contains a 40,000 sq. meter garden.

Chile (*Capsicum annum* L.), Biodiversity and Culture

A gourmet tasting of chiles presented by native cultures of Mesoamerica. (Citro)

There are countless number of chiles that nurture Mexicans today. We are what we eat. This will be an opportunity to witness a gourmet tour by tasting traditional dishes prepared with "chiles criollos". Music, poetry and rituals will be part of the program.

Banquet

Distinguished Economic Botanist event

USD\$35 (Formal dinner & music).

The banquet will be held in the Crowne Plaza Hotel. Olmeca Room, 20:30 hrs.

Meeting Program

SIMPOSIA

1. From plant use and domestication to vegetation management: The role of local communities for conservation

Indigenous and Community Conserved Areas (ICCA) are considered to be key for an integrated conservation strategy. In countries like Mexico, Natural Protected Areas (NPA) correspond to a very small percentage of the national territory and are not necessarily representative of all ecosystems needing conservation. Also NPA often subsist in contexts of social conflicts, for which alternative strategies for conservation that integrate social needs are required. Furthermore, the connection between biodiversity and culture is better understood and it is now recognized that often, local people integrate as part of their natural resources management system, the conservation of particular areas. These areas are important, and persist, given their cultural value and are now widely recognized as part of a national conservation strategy. However, this topic is seldom discussed in the academic settings. We consider that it could be a novel topic for the SEB, as it is a current subject, relating the implications of the connections between plants and people. For this subject relevant topics include ethnoecology and ethnobotany, including the corresponding

discussion on property rights, the value of plants and the management of areas for their conservation, issues regarding biocultural value, among others.

2. Ethnobotany of economics plants: local knowledge, commerce and sustainability

Under the circumstances of habitat reduction, cultural disintegration and the loss of botanical knowledge, ethnobotany portrays multiple risk scenarios. Yet, in an unequal world it can also be seen as a contributor to the development of rural and urban societies, as the description of new species and the reappraisal of the already known emerge as useful information. However, this combination of economics and flora resources encourages not only scientific questions but also a wide set of thoughts related to political and ethical decisions. This topic will then open discussions and the presentation of papers related to sustainability of ethnobotanic resources, resource access and equity, rescue and conservation of local knowledge as well as economic development of rural and urban settings and commercialization of economic plants in local and global contexts.

3. Food self-sufficiency & economic botany: a subsistence agriculture point of view

Scientific development has demonstrated interdependence between social and environmental settings around the countries in the globe. Nevertheless in today's world, access to food resources has become a problem of inequality where some societies tend to consume more than necessary and others are pushed to deprivation limits. This area will give an opportunity to reflect on the concept of food security and the role of economic botany with particular emphasis on agrobiodiversity, as well as the different strategies used by groups, societies and nations to face challenges within this subject.

4. Ancient systems of food production

Industrial food production systems have evolved into complex processes involving the implementation of sophisticated technologies and extended supply chains, a process that has paralleled to the loss of cultural local knowledge. In contrast, ancient systems of food production have been primarily based on social and environmental interactions that

have been established by a solid local knowledge regarding natural resources and their management, and through time, have been able to adapt to local environmental conditions. However, these systems have become vulnerable due to external factors. May these ancient practices have the potential to offer viable alternatives for today's challenges? This theme will allow the presentation of experiences and ideas around genetic varieties, use of traditional species with organic production and food security potential, analysis of local agroecosystems, and other challenges faced like property rights, species loss, etc.

**Special symposium
Plant domestication
as an ongoing process:
Implications and applications
for conservation and resilience**

David E. Williams and Marleni Ramirez
(Conveners). *Bioversity International,*
Rome, Italy and Cali, Colombia

Through a series of case studies, this symposium aims to highlight the ancient, dynamic and ongoing processes of plant domestication, and how they continue to give rise to novel crop varieties and farming practices. For the purposes of the symposium, the concept of domestication is considered in the broad sense, to encompass a variety of disciplinary approaches that can shed light on the potential applications of those processes

to enhance the contemporary management of agrobiodiversity. The factors contributing to the domestication and diversification of crop plants will be examined through the analysis of archaeological, agromorphological, ethnohistorical, ethnographic and genetic evidence. The presentations will address crop diversity at the genepool level, including domesticates, their local varieties and closely related wild and weedy species. Case studies from Latin America will provide insights on the role of culture, inter- and intra-continental diffusion, introgressive hybridization, extreme weather events and mutation on the adoption, re-adaptation and diversification of crop species through local selection practices. Moreover, the guest speakers will illustrate how a better understanding of these farmer-driven processes can be incorporated into more effective strategies for the conservation and use of genetic resources, and provide contemporary farmers, breeders and consumers with increased options for responding to social, economic and climatic change. Following the symposium presentations, a roundtable discussion will be held to identify and prioritize some key research gaps, and recommend approaches that help maintain farmers' involvement as a viable and effective evolutionary force for our crops, and enhance the on-farm conservation of crop diversity. These approaches can also be usefully applied by scientists, development agencies and policy-makers to improve the livelihoods, nutrition, and food security of rural farming communities. Building upon the public

awareness opportunities associated with the 2010 International Year of Biodiversity, the symposium will serve to highlight the importance of on-farm management of agricultural biodiversity and its fundamental role in securing the future wellbeing of humankind.

Schedule at a glance

Sunday 6

SEB Meeting

Registration
& Tours information
Hotel Lobby

SEB Council Meeting

08:00-16:00 hrs.
Tolteca Room

Opening Reception

19:00 hrs./MAX
(Social Event)

Field Trips:

Pixquiac River
08:00-18:00 hrs.
Local Market
09:00-13:00 hrs.
Botanical Garden
10:00-12:00 hrs.
Anthropology Museum
16:00-18:30 hrs.

Monday 7

SEB Meeting

Registration
& Tours information
Hotel Lobby

Opening Symposium:

Agrobiodiversity, lessons
for conservation and
development
Olmeca Hall

Concurrent Sessions

Symposium 1:

From plant use
and domestication
to vegetation
management: The role
of local communities
for conservation
Olmeca Hall

Concurrent Sessions

Poster Session

Inauguration
Olmeca Hall

Exhibitors

Tuesday 8

Symposium 2:

Food self-sufficiency
& economic botany:
a subsistence agriculture
point of view
Olmeca Hall

Concurrent Sessions

Symposium 3:

Ancient systems
of food production
Olmeca Hall

Concurrent sessions

Workshop: Teaching
strategies to promote
active learning in
ethnobotany
Huasteco Room

Chile, Biodiversity & Culture

19:00 hrs./CITRO
(Social Event)

Exhibitors

Wednesday 9

Special Symposium:

Plant domestication
as an ongoing
process: implications
and applications for
conservation and
resilience
(Bioversity International)
Olmeca Hall

Student Mixer

Tierra Luna

Exhibitors

Thursday 10

Symposium 4:

Ethnobotany of economic
plants: local knowledge,
commerce and
sustainability
Olmeca Hall

Concurrent Sessions

SEB Annual Business Meeting

Mexica Room

Banquet

Distinguished
Economic Botanist
20:30 hrs./Crowne Plaza
Olmeca Hall

Exhibitors

Cultural Workshop:

Traditional sauce
preparation
Huasteco Room

Friday 11

Field Trips:

Chavarrillo
06:00-18:00 hrs.

Daily Program Agenda

MONDAY, 7 JUNE

07:00-08:45 **BREAKFAST**

Olmecca Hall

09:00-10:00 **OPENING CEREMONY**

OPENING SIMPOSIUM. AGROBIODIVERSITY: Lessons for conservation and local development

10:00-10:30 Los centros de diversificación biocultural y el uso sustentable de los recursos bióticos por las comunidades indígenas de México

Eckart Boege

10:30-11:00 Crisis ambiental y dendrocultura. Papel de los árboles remarcables en la comunicacion ambiental y en el turismo sostenible

Martí Boada

11:00-11:30 Diversity of the Mexican maize agroecosystem and transgenic maize

Antonio Turrent

11:30-12:00 Agrodiversity from the below-ground perspective: lessons from Sierra de Santa Marta, Los Tuxtlas

Simoneta Negrete-Yankelevich

12:00-12:15 **COFFEE BREAK**

CONCURRENT SESSIONS

Olmecca Hall

12:15-12:30 The role of primary and secondary crops in species and cultural conservation in Boumba, Niger (95)

Jocelyn G. Müller

12:30-12:45 Genetic and ethnobotanic forest resources in the milpera region of Yucatan, Mexico (100)

José Vidal Cob-Uicab

12:45-13:00 The History of Eggplant Domestication: Phylogeographic Relationships Among Candidate Progenitors And Asian Landraces (97)

Rachel Meyer

13:00-13:15 Healthy Kids, Healthy Forest Program in Mexico and Guatemala (98)

Cecilia Sanchez Garduno

13:15-14:30 **LUNCH BREAK**

SIMPOSIUM 1. From plant use and domestication to vegetation management: The role of local communities for conservation

14:30-15:00 Toward the Domestication of *Vanilla pompona* (Orchidaceae) from Wetlands of the Peruvian Amazon, Phase 1: Agricultural, Chemical, and Ecological Investigations

John P. Janovec

15:00-15:30 Plant management and domestication in the Tehuacán Valley: Traditional perspectives for biodiversity conservation

Alejandro Casas

15:30-16:00 Does local participation enhance the conservation of protected areas? A comparative study in southeastern Mexico

Luciana Porter-Bolland

16:00-16:15 **COFFEE BREAK**

CONCURRENT SESSIONS

Olmecca Hall

16:15-16:30 Estimating the Local Value of Non-Timber Forest Products to Pendjari Biosphere Reserve Dwellers in Benin (1)

Fifanou G. Vodouhe

16:30-16:45 Real and simulated impacts of religious harvesting on ornamental bromeliads in Veracruz, Mexico (2)

Ingrid Haeckel

16:45-17:00 Scientific and empirical based landscape classification for land-use planning in the Mexican Pacific coast (3)

Minerva Campos Sánchez

- 17:00-17:15 Plant species and their uses in homegardens of migrant Maya and Mestizo peasants in Calakmul, Campeche, Mexico (4)
Korinna Neulinger
- 17:15-17:30 Process of domestication of *Stenocereus pruinosus* (Cactaceae) in the Tehuacan Valley, central Mexico (5)
Fabiola A. Parra Rondine
- 17:30-17:45 El papel de los tianguis y/o mercados orgánicos locales en México en la conservación de la diversidad biológica y cultural (6)
Miguel Ángel Escalona Aguilar
- 17:45-18:00 Forest Conservation Programs on Indigenous Communities of the Huasteca Potosina, Mexico (7)
Aida Ramos Viera
- 18:00-18:15 Developing a regional strategy for conserving agrobiodiversity: a new paradigm for the arid southwest (8)
Suzanne C. Nelson

CONCURRENT SESSIONS

Mexica-Tolteca Room

- 12:15-12:30 Frutales silvestres poco valorados de la cuenca del río Nautla en el centro de Veracruz, México (99)
Mario Vázquez Torres
- 12:30-12:45 Modern trends of traditional psychoactive drug plant use in Micronesia (96)
Mark D. Merlin
- 12:45-13:00 Ethnomedicinal knowledge in traditional management of human ailments in Lake Victoria Basin, Kenya (102)
C.W. Lukhoba
- 13:00-13:15 Conocimiento local sobre el manejo de leña en tres comunidades cafetaleras del centro de Veracruz (101)
Citlali Aguilera
- 13:15-14:30 **LUNCH BREAK**

CONCURRENT SESSIONS

Mexica-Tolteca Room

- 16:15-16:30 Horizontal traditional knowledge transmission balance the generational knowledge loss among mushroomers (47)
Roberto Garibay-Orijel
- 16:30-16:45 A Hawaii Case Study: Knowledge of Traditional Gathering Areas (9)
Katie L. Kamelamela
- 16:45-17:00 Forest conservation in Chiapas, Mexico from the perspective of alternative coffee growers (65)
Evodia Silva Rivera
- 17:00-17:15 Regiones mezcaleras y usos del maguey en Michoacán (66)
Emma L. Iglesias Mancera
- 17:15-17:30 Encouraging Community Involvement on the Grass Roots Level for Ethnobotanical Research and Outreach (70)
Mimi Hernandez
- 17:30-17:45 Plants up for Adoption: Why do Southeast Asians so readily accept introduced plants into use, especially those from the Neotropics? (74)
Nathaniel Bletter
- 17:45-18:00 Selection, Management and Diffusion of Açai Branco by Smallholder Farmers in the Amazon Estuary (91)
Ashley DuVal
- 18:00-18:15 Observations on the traditional phytotherapy among the inhabitants of Gopalganj district of Bangladesh (19)
Ariful Haque Mollik
- 19:00 **Poster Session Inauguration Olmeca Hall**

TUESDAY 8, JUNE

07:00-08:45 **BREAKFAST**

SIMPOSIUM 2. Food self-sufficiency & economic botany: a subsistence agriculture point of view

09:00-09:30 Agrobiodiversidad, autosubsistencia y especialización: lecciones aprendidas de la producción del café

Víctor M. Toledo

09:30-10:00 The wild forms of chile pepper (*Capsicum spp*) of Mexico: domestication, uses, distribution and opportunities for conservation

José de Jesús Luna Ruiz

10:00-10:30 El café cultivado bajo la sombra de los árboles, un recurso de gran valor para la biodiversidad de México

Armando Contreras Hernández

10:30-10:45 **COFFEE BREAK**

CONCURRENT SESSIONS

Olmecca Hall

10:45-11:00 *In situ* conservation of maize landraces of Maya-Yucatecan Milperos (16)

Arias Luis

11:00-11:15 Diversidad de tipos de maíz en comunidades Tzotziles de Chiapas (15)

Efraín de la Cruz Lázaro

11:15-11:30 Biodiversidad y seguridad alimentaria en el norte de Puebla, México (14)

Francisco Basurto

11:30-11:45 **BREAK**

11:45-12:00 Especies de *Peperomia* Ruiz et Pavón (Piperaceae) comestibles de Oaxaca, México (43)

Marco Antonio Vásquez-Dávila

12:00-12:15 Economic contribution of home gardens in southern, Campeche, Mexico (11)

José A. Alayón-Gamboa

12:15-12:30 How Local is Local? Traditional Maize Seed Systems in the Face of Climate Change in Mexico (12)

Mauricio R. Bellon

12:30-12:45 Conservation of local maize varieties in Mexican traditional agriculture: Identifying the role of agrobiodiversity (13)

Gabino Nava Bernal

12:45-13:00 Ancient food systems of the Rio Negro (Brazilian Amazon) in an urbanization context (17)

Esther Katz

13:00-13:15 Ethnobotanical contributions to safeguard biodiversity, diversify livelihoods and preserve indigenous knowledge through rainforestation farming in mountainous regions of Xishuangbanna, Yunnan, China (18)

Pavlos Georgiadis

13:15-14:30 **LUNCH BREAK**

SIMPOSIUM 3. Ancient systems of food production

14:30-15:00 An Alternative Environmental History of the Maya Forest

Anabel Ford

15:00-15:30 Development of strategies for *in situ* conservation of agrobiodiversity in Yucatan

Juan J. Osornio

15:30-15:45 **BREAK**

CONCURRENT SESSIONS

Olmecca Hall

15:45-16:00 The population ecology of *Securidaca longepedunculata* Fresen.: An aphrodisiac amongst the Vhavenda people of Limpopo Province, South Africa (50)

Tshisikhawe, M.P.

16:00-16:15 Soil modification in pre-contact Māori kûmara gardening: Use of charcoal? (51)

Mike Burtenshaw

16:15-16:30 Ecoregional distribution of potentially useful species of Araceae and Bromeliaceae as non-timber forest products in Bolivia (52)

Thorsten Krömer

16:30-16:45 Was the Kiso-hinoki cypress preservation movement effective during historical period? (53)

Junko Kitagawa

16:45-17:00 **COFFEE BREAK**

17:00-17:15 Recolonization of vascular epiphytes in shaded coffee agroecosystems (57)

Tarin Toledo-Aceves

17:15-17:30 Evaluación de la diversidad de especies útiles para leña y de los gases que afectan la salud de los usuarios de la misma en Tenosique, Tabasco, México (58)

Susana Ochoa Gaona

17:30-17:45 Loss of genetic structure in a traditional crop variety over a large and heterogeneous area: The effect of market seed (64)

Helen Jensen

17:45-18:00 Effect of domestication on the germination of columnar cacti from the Tehuacan Valley (60)

Susana Guillén

18:00-18:15 Diversity in Breadfruit Seasonality: A Resource for Year-Round Production (67)

A. Maxwell P. Jones

CONCURRENT SESSIONS

Tolteca Room

10:45-11:00 Knowing many ways: Engaging the diversity of plant knowledge within the Standing Rock Oyate (39)

Morgan L. Ruelle

11:00-11:15 The Genus Agave in the Huichol Sierra of Jalisco, Mexico (40)

James A. Bauml

11:15-11:30 Conocimiento, uso y manejo de la flora silvestre y semicultivada útil, en tres comunidades cafetaleras de Veracruz (41)

María Guadalupe Ruiz Gómez

BREAK

11:30-11:45 Ethnoecology and food sovereignty among the Songhai people of Niger: species, local knowledge, and implications for sustainable rural development (10)

Alexandra M. Towns

12:00-12:15 Las palmeras en humedales veracruzanos: Usos y tradiciones locales. (42)

Rosa María González-Marín

12:15-12:30 Quantitative Analysis of Yucatec, Mopan and Kekchi Domestic Gardens as "Biodiversity Hotspots" (103)

David Campbell

12:30-12:45 Valoración social de plantas en una comunidad indígena (Veracruz, México) (45)

Ana Paulina Vázquez Karnstedt

12:45-13:00 Helechos arborescentes usados en la producción de 'maquique' en el centro del estado de Veracruz, México (46)

Mónica Palacios-Rios

13:00-13:15 Cacao, bu'pu, chiro, popo: cuatro nombres, una sola bebida (44)

Mayra Villar-Buzo

13:15-14:30 **LUNCH BREAK**

CONCURRENT SESSIONS

Tolteca Room

15:45-16:00 El manejo tradicional y el mantenimiento de la diversidad vegetal: el caso de *Oecopetalum mexicanum* en la Sierra de Misantla Veracruz, México (48)

Juan Carlos López

16:00-16:15 Candy Barrel Cactus: A Traditional Mexican Plant Resource Subject to Uncontrolled Extraction and Browsing (54)

Cecilia Jiménez-Sierra

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- 16:15-16:30 Stinging nettle cream for osteoarthritis (55)
Keith Rayburn
- 16:30-16:45 First Contact in Hawai'i (1778) - The Impact of Globalization in the First Two Decades (56)
Al Keali'i Chock
- 16:45-17:00 **COFFEE BREAK**
- 17:00-17:15 The Domestication and Use of Sumpweed (*Iva annua*) in Eastern North America (61)
Gail E. Wagner
- 17:15-17:30 Flora vascular con características potenciales para el aprovechamiento y conservación de los fragmentos de selva en el municipio de Atzalan, Veracruz (62)
Mireya Burgos Hernández
- 17:30-17:45 Evaluación de la actividad antimicrobiana de cuatro plantas utilizadas contra infecciones gastrointestinales en Tacotalpa, Tabasco, México (63)
Judith Espinosa Moreno
- 17:45-18:00 Sustainability of an Appalachian herb, black cohosh, *Actaea racemosa* L.: determining factors of habitat and abundance in western Maryland (59)
Sunshine L. Brosi
- 18:00-18:15 Domestication and herbivore-induced volatile emission in tomato plants (72)
Alicia Bautista Lozada
- 18:15-18:30 Implementing a new, integrated approach to the conservation and use of agricultural biodiversity at the international agricultural research centers of the CGIAR (49)
David E. Williams

WORKSHOP

Huasteco Room

- 15:45-18:15 Teaching strategies to promote active learning in ethnobotany

SOCIAL EVENT

- 19:00 Chile (*Capsicum annum* L.), Biodiversity and Culture/CITRO

WEDNESDAY 9, JUNE

07:00-08:45 **BREAKFAST**

Olmecca Hall

SPECIAL SIMPOSIUM. Plant Domestication as an Ongoing Process: Implications and Applications for Conservation and Resilience

- 9:00 - 9:20 Introduction to the Symposium
David Williams, Marleni Ramirez
Invited Speakers
Marleni Ramirez Chair
- 9:20-10:00 The cultural aspects of early crop adoption in western South America
Christine A. Hastorf
- 10:00 – 10:40 Studies on the domestication of chili peppers in Mexico
Araceli Aguilar Meléndez
- 10:40-11:00 **COFFEE BREAK**
- 11:00-11:40 Landscapes of maize in Mexico: Farmer-mediated crop evolution and *in situ* conservation of genetic resources
Hugo R. Perales, Kristin Mercer
- 11:40-12:20 Extreme climatic events, seed flows and crop varietal Diversity: Effects of a hurricane on agricultural biodiversity in central Yucatan, Mexico
John Tuxill
- 12:20-13:00 On-going evolution of the potato in its Andean center of origin: Exploring the evidence
Stef de Haan
- 13:00-14:30 **LUNCH BREAK**
- CONTRIBUTED PAPERS**
- Xavier Scheldeman** Chair
- 14:30-14:45 The role of crop diversity for food security in a changing climate: Lessons from early and present-day farmers in Ethiopia
Hannes Dempewolf

- 14:45-15:00 Farmer choices and environmental adaptation of *Phaseolus* species in Oaxaca, Mexico
Margaret Worthington
- 15:00-15:15 El cultivo de las chías (*Chenopodium berlandieri* ssp. *nutalliae* y *Amaranthus hypochondriacus* en Opopeo, Michoacán
Cristina Mapes
- 15:15-15:30 Ancient Genes for Maize Improvement
Mary Eubanks
- 15:30-15:45 Ongoing evolution of oca under human influence: Implications for conservation
Eve Emshwiller
- 15:45-16:00 **COFFEE BREAK**
- ROUNDTABLE DISCUSSION**
- Mauricio Bellón** Chair
- 16:00-17:30 Panelists: **David Williams, Marleni Ramirez, Christine Hastorf, Hugo Perales, Maria Scurrah, Stef de Hann, John Tuxill, Eve Emshwiller, others TBD**
- 17:30 **Conclusions and closure of symposium**
- 19:30 **STUDENT MIXER**
- Tierra Luna, Rayón No. 18, Col. Centro.

THURSDAY 10, JUNE

07:00-08:45 **BREAKFAST**

Olmecca Hall

- SIMPOSIUM 4. Ethnobotany of economic plants: local knowledge, commerce and sustainability**
- 09:00-09:30 Sustainable use of plant diversity in a changing world: lessons from Mexican Ethnobotany and botanical gardens
Javier Caballero
- 09:30-10:00 Amazonian anthropogenic landscapes: the view from the 'new ecologies'
Miguel Alexiades
- 10:00-10:15 **BREAK**

CONCURRENT SESSIONS

Olmecca Hall

- 10:15-10:30 An ethnobotanical survey of plants used to treat sexual transmitted infections by a rural community of northern KwaZulu-Natal, South Africa (20)
Helene de Wet
- 10:30-10:45 The Mexican lotus (*Nymphaea ampla*) and the Feathered Serpent: equivalent conduits to the Maya spiritual realm (21)
J. Andrew McDonald
- 10:45-11:00 The African Herbal Pharmacopeia - Challenge and Potential (22)
Thomas Brendler
- 11:00-11:15 East African plant use – differences in plant use between nomadic and agricultural societies (23)
Rainer Bussmann
- 11:15-11:30 Plant Management in the Tehuacán Valley (24)
José Blancas Vázquez
- 11:30-11:45 **COFFEE BREAK**
- 11:45-12:00 Agrobiodiversity in an urban environment: The importance of foods as medicines (30)
Ina Vandebroek
- 12:00-12:15 Ethnobotany of Mexican bamboos: an important resource (31)
Teresa Mejia-Saulés
- 12:15-12:30 Native Plant Names and Uses Known to School Children in 5 Countries: Guatemala, Dominican Republic, El Salvador, Nicaragua and United States (Crow and Lakota) (32)
Donald L. Hazlett
- 12:30-12:45 Integrating ethnobotany with cultural landscape protection in the Amalfi Coast (Southern Italy) (33)
Savo Valentina

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12:45-13:00 Wild Edible Plant Knowledge by the Turumbu, Mbole and Bali ethnic groups, District Tshopo, Oriental Province, DR Congo (34)

Termote Céline

13:00-14:30 **LUNCH BREAK**

CONCURRENT SESSIONS

Olmecca Hall

14:30-14:45 Variation of Kernel Anthocyanin and Carotenoid Pigment Content in Arido-American Land Races of Maize (78)

Richard Pratt

14:45-15:00 Domestication processes of the tropical tree *Chrysophyllum cainito* L. (Sapotaceae) (73)

Jennifer J. Petersen

15:00-15:15 Stratification protocols and germination rates of black cohosh (*Actaea racemosa* L.) populations from western Maryland (75)

Natalie A. Walsh

15:15-15:30 Caracterización de ecotipos de chile poblano (*Capsicum annuum* L.) en Tlalancaleca, Puebla, México (76)

Ernesto Castañeda Hidalgo, Mariana Díaz Jarquín

15:30-15:45 Bactericidal and Bacteriostatic Effects of 15 Anti-diarrheal Plants from Central Anatolia (77)

Janna Rose

15:45-16:00 Anti-biofilm activity of *Rosa canina* galls: a Turkish traditional medicine (68)

Cassandra L. Quave

16:00-16:15 Photographic survey of Assumption Day herbal bouquets in Poland (69)

Łukasz Łuczaj

16:15-16:30 Changes in amyl alcohols as compounds indicative of fermentation degree in *Theobroma cacao* L. var. Forastero in Tabasco México (80)

Jacobo Rodríguez-Campos

16:30-16:45 How woody vegetation mosaic contributes to maintain biodiversity in grazed pastures of Central Veracruz, Mexico? (81)

Bibiana López Cano E.

16:45-17:00 Estudio del uso potencial de *Peperomia* (Piperaceae) en el estado de Veracruz, México (82)

Daniela Vergara Rodríguez

17:00-17:15 Traditional Reproductive Health, Fertility Regulation, and the Use of Hormone-Mimicking Plants among the Q'eqchi Maya in Southern Belize (92)

Jillian De Gezelle

CONCURRENT SESSIONS

Mexica Room

10:15-10:30 The Ethnobotany of *Ficus* in Barbados (25)

John Rashford

10:30-10:45 Especies medicinales y comestibles toleradas en los traspatios en la comunidad de Ixhuatlancillo, Veracruz, México: agrodiversidad y diversidad organizacional (26)

Yaqueline Gheno-Heredia

10:45-11:00 Etnobotánica de plantas con aplicación en la medicina tradicional en la zona de la sierra de Tabasco, México (27)

Dora Centurión Hidalgo

11:00-11:15 Significance of food plants bartering in traditional markets of the Tehuacan-Cuicatlán Valley (28)

Yaayé Arellanes

11:15-11:30 Conocimiento y consumo de hongos silvestres comestibles en Durango, México (29)

Néstor Naranjo Jiménez

11:30-11:45 **COFFEE BREAK**

11:45-12:00 Cooling Teas of Barbados—Therapeutic and Market Potential (71)

Sonia Peter

12:00-12:15 Integración al mercado local y biodiversidad: Grupo de herbolaria "Hamelia" (35)

Ma. del Carmen Vergara-Tenorio

12:15-12:30 Environment and Gender: Nipa roof shingles from *Nypa fruticans* (Arecaceae), in Palawan, Philippines (36)

Maria Fadiman

12:30-12:45 Past, Present, and the Future of a Magical Cactus from Mexico (37)

Stacy B. Schaefer

12:45-13:00 The diversity, economic and nutritional value of Totonac home garden produce and their links to food habits (38)

Beatriz Contreras

13:00-14:30 **LUNCH BREAK**

CONCURRENT SESSIONS

Mexica Room

14:30-14:45 Bocaiúva (*Acrocomia aculeata* (Jacq) Lodd ex Mart; Arecaceae): an alternative for income generation for traditional communities in Brazil (83)

Gisele Lorenzi

14:45-15:00 Desarrollo empresarial comunitario como estrategia de conservación: el caso de la vainilla en la región Totonaca, del estado de Veracruz, México (84)

Enrique Hipólito-Romero

15:00-15:15 El uso del género *Beaucarnea* para conservar la selva seca en México (94)

María Luisa Osorio Rosales

15:15-15:30 Could doubling the maize harvest be a bad thing? Economic rationality in mixed cropping systems (85)

Heike Vibrans

15:30-15:45 Use and spatial availability of Agave potatorum in San Luis Atolotitlan, Puebla, Mexico (86)

América Minerva Delgado Lemus

15:45-16:00 The sustainable management and conservation of *Santalum yasi* (sandalwood) in Fiji and Tonga: A combined ecological and genetic approach (87)

Ryan Huish

16:00-16:15 Chocolate and malaria: an evaluation of cocoa flavanols as an anti-plasmodial prophylaxis (88)

Steve Maranz

16:15-16:30 Conociendo las plantas de mi localidad. La botánica como una herramienta educativa (93)

Roberto Castro-Cortes

16:30-16:45 The Principal Flowers of Ancient Elite Rituals at Copan, Honduras (89)

Cameron L. McNeil

16:45-17:00 The relationship of *Chenopodium domesticates* and a preliminary phylogeny of American *Chenopodium* (90)

Brian Walsh

17:00-17:15 Inhibition of adipogenesis by saw palmetto extracts: A possible mechanism for its effects against BPH (79)

Bradley C. Bennett

17:15-18:15 **SEB Annual Business Meeting. Mexica Room**

SOCIAL EVENT

20:30 **Banquet**

Distinguished Economic Botanist

Olmeca Hall

WORKSHOP

10:15-12:30 **Cultural Workshop:** Traditional sauce preparation
Huasteco Room

Meeting Abstracts

From plant use and domestication to vegetation management: The role of local communities for conservation

1. Estimating the Local Value of Non-Timber Forest Products to Pendjari Biosphere Reserve Dwellers in Benin

**Fifanou G. VODOUHE¹, Ousmane COULIBALY²,
Charlotte GREENE³, Brice SINSIN¹**

*Laboratory of Applied Ecology - University of
Abomey-Calavi (Benin)¹, International Institute
of Tropical Agriculture, Cotonou, Benin², Department of
Geography, California State University
Fullerton, Fullerton, CA, USA³*

This paper uses an indices method based on participant ranking of species to quantify use-values of Non-Timber Forest Products (NTFPs) and the socio-economic factors that influence these values for people living around the Pendjari Biosphere Reserve in Benin. There were 76 species identified that had a high index value to people. The 10 most valued species were *Parkia biglobosa*, *Adansonia digitata*, *Vitellaria paradoxa*, *Tamarindus indica*, *Lannea microcarpa*, *Vitex doniana*, *Hibiscus asper*, *Melochia corchorifolia*, *Khaya senegalensis*, and *Diospyros mespiliformis*. Species values were influenced by the vegetative form of the species as well as by the gender of a participant and his/her affiliation to the ethnic

group. The study also illustrates that women had a preference for NTFP species with high commercial and nutritional values, while men preferred plants that provide construction material and medicine. Moreover, the ethnic group that historically had more contact and interaction with the vegetation valued NTFPs more than any other group. The difference in value attributed to species by people was also driven by the vertical transmission of ethnobotanical knowledge in the study area. For long-term biodiversity conservation, it will be useful to involve the needs of all of the local communities in the design of a management plan and focus attention on the most important species.

2. Real and simulated impacts of religious harvesting on ornamental bromeliads in Veracruz, Mexico

Ingrid Haeckel

*Department of Geography and the
Environment The University of Texas at Austin*

Ornamental species of the epiphytic genus *Tillandsia* (Bromeliaceae) are widely used in religious customs throughout montane regions of southern Mexico, possibly since pre-Hispanic times, and have be-

come increasingly common in international horticultural trade. Despite heavy religious and commercial demand, nearly all bromeliads in Mexico continue to be harvested from wild populations and are furthermore threatened by habitat degradation and loss. Although some recent research in Mexico has documented regional horticultural demand for epiphytic bromeliads and explored the potential for sustainable harvesting of these non-timber forest products (e.g. Flores-Palacios and Valencia-Diaz 2007; Wolf and Konings 2001), little is known about the magnitude and impacts of bromeliad harvesting for religious customs. Research was carried out in the Xalapa region of Central Veracruz, Mexico from 2006-2009 on the utilization of bromeliads in decorative frames known as arcos florales, which are raised at churches for Catholic feast days (Haeckel 2008). An inventory of adornments constructed in four municipalities was carried out during an 11 month period in 2006-2007 and all *Tillandsia* spp. inflorescences were counted using high resolution photographs. An estimated 25,073 *Tillandsia* rosettes of nine species native to local cloud forest were used in 57 adornments during the study period. *T. imperialis* E. Morren ex Roehl, endangered in Mexico, was identified in interviews with harvesters as the species most threatened by harvesting and was studied in further detail. Harvest rates of *T. imperialis* were estimated based on observations from five harvest excursions during summer

2008. From 2007-2009, I documented the growth, survival, and reproduction of approximately 1100 *T. imperialis* plants on 20 trees at a protected forest site. Lefkovich matrix models were constructed to model population dynamics, elasticity values were calculated, and harvest effects were simulated based on observed rates. Although survival, in particular of clonal plants, is the most important demographic process for *T. imperialis*, results suggest that harvesting of 10 percent of flowering plants per year could be sustainable. Challenges to the conservation and management of ornamental *Tillandsia* species are discussed.

3. Scientific and empirical based landscape classification for land-use planning in the Mexican Pacific coast

Minerva Campos Sánchez¹, Alejandro Velázquez Montes², Martí Boada Juncà¹, Gerardo Bocco Verdinelli²

Instituto de Ciencia y Tecnología Ambiental (ICTA), Universidad Autónoma de Barcelona. Campus Bellaterra. Edificio C. Torre 5. Planta 4. Cerdanyola del Vallès. 08193. Barcelona, España¹, Centro de Investigación en Geografía Ambiental, Universidad Nacional Autónoma de México. Antigua Carretera a Pátzcuaro No. 8701 Col. Ex-Hacienda de San José de La Huerta C.P. 58190 Morelia Michoacán. México²

There is an increasing recognition about how the local knowledge and practice, social perceptions and in general the multiple visions of local actors regarding

their relationships with ecosystems, can brought to light complementary information which may be used for scientific and land use planning purposes. It is believed that local people, precisely because of their long-term residence in the place they live, possess a wealth of knowledge about the local natural environment and ecological processes; in addition, they are able to effectively apply local management strategies and traditional forms of access. The goal of this study is to understand how peasants actually use and recognize the different landscape units and the environmental goods and services therein provided in a coastal ejido in the Mexican Pacific. To this end, we first identified landscape perception units (LPU), which were defined as those tracts of land that peasants recognize, describe and manage. Then we created the Landscape Perception Unit Importance Value Index (LPUIVI) which stems from the need to evaluate landscapes from a cultural standpoint; specifically, regarding their importance in providing environmental goods and services. Peasants primarily used three criteria for their typology: landform, soil, and land use and cover. From these, vegetation type and land use criteria were mostly used by farmers to classify the land. In the coastal region of Michoacan people showed a rich and complex knowledge regarding landscapes that depends on experience and types of cultural bonds to the land. Although LPUs are the result of a complex body of knowledge, landforms, soil and land cover seem to be significant attributes in landscape classification and use. Peasants have a more detailed classification of land cover types than soils, terrain or other features, although in the general

classification of the LPUs all these components were taken into account. The methodology and results presented in this study indicate that it is possible to analyze and evaluate in which way local experts perceive and use their landscapes, and how this information may be highly consistent with and thus complement scientific appraisals.

4. Plant species and their uses in homegardens of migrant Maya and Mestizo peasants in Calakmul, Campeche, Mexico

Korinna Neulinger¹, José Armando Alayón-Gamboa², Christian Reinhard Vogl¹

Working group: Knowledge Systems and Innovations, Division of Organic Farming, Department of Sustainable Agricultural Systems, University of Natural Resources and Applied Life Sciences Vienna, Vienna, Austria, 1180¹, Working group: Ecosystems and Sustainability of Socio-Ecological Systems (ESSES), El Colegio de la Frontera Sur (ECOSUR), San Francisco de Campeche, Campeche, Mexico, 24000²

Tropical homegardens are unique land use systems with high agrobiodiversity and important contributions to livelihood sustainability. In the year 2008 an ethno botanical research was conducted in Calakmul, Campeche, Mexico, a zone considered to be of high biocultural diversity. Problems addressed in this work are the loss of biodiversity and

of traditional knowledge on plants. Objectives: Identify the botanical composition in the homegardens, and to describe the knowledge and behavior of Maya and Mestizo peasants related to management and processing of products from the homegardens. Methods: An ethnobotanical survey was carried out on 20 homegardens in 4 immigrant villages in Calakmul, Campeche, Mexico. Data from plant species, management, and preparation of products was recorded by inventories and interviews. In addition, the botanical composition, the structure of the homegardens, the socioeconomic background and the traditional knowledge of the farmers was documented. A Ranking was applied to show the valuation of the farmers on different functions of the homegardens. Results: 310 plant species were identified, of which the most abundant families were the Leguminosae (29 species), the Euphorbiaceae (16 species) and the Palmaceae (13 species). The herbaceous plants were most abundant (119 species) and the most frequently found species were *Citrus sinensis*, *Chenopodium ambrosioides* and *Spondias mombin*. The most frequent use of plants is ornamental (41 %), followed by food (35%) and medicinal use (30%). 28 plant species were exclusively found in homegardens of Mestizos and 5 plant species appeared exclusively in Maya homegardens. The number of species varies between farms (32 - 141 plant species) and villages (111 - 203 plant species). Conclusion: The botanical composition of the homegardens is strongly related to the cultural background of the farmers. Nevertheless age, gender or culture (being Maya or Mestizo) does

not have an impact on the farmers' valuation of the different functions of home gardens. The high diversity of plants found in the home gardens and the ethnobotanical knowledge of the farmers imply that home gardens fulfill many needs in the livelihood systems of the farmers of Calakmul.

5. Process of domestication of *Stenocereus pruinosus* (Cactaceae) in the Tehuacan Valley, central Mexico

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The Tehuacán Valley is a principal area of plant domestication in Mesoamerica. There, artificial selection is practiced on nearly 120 native plant species with coexisting wild, silvicultural, and cultivated populations. Eight native species of columnar cacti are under domestication, and among them *Stenocereus pruinosus* is the most intensely managed. Objectives: Document how artificial selection operates on *Stenocereus pruinosus* through traditional management and whether it has determined morphological and genetic divergence between wild and managed populations. Methods: Semi-structured interviews were con-

ducted to 83 households of three villages to investigate motives and mechanisms of artificial selection. Management effects were studied by comparing variation patterns of 14 morphological characters and population genetics (4 microsatellite loci) of 264 plants from nine wild, silvicultural, and cultivated populations. Results. Variation in fruit characters are recognized by most people, which are the principal targets of artificial selection mainly directed to favor larger and sweeter fruits with thinner or thicker peel with fewer spines, and pulp colors other than red. Artificial selection operates in agroforestry systems favoring abundance (through let standing plants and planting branches) of the preferred phenotypes, and acts more intensely in homegardens. Significant morphological divergence between wild and managed populations was observed in fruit characters and in plant vigor. On average, genetic diversity in silvicultural populations ($H_e=0.743$) is higher than in wild ($H_e=0.726$) and cultivated ($H_e=0.700$) populations. Most of the genetic variation (90.58%) occurs within populations. High gene flow ($NmFST>2$) was identified among almost all populations studied, slightly limited by mountains among wild populations, and by artificial selection among wild and managed populations. Conclusions: Traditional management of *S. pruinosus* involves artificial selection which, despite the high levels of gene flow, has promoted morphological divergence and moderate genetic structure between wild and managed populations, while conserving genetic diversity.

6. El papel de los tianguis y/o mercados orgánicos locales en México en la conservación de la diversidad biológica y cultural

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En México desde el año 2003 surgen los primeros tianguis y/o mercados de alimentos orgánicos locales (TMEL), de manera independiente y en contextos distintos, pero siempre en las áreas urbanas y con base en las inquietudes de los consumidores, los cuales invitan a participar a campesinos y/o pequeños productores locales. Dichas iniciativas nacen de las preocupaciones sobre el riesgo que tienen para la salud, las formas actuales de producción, procesamiento y comercialización de los alimentos, así mismo sobre sus impactos en el medio ambiente y para favorecer la eco-nomía y mejorar la calidad de vida de las personas que intervienen en los TMEL. El objetivo fue conocer

el papel que los TMEL juegan en la conservación de la diversidad biológica y cultural. Trabajando en 6 de los 18 mercados que existen en México, la información se obtuvo a través de: a) Una encuesta a productores y consumidores, b) Dinamización de talleres; c) Entrevistas a profundidad a: coordinadores y/o promotores de los tianguis y/o mercados orgánicos, y a productores y consumidores para conocer su opinión sobre su participación en estas iniciativas y como valoran la diversidad de alimentos que se ofrecen. A nivel de unidad de producción se encontró que los campesinos y/o pequeños productores que participan en los TMEL, valoran y mantienen la diversidad en sus unidades productivas, tanto en los procesos de propagación y/o reproducción, como en la producción y procesamiento, utilizando elementos tradicionales que sumados con elementos tecnológicos actuales permiten mejorar su producción. A nivel de mercado local, se observó que si bien hay una diversidad amplia de alimentos, se ofrecen en total en los 6 mercados estudiados alrededor de 134 alimentos diferentes, de los cuales 25% son de origen mesoamericano. La oferta y la demanda de alimentos se ve todavía restringida a hábitos de consumo urbano. Lo que plantea la necesidad de fortalecer actividades de formación en los consumidores para integrar a su dieta alimentos tradicionales. Se piensa que los Sistemas Participativos de Garantía están colaborando en una apropiación a nivel local de la diversidad biológica y cultural, por la dinámica que se establece entre los actores.

7. Forest Conservation Programs on Indigenous Communities of the Huasteca Potosina, Mexico

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Mexico has structured one of the biggest programs in Latin America for forest conservation and restoration called Proarbol. The program managed by the National Forest Commission (CONAFOR) with the technical assistance and financial support of the World Bank and the Global Environmental Facility is devoted to create a market economy of the environmental services of the forest, especially in ejidos and communities threatened with deforestation and poverty (Muñoz-Piña, et al., 2008). The financial support goes to the local people as payments for their "custodianship" of the forests for five years and after that local communities are expected to become self sufficient to sell their forest custodianship to companies that might benefit directly from their forest preservation (Conafor, 2009). In the Huasteca Potosina, a region highly threatened by the forest conversion into agriculture and cattle ranching, a preliminary survey shows that the program has had different impacts among indigenous communities. Objectives: See how the Proarbol program has been implemented in the region to identify the elements of strength and weaknesses of the program among different indigenous communities. Methods: Field observations, geo-reference of the reforested areas, questionnaires to participants of

five communities and semi-structured interviews to technicians and NGO's were the preliminary data collected. Results: Logistical problems like receiving plants for reforestation at the beginning of the dry season and lack of maintenance of the reforested areas due to delays on the financial support or community interest on spreading the funds among all their members instead of the reforested areas were the main determinants for unsuccessful projects. Community cohesion, bigger patches of communal forest and long history on forest conservation were the main determinants for successful projects. Conclusion: Agricultural and cattle ranching are still threatening the region. Reforestation programs have been unsuccessful on reversing land use change in participating communities where there is no continuity on maintenance of reforested areas, especially in areas with long history of cattle ranching. Despite the logistical problems involved in the program, some communities have been able to overcome them with creative strategies and internal rules that work better for their local circumstances.

8. Developing a regional strategy for conserving agrobiodiversity: a new paradigm for the arid southwest

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The southwestern US and northwestern Mexico is an area of tremendous biological and cultural diversity—a so-called biocultural 'hot spot'. Indigenous farmers in the greater southwest were great innovators of agrobiodiversity. Since 1983, the non-profit group, Native Seeds/SEARCH (NS/S), has been working to conserve the diversity of agricultural crops that have been utilized by the many cultures whose homelands included the southwestern U.S. and northwestern Mexico. Though NS/S is considered a major regional seedbank, maintaining approximately 1800 accessions of domesticated crops and their crop wild relatives from the region, they utilize both *ex situ* and *in situ* strategies to conserve these genetic resources. Given the pro's and con's of both *ex situ* and *in situ* conservation strategies, a new paradigm for conserving agrobiodiversity in the southwest is envisioned that would utilize both strategies in ways that fully complement the strengths and minimize the weaknesses of each. Such a strategy would employ the important 'holding tank' function of *ex situ* genebanks, where static collections of crop varieties are stored for future use by plant breeders searching for genes of interest, combined with the dynamic processes that happen *in situ* between plants and people—the selection and management that occurs in farmers' fields and within communities—that is integral to both the development of agrobiodiversity and its utilization. Rather than 'reintroducing' old varieties that may once have been "locally-adapted" but are now less so due to climate change, accessions maintained in the

NS/S seedbank can be used to develop highly heterogeneous materials for distribution to indigenous farmers in order to jump-start the process of selection and adaptation once again. This not only maximizes use of genetic resources held in the seedbank but also increases the effectiveness of the farmer-breeding process by conducting selection under the specific environmental conditions in which the new varieties will be utilized. This new paradigm shifts the responsibility for crop improvement and conservation from solely that of researchers, plant breeders, or institutions per se to that of a shared network of participatory communities, and makes indigenous farmers in the greater southwest once again the great innovators of agrobiodiversity.

9. A Hawaii case study: knowledge of traditional gathering areas

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Humans depend on natural resources for subsistence and cultural perpetuation in rural communities around the world. It is well documented that indigenous cultures are being affected by growing urban populations, which are impacting traditional practices. In Hawaii, rural communities who rely on subsistence activities are being identified as cultural kipuka,

places within a contemporary setting where Hawaiian culture is able to be regenerated and revitalized. Land divisions or ahupuaa have different resource availability for gathering natural resources. Hakipuu is one ahupuaa, valley and stream of a rural community on the Northern end of Kaneohe Bay, Oahu that has been identified as an area with potential for reestablishment of cultural continuity and as being in need of immediate attention to protect its natural and cultural resources. In view of these threats, this study aims to identify the plants currently being gathered in Hakipuu and the plant community structure and composition of preference gathering sites. My hypothesis include: I) Areas where species are being gathered are near springs, and include more introduced than native species; and II) Each gathered species has multiple uses. My methods include historical landscape research, participatory rural appraisal, and measurement of plant community structure and composition. This will provide key information on how, where and what species are gathered and which are key species and sites for restoration that can mitigate any effects of overharvest and potentially increase the availability of resources gathered by the community. The information from this study will be used in creating a community resource map for Hakipuu. Community resource maps should be compiled for all cultural kipuka in Hawaii, with input and use by local gathers, in order to ensure cultural continuity and bring attention to threatened resource areas.

Food self-sufficiency and economic botany: a subsistence agriculture point of view

10. Ethnoecology and food sovereignty among the Songhai people of Niger: species, local knowledge, and implications for sustainable rural development

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The Songhai people of Niger live in the Sahelian zone of West Africa, along the intersection of the Niger River and its seasonal tributaries. The indigenous plants and fish sharing this ecological landscape contribute to the daily nutrition, economic stability, and cultural identity of the Songhai people. This local food system and its corresponding local knowledge have largely been understudied in scientific research and underemphasized in the implementation of food security and development programs. Objectives: To identify common edible wild plant and fish species, document local ethnoecological knowledge, and compare the roles of foods collected in the wild with foods produced from agricultural activities. Results and findings will be shared with the village of Tallé and the development community. Methods: Using participatory approaches, forty community members were selected in the rural village of Tallé to take part in ethnoecological research

between September and December 2009. We used qualitative interviews, free listing exercises, focus groups, and plant specimen collection to gather data. Results: Community members identified over thirty species of fish and fifteen species of wild plants that are consumed regularly. They are consumed independently (fresh or dry) and in combination with cultivated foods. Local agroecological concepts include soil classification schemes, companion plants, food preferences, and changes in diversity/availability, with varied responses depending on age and gender. Participants did not identify any development projects currently working with wild foods in the village. Conclusion and Next Steps: The local food system in Tallé is a combination of agriculture and environment, ingrained in seasonality, culture, and an intimate knowledge of the land. These wild foods are integral to sustaining the human population and contribute more than food security; they provide food sovereignty for the Songhai. The impact of sustainable development programs can be strengthened through consulting local expertise, integrating culturally/ecologically relevant foods, and informing food policy with local voices, both male and female. Next steps include: (1) documenting our research using photographs and voice recordings for the use of the people of Tallé, and (2) creating materials to share research findings with the sustainable rural development and research communities in Niger.

11. Economic contribution of home gardens in southern, Campeche, Mexico

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The homegardens are a year around food sources for peasant families and complement their income. This contribution depends on the emphasis placed by the family on the composition and diversity of the garden; and is based on a saving system for the family budget. Objectives: The objective of the research was to determine the economic contribution of homegardens on household income, and identify the main products for the families, based on its economic value. Methods: A randomly 60 homegardens was selected on three communities around the Calakmul Biosphere Reserve. Monthly interviews were applied to determine the investment and income generated by the different products harvested around the year. In addition, it was identified plant species with the most important economic value for the families. Results The family homegardens represented between 12% and 18% of total household income. This contribution was similar for that reported in family homegardens from Central American

countries. The botanic families that contributed with the higher economic income for households included species from the Rutaceae and Musaceae families. In addition, farm animals such as chickens, turkeys and pigs complemented the household income. Conclusion: The family home gardens in southern Campeche are a crucial component for peasants' economy. In this agrosystems, families produce a wide variety of plant and animal products for local market and represent a source of benefits throughout the year.

12. How local is local? traditional maize seed systems in the face of climate change in Mexico

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This study addresses the hypothesis that traditional maize seed systems may not be able to provide small-scale farmers with adapted landraces in the face of climate change even though Mexico is center of diversity for this crop. The spatial scope of

traditional maize seed systems in transects across an altitudinal gradient from 10 to 2980 masl in five states of eastern Mexico was studied. Transects represent three major maize mega-environments: lowland, mid-altitude and highland. A random sample of 20 communities in four transects were selected, with 20 households per community randomly chosen for a total sample of 400 households. An inventory of seed lots used by the households was elicited with the specific location where the seed was obtained and then mapped. Seed management practices and other socioeconomic and environmental information were gathered. To assess the potential climatic or environmental changes to the study area, downscaled outputs from three major IPCC global circulation models were used covering two time periods; 2020 and 2050. Potential environmental shifts in mega-environments are compared to the current spatial scope of traditional seed systems. Results show that traditional seed systems are very local with more than 90% of seed lots originating within a radius of less than 10 km of where they were planted, though with statistically significant differences across environments. Predicted climatic changes show substantial shifts in the spatial distribution patterns of the predominant maize agro-climatic environments. These changes were overlaid with the 10 km radius of seed origin to identify the extent that the current spatial scope of the seed systems overlaps with analogous maize environments predicted for 2020 and 2050. If predicted environments are similar, the scope of the seed systems is considered adequate; if not, farmers may need to get seed outside their traditional

ranges, in areas resembling the novel environment they will face. This may present information and access challenges because farmers may not know where to look for the required “new” germplasm. Interventions may need to be designed and implemented to allow traditional maize farmers to obtain “new” landraces to adapt to climate change.

13. Conservation of local maize varieties in Mexican traditional agriculture: Identifying the role of agrobiodiversity

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Agrobiodiversity refers to the interactions between biophysical resources, farmers’ endowments, agricultural management practices and utilized species. This concept can be used to understand on-farm conservation and management of local crop varieties. In Mexican traditional agriculture, maize diversity is influenced by farmers’ criteria to select certain traits of their seeds. With the introduction of improved, high-yielding varieties, it is thought that maize diversity will inevitably decline, since there are no incentives to

conserve local varieties. A survey was applied in a campesino (small-scale) agricultural community, in order to understand decisions on how many maize varieties are cultivated. The analysis uses a combined agrobiodiversity and livelihoods framework. The variables were divided into farm and livelihood resources, household characteristics, and off-farm labour. It was found that wealthier households tend to grow more varieties, although this does not necessarily correspond with available land. Instead, land fragmentation tends to increase the number of cultivated varieties. Amongst household characteristics, only gender ratio was found to have a significant effect on maize diversity, with female dominated households growing a higher number of varieties. Maize diversity is influenced by off-farm labour in multiple, complex ways, not completely captured by the survey. It is concluded that small-scale farming systems may be successful at on farm biodiversity conservation through internal incentives, such as insurance against climatic hazards, better adaptation to soil types, or cultural/culinary preferences. The agrobiodiversity framework applied to campesino communities can successfully link the agendas of both conservationists and development specialists.

14. Biodiversidad y seguridad alimentaria en el norte de Puebla, México

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El norte de Puebla es una zona de alta diversidad biológica, ambiental y cultural, localizada en tres regiones fisiográficas de México: la Sierra Madre Oriental, el Eje Transvolcánico Mexicano y la Planicie Costera del Golfo, presenta un gradiente altitudinal entre 100m y 2300m, mismo que se corresponde con un gradiente climático y de vegetación. En ella habitan cinco grupos étnicos y se reconocen más de 800 especies de plantas útiles, de las cuales alrededor de un tercio son comestibles. Objetivos: Analizar el papel de la biodiversidad en relación con la seguridad alimentaria en el norte de Puebla. Métodos: La información sobre plantas comestibles de datos sobre la flora útil de la Sierra Norte de Puebla se analiza y compara con datos oficiales de producción, censos de población y estimaciones del grado de marginalidad para conocer en qué medida contribuye la biodiversidad a lograr la seguridad alimentaria en esta región del país. Resultados: En el norte de Puebla se tiene un inventario de 230 especies de plantas comestibles, considerando los cultivos básicos, otras plantas cultivadas y especies obtenidas mediante recolecta, incluyendo, granos y semillas, frutas, quelites, raíces o ‘camotes’ y flores. De acuerdo con las estadísticas oficiales se tiene una producción de maíz que supera con más de 59 000 toneladas las necesidades alimentarias de la población y sin embargo la mayoría de los 59 municipios de la zona son considerados

con alta y muy alta marginación económica y social, y están lejos de lograr la seguridad alimentaria para toda la población. Conclusión: El binomio Biodiversidad-Seguridad alimentaria no es una ecuación de fácil solución y no basta la primera para alcanzar la segunda.

15. Diversidad de tipos de maíz en comunidades tzotziles de Chiapas

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En México, la siembra de maíz es "bimodal", la cual se expresa en el hecho de que una minoría son grandes agricultores, y una abrumadora mayoría, casi dos millones de pequeños agricultores producen para el autoconsumo o mercados locales. Para los zinacantencos, indígenas de las tierras altas de Chiapas hablantes de la lengua tzotzil, la supervivencia ha dependido intermitentemente del cultivo del maíz intercalado con frijol, en un sistema complejo de agricultura conocido como milpa. Objetivo: Proporcionar un análisis preliminar sobre la importancia y diversidad de maíz en dos comunidades tzotziles. Metodología: El área de estudio fue el municipio de Zinacantán, Chiapas.

Ubicado en el altiplano chiapaneco. Se eligieron dos comunidades, las cuales representan los tipos de tenencia de la tierra en la región, las comunidades fueron Pasté y Nachig. Se aplicaron 131 encuestas mediante entrevistas personales en el mismo número de hogares seleccionados al azar. 66 encuestas en Pasté y 65 en Nachig. Resultados: El 98.48% de los entrevistados de Pasté sembraron maíz, en tanto que de Nachig fue el 93.85%. Los 66 entrevistados de Pasté sembraron 98 lotes de maíz, 44 de maíz blanco, 45 de maíz amarillo, cinco de maíz rojo y cuatro de maíz negro. Mientras que los 65 entrevistados de Nachig sembraron 84 lotes de maíz, 39 de maíz blanco, 41 de maíz amarillo y cuatro de maíz negro. La media de tipos de semilla de maíz por productor fue de 1.48 para Pasté y 1.29 para Nachig. Conclusión Se encontró que el maíz se sigue sembrando en la mayoría de los hogares entrevistados. Con respeto al número de semilla por productor se observa una disminución significativa, Al respeto Cancian (1992) reporta para Nachig una media por agricultor de 3.9.

16. *In situ* conservation of maize landraces of Maya-Yucatecan milperos

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Milpa is the traditional system of maya shifting cultivation in 150,000 ha by year in the state of Yucatan. Local maize landraces are highly cultivated but scarcely known. Recently improve varieties were introduced by modernization programs. Objectives: Ethnobotanical analysis of *in situ* conservation landraces of maize in the milpas of Yucatan for rescue and genetic crop conservation. Methods: Collection and identification of maize landraces. Ethnobotanical questionnaires for milperos and demonstrative milpa plots of maize landraces. Results: Traditional Milperos Farmers from Yucatan, recognize Fifteen local or native populations of maize races, on Tuxpeno, Nal Tel and Dzit Bacal. The activities of the milpero family around *in situ* conservation of local seed stocks have corn-generic distinction, corresponding different responsibilities to women, mainly in food processing for consumption and in the case of men in agricultural practices, where both are complementary and defining mechanisms for decision making. The milperos classify their varieties of maize, and other crops considering phenological characters of plant and ear morphology, mainly in Mayan language terms evidencing a great ancestral knowledge about maintenance and use of genetic resources. Conclusion: Milperos from Yucatan conserves traditionally their maize landraces but some varieties of nal-tel race are reducing the cultivation frequency because introduction of modern varieties.

Ancient systems of food production

17. Ancient food systems of the Rio Negro (Brazilian Amazon) in an urbanization context

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The food systems of the Rio Negro region, in the Brazilian Northwest Amazon, are still typical Amerindian. They traditionally rely on agriculture and fishing, as well as on hunting and gathering. In this rich forest environment, at the side of a major river and its tributaries, a high number of animal species are known and exploited. The local agriculture is also characterized by a high biodiversity. Around cassava (and its numerous varieties), many fruit trees, tubers and annual species are grown. Until recently, most inhabitants lived in small communities, dedicating they time to extractivism and auto-subsistence activities. By exchanging forest products against outside products, they have been using, for several decades, food and beverage items such as sugar, coffee, cans, salted meat, industrial drinks and alcohol, but in a proportion that was not strongly affecting their traditional diet. Nevertheless, in the last fifteen years, many people have migrated to the towns of the region, originally very small but where the population tremendously increased. A certain proportion of the

population still practises agriculture in the peri-urban area, but fish and game have become scarce around the urban centers, and more and more people are employed in service activities, so that they dedicate less time to subsistence activities. Moreover, young people are less and less willing to follow their parents' traditional model. Urban inhabitants' diet still follows the traditional model but relies more and more on products such as industrial drinks, frozen meat, rice, beans and even cassava flour produced outside of the region, of much lower quality than locally produced food. How would it be possible to maintain the traditional access to a very wide variety of foods issued from the natural resources? Attempts are being made in the research project, in partnership with the local associations, to value local food and agricultural systems, but may it resist to trends of globalization?

18. Ethnobotanical contributions to safeguard biodiversity, diversify livelihoods and preserve indigenous knowledge through rainforestation farming in mountainous regions of Xishuangbanna, Yunnan, China.

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Agricultural productivity and the availability of wild foods are strongly connected to the well-being of the world's poorest people. There is an increasing need for innovative agricultural approaches for poverty reduction. Those seek to enable the rural poor to expand their economic opportunities while sustaining and enhancing their forests and other biological as well as cultural resources. The combination of indigenous knowledge and contemporary science is promising to build a shared understanding of the value of biocultural diversity for the improvement of local livelihoods, with a view to influencing strategies that can reduce poverty and conserve nature. A solution for diversifying rural income while conserving biodiversity and ecosystem services in Xishuangbanna is Rainforestation Farming. Rainforestation represents a highly diverse land-use system for the humid tropics. Through this, degenerated former rainforest areas are ecologically and economically rehabilitated in a near-to-nature approach by using indigenous trees as combination of timber- and fruit trees and shade-tolerant annual and perennial crops for optimum diversification. The Rainforestation Farming system therefore combines biodiversity protection with production and offers additional benefits like carbon sequestration, water retention, erosion control and habitat to a maximum of accompanying flora and fauna. The viability of this land-use concept depends upon linking it with what has been recently called 'Biodiversity Business': a commercial enterprise that generates profits through activities which conserve biodi-

versity, use biological resources sustainably and share the benefits arising from this use equitably. Ethnobotanical data generated from Lahu, Akha, and Dai ethnic communities initially provide important information about indigenous species utilization, which can further be processed for actions ranging from conservation of plant genetic resources, ecosystem rehabilitation and knowledge rejuvenation, to knowledge- and biodiversity-based productive systems for endogenous, self-directed development and income generation. The presentation will communicate initial research findings and practical implementation examples in key ecosystems of the region.

Etnobotany of economic plants local knowledge, commerce and sustainability

19. Observations on the traditional phytotherapy among the inhabitants of Gopalganj district of Bangladesh

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Plant materials are being used from time immemorial as one of the main sources of medicine to combat various diseases. Gopalganj district is one of the less studied regions of Bangladesh for its ethnomedicinal values. The district has about 1.1 million inhabitants and its surface area is 1,490 square kilometer. Objectives: The present paper synthesizes the first report related to the documentation and conservation of ethnomedicinal plants of Gopalganj district and their socio-economic relationship with the forests and its resources, this knowledge is impressionistic and not well documented. Methods: Ethnomedicinal data were collected using semi-structured interviews, field observations, preference and direct matrix ranking with traditional medicinal practitioners. Information was also collected by interviewing native people, mainly elderly:

engaged in farming and stock-raising activities and housewives. The plant samples collected, indicated by the locals or traditional medicinal practitioners, has been identified according to "Flora of Bangladesh". The exsiccata vouchers are preserved in the Bangladesh National Herbarium. Results: First-hand information about 108 plant species belonging to 093 genera and 079 families were recorded during extensive field surveys carried in Gopalganj district of Bangladesh; which are therapeutically used against different diseases such as gastrointestinal problems, respiratory tract infections, joint pains, fevers, mental health problems, wounds, baldness, skin disorders, diabetes, sexually transmitted infections, tumor, chickenpox, snake-bites, hepatitis, miscarriage, cancer, hypertension, edema, cholera, rabies, mumps, eye inflammation, maternal and adolescent health hygiene. Part of the plant used, dosage and the mode of drug administration in different ailments are described. No significant correlation was observed between the age of traditional medicinal practitioners and the number of plants reported and the indigenous knowledge transfer was found to be similar. More than one plant species were used more frequently than the use of a single species for remedy preparations. Plant parts used for remedy preparations showed significant difference with medicinal plant species abundance in the study area. Conclusion: A number of these plants are becoming highly endangered.

Documenting the eroding plants and associated indigenous knowledge can be used as a basis for developing management plans for conservation and sustainable use of medicinal plants in the area.

20. An ethnobotanical survey of plants used to treat sexual transmitted infections by a rural community of northern KwaZulu-Natal, South Africa

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The study area is in a very poor region with 45% households without formal income. As a result most of the men migrate to urban areas in search of employment. Male migration has been associated with high-risk sexual behavior and elevated risk of infection. The latest data estimated that 26.4% of KwaZulu-Natal's working age population is HIV positive. A major reason for this high rate is the high occurrence of other sexually transmitted infections which facilitates the transmission of HIV. It is estimated that 70% of South Africa's population make use of plants in their cultural life and to cope with health problems. This is the first ethnobotanical survey in South Africa to gain information on plants grown in homesteads for treating sexual transmitted diseases (STI's). Objectives: To docu-

ment the ethnobotanical knowledge on the usage of plants to treat STIs by a rural community in northern KwaZulu-Natal. Methods: Interviews were conducted with 80 homestead inhabitants, using structured questionnaires. The focus was on plants which grow in and around the immediate vicinity of homesteads. Results: Thirty eight plants species were recorded as being used to treat STI's. They are represented by 28 families, from which 31 species are indigenous to South Africa and 7 species are exotic. No literature could be found on the use of 11 of the species for treatment of STI's. The three most mentioned plant species are: *Hypoxis hemerocallidea* (22%), *Senecio serratuloides* (22%) and *Ranunculus multifidus* (15%). Most of the plants species are used in different combinations for better efficacy according to the interviewees. The remedies are drunk as an infusion or taken as an enema. Conclusion: The wide variety of plants that are used to treat sexual transmitted diseases in this area supports the value that medicinal plants can have in the primary health system of the rural people in northern KwaZulu-Natal.

21. The Mexican lotus (*Nymphaea ampla*) and the Feathered Serpent: equivalent conduits to the Maya spiritual realm

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The symbolic role of the Maya water lily, *Nymphaea ampla* DC., has been fraught with speculation and debate since the pioneering monograph of Rands. One perennial suggestion is that the plant was employed as a euphoric by Maya elites, owing in large part to the ritual use of water lilies in libation scenes of ancient Egypt and Mesopotamia, where in time's past the same plant was closely associated with a solar god and a feathered serpent. A systematic study of water lily symbolism in the lowland tropics of Mexico and Central America indicates that the Maya lotus is similarly associated with a solar god, a feathered serpent, and a facial image of this reptilian creature called Chaac. Pre-Colombian images of these deities are consistently surrounded by *Nymphaea ampla*, often by placing stylized renderings of the plant's flowers in the mouth, eyes, and ears of these gods. Indeed, one enduring name for the Maya lotus in modern Yucatec is xikin chaac ('ear of Chaac'). Since the feathered serpent is often depicted in Maya art and architecture as a conduit through which dynasts and priests communicated with their gods and ancestors, usually by facing the maw of the 'vision serpent', iconographic evidence lends credence to the hypothesis that *Nymphaea ampla* was employed as an entheogenic medium. A re-analysis of the physical attributes of the feathered serpent indicates that this widespread Mesoamerican motif is a theriomorphic symbol of the water lily, whose writhing body represents the plant's peduncle, and whose feathers represent the plant's corolla. This perspective casts a new light on the mysterious beliefs and religious practices of ancient Mesoamerica.

22. The African herbal pharmacopeia - challenge and potential

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The African continent encloses some 40-45.000 higher plant species that present enormous industrial potential. Africa contributes 25% of the global pool of plant genetic resources currently being traded. While over 5.000 plants are known to be used medicinally, few have been described and studied. This gross under-utilization is further challenged with massive loss of biodiversity. In spite of these challenges, Africa has contributed to the world's leading commercial medicinal plants with *Aframomum melegueta*, *Catharanthus roseus*, *Cryptolepis sanguinolenta*, *Griffonia simplicifolia*, *Harpago-phytum procumbens*, *Hoodia gordonii*, *Prunus africana*, *Rauvolfia vomitoria*, to name just a few. The enormous potential for the business and agricultural sectors in African countries can only be exploited with internationally recognized quality standards in place. The absence of the latter is a major barrier to regional and international trade. The preparation and publication of the African Herbal Pharmacopeia by the Association of African Medicinal Plant Standards (AAMPS) proposes to help address these issues. Fifty four important

African medicinal plant species have been described comprising relevant safety, efficacy and quality data in order to promote the cultivation and trade of these important medicinal plants. The present paper will elaborate on the documenting and studying African medicinal plants and the potential they represent for the continent in terms of trade and business.

23. East African plant use – differences in plant use between nomadic and agricultural societies

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This paper examines the differences in plant use between the Kikuyu, Maasai and Samburu societies in Kenya. The Kikuyu people mostly occupy the Central Province of Kenya. Farming is the main economic activity in the area with coffee and tea as the main cash crops. This region has high population density and large concentration of forests, which are facing intense pressure due to over-utilization and hence medicinal plants may be disappearing before their uses are documented. The Samburu are pastoralists in Northern Kenya, and have to a larger extent maintained their traditional lifestyle. The "Il-Purko" Maasai live as pastoralists in the South of the country, to which they were moved from Central Kenya by the British Colonial Administration in 1904. This makes their comparison to the other

groups studied particularly interesting. Traditionally the nomadic tribes attribute most illnesses to the effect of pollutants that block or inhibit digestion. This can include "polluted" food, contagion through sick people as well as witchcraft. In most cases the treatment of illness involves herbal purgatives to cleanse the patient. There are however frequent indications of plant use for common problems like wounds, parasites, body aches and burns. In contrast, the agricultural Kikuyu regard health problems more as caused by spiritual effects, e.g. the influence of an enraged ancestor. The differences in lifestyle and assessment of health needs clearly are reflected in the plant knowledge of the study groups. The Samburu have retained a very large plant knowledge, with 249 plant species used in daily life. The Maasai in contrast used only 99 species. The agricultural Kikuyu used the largest number of plant species, which also reflects their privileged location in an ecotone that contains both, savanna and large forest tracts, and thus the most diverse flora of the country.

24. Plant management in the Tehuacán Valley

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Studies on interactions between humans and plant commonly recognize two main strategies: gathering and agriculture. However, archaeological and ethnobiological researches have provided valuable information documenting a broader spectrum of interactions. The Tehuacán-Cuicatlán Valley is an important scenario of domestication of plants and for documenting their management forms. Objectives: Our study was directed to characterize the spectrum of management types and levels of intensification involved. Methods: Ethnobotanical researches were conducted by the authors in 12 villages of five indigenous groups and Mestizo people of the region. The information was organized in a data base, and then detailed and got to a consensus through a series of workshops. Results A total of 1608 useful plant species were identified, 610 of them with at least one management type other than simple gathering. Managed species are mainly used as food, fodder, medicinal and ornamental, belonging to 101 plant families. Most management forms involve artificial selection at different intensity levels. Nearly 60% managed species are native to the region and the rest are introduced

from other regions of Mexico and the World. Conclusion: The information allows visualizing co-occurrence of incipient and advanced forms of management at different intensity levels within and among species, which helps to postulate testable hypotheses on factors influencing plant management and domestication in an important area for studying the origins of agriculture.

25. The ethnobotany of *Ficus* in Barbados

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The genus *Ficus*, containing some 900 species of trees, shrubs and vines found throughout the tropics and subtropics, is one of the largest, most varied and most celebrated member of the diverse Moraceae family, and in Barbados, it is represented by one native species, *Ficus citrifolia*, and fifteen introduced species, some of which, like *F. microcarpa*, *F. benjamina* and *F. elastica* have several distinct varieties. Based on fieldwork done in 2006, 2007 and 2009, this paper looks at the ethnobotany of *Ficus* in Barbados and reports for the first time that *F. microcarpa* var. *nitida* is now naturalized in Barbados. Figs are widespread in the landscape of Barbados where they are often the most extraordinary trees present, and it is noteworthy that the island is generally believed to have received its name from the native bearded fig, *F. citrifolia*. *Ficus* spe-

cies are frequent along roadsides and city streets and are also common in home environments, parks, and public and private gardens. They are also featured in the landscape grounds and interior spaces of many institutions, private associations and commercial establishments including offices, shopping malls and resort hotels.

26. Especies medicinales y comestibles toleradas en los traspatios en la comunidad de Ixhuatlancillo, Veracruz, México: agrodiversidad y diversidad organizacional

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Se estudiaron las especies medicinales y comestibles existentes en los traspatios de la comunidad de Ixhuatlancillo, Veracruz, México con el enfoque de la agrodiversidad y la diversidad organizacional desde el punto de vista de la agricultura de subsistencia. La población en general tolera especies medicinales y comestibles tanto silvestres como cultivados

(legumbres, medicinales, condimenticias y ornamentales: flor-follaje). Se detectaron diferentes espacios: solar, traspatio y parcela familiar. Se registraron 297 plantas con 170 plantas comunes a todas las unidades familiares. Son adquiridas por intercambio entre unidades familiares, recolección directa del ambiente natural y por compra directa en mercados locales. En cuanto a la diversidad organizacional, tienen seis diferentes tipos de labores culturales y más de cinco momentos para hacerlos a lo largo del año. Se registran siete rangos de edad (desde 20 años hasta 90) y nueve grados de parentesco para las labores hechas tanto por hombres como por mujeres. En ningún caso reciben remuneración económica. La mujer (madre, abuela o suegra) es el elemento principal de la cadena de transmisión del conocimiento, sobre todo para las especies medicinales. En cuanto a la distribución, se registran dispuestas en jardines frontales, al inicio del solar trasero, cerca de la cocina y del lavadero. Las personas cercan o protegen sus plantas para evitar problemas con sus animales de crianza (gallinas, borregos, cabras entre otros). Utilizan plástico, madera o rafia. Muchas plantas son sembradas primero en recipientes y posteriormente se trasplantan. En términos generales, existe un conjunto de acciones y actividades específicas que indican que las personas en la comunidad de Ixhuatlancillo, toleran y fomentan tanto plantas comestibles como medicinales, silvestres ó cultivadas. Las primeras como parte de la atención primaria de su salud y las segundas como base de la subsistencia familiar. Hace falta hacer análisis más detallados. Sin embargo, este acercamiento

a la agrodiversidad y diversidad organizacional de la comunidad de Ixhuatlancillo, es importante para entender cómo se da el trinomio hombre-planta-ambiente, retomando los valores culturales y tradicionales para el manejo y protección del germoplasma vegetal.

27. Etnobotánica de plantas con aplicación en la medicina tradicional en la zona de la Sierra de Tabasco, México

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En las comunidades alejadas de las cabeceras municipales, y a la vez aledañas a la selva, las mujeres utilizan en el hogar la biodiversidad vegetal cercana para alimentarse, proveerse de utensilios y combustible, curarse, entre otros usos. El conocimiento de las plantas medicinales está vivo dentro de la experiencia en cada miembro de la comunidad. Por medio de diversos estudios se sabe que la mayoría de las especies vegetales poseen propiedades bactericidas, anti-inflamatorias, antivirales, antipiréticas, insecticidas y fungicidas. Objetivo: Recuperar, transcribir e identificar el conocimiento que sobre las plantas

poseen las mujeres en el seno familiar y que utilizan para curar diversas enfermedades así como la forma en que las preparan, combinan y aplican. Métodos: La información fue recuperada a través de una encuesta aplicada a informantes clave (mujeres) en comunidades bilingües de los municipios de la zona sierra de Tabasco en donde se obtuvieron datos generales, aspectos endoculturales, forma de uso de las plantas medicinales, producción y comercialización. Las plantas enlistadas se clasificaron de acuerdo a la enfermedad para la que son administradas registrando la parte vegetal utilizada y la forma de uso. Resultados: Se encontraron 122 plantas medicinales y las partes utilizadas incluyen la savia, semilla, rizoma, resina, corteza, tallo, fruto, raíz, flor, hoja y la planta completa. Las diferentes plantas mencionadas se usan para combatir diversas enfermedades tales como diarrea y dolor de estómago, golpes, picadura de insectos, parásitos, fiebre y vías respiratorias, inflamación, diurético y riñones, afecciones cutáneas, enfermedades culturales. Se utilizan en forma de infusión, macerado, cataplasma, tintura, baño, frotado. La forma de preparación de las plantas medicinales es empírica y la conservación de las mismas se está realizando con la deshidratación en forma de manojos colgados a la sombra para realizar la preparación necesaria en cualquier época del año. Conclusión: El conocimiento de las plantas medicinales es amplio en diversidad y las aplicaciones para los diversos tipos de enfermedad y las formas de aprovechamiento varían en cada núcleo familiar.

28. Significance of food plants bartering in traditional markets of the Tehuacán-Cuicatlán Valley

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Bartering is an exchange of goods without using money. In Mexico this is a pre-Columbian transaction currently occurring in traditional areas, in which none of the parts obtains gains since it involves an exchange of equivalent goods. Bartering remains being important in the traditional markets of the Tehuacán-Cuicatlán Valley where people exchange a number of plant species both cultivated and collected from natural ecosystems. Objectives: The study aimed at analyzing strategies of bartering of edible plants in traditional markets of the region and assessing their implications for the economy of households of local people. Methods: The six main regional markets were visited throughout one year. Persons practicing barter of food plants were identified and inter-

viewed in relation to the equivalencies and the role of the practice in their economy. Plants exchanged were collected and identified. Results: Bartering occurs in 80% of the markets studied and is carried out mainly by women. The market of Ajalpan was the one where this transaction was observed more frequently. We identified 43 species of edible plants exchanged through barter. The products are most frequently exchanged are seasonal fruits of columnar cacti (xoconostle, jiotilla), native trees (chupandia, tempesquistle), and cultivated trees (mango, zapote), and maize. Bartering is specially high in holidays like the day of the death, Easter, and Christmas. The quality of the products traded (size, amount, maturity) is an important variable in the negotiation. Conclusion: Bartering is a complementary exchange system which positively affects the family economy on producers and/or consumers of traditional markets in the region. Most edible plants are native and exchanged seasonally; however, this exchange system is declining.

29. Conocimiento y consumo de hongos silvestres comestibles en Durango, México

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El conocimiento y consumo de hongos silvestres comestibles es importante entre los mexicanos, principalmente del centro del país, pero conforme se avanza hacia el norte de México el conocimiento y consumo se reduce a pocas especies. En Durango la población no indígena aparentemente conocen y consumen menos especies que los indígenas tepehuanos. Objetivos: Determinar el conocimiento y las especies de hongos silvestres comestibles que consumen los habitantes de El Salto, P.N, Durango, México. Métodos: Se aplicaron 100 encuestas al azar, durante la temporada de lluvias julio a septiembre del 2009, Las encuestas fueron diseñadas con 22 preguntas, de estas 17 de opción múltiple o de tipo cerrado y 5 abiertas para recibir comentarios. Resultados: El 98% de los encuestados conocen los hongos, el 95% los comen y el 62% lo hace por tradición familiar y el 84% consideran que el sabor de los hongos es bueno. Las seis especies de hongos silvestres comestibles que conocen y consumen son: *Amanita caesarea* (Scop. Ex Fr.) Grev. (amarillos), *Hypomyces lactifluorum* (Schw.) Tulasne (orejas de cochino), *Ramaria flava* (Fr.) Quel. (arrocitos), *Hericium erinaceus* (Bull.:Fr.) Pers (melena de león), *Boletus edulis* Bull. ex Fr (marquezote) y *Agaricus campestris* Linnaeus: Fries (llanero), poca gente consume las seis especies. Conclusión: El conocimiento y consumo de hongos es menor a los indígenas tepehuanos, y a los habitantes del centro del país, pero al igual que ellos los colectan para complementar su alimentación y ayudar a palear su déficit económico, al sustituir de manera importante algunos alimentos que adquieren el mercado local.

30. Agrobiodiversity in an urban environment: The importance of foods as medicines

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A comparative ethnobotanical survey among Dominicans living in New York City and the Dominican Republic showed that plant species usually considered as foods, e.g. avocado (*Persea americana* Mill.), are also commonly used as medicines. We recorded a total of 124 and 109 foods used as medicines (or functional foods), hereafter called food medicines, in New York City and the Dominican Republic, respectively. Culturally salient food medicines were lime and lemon (*Citrus limon* (L.) Burm. f. and *Citrus aurantifolia* (Christm.) Swingle), bitter orange (*Citrus aurantium* L.), cinnamon (*Cinnamomum verum* J. Presl and *Cinnamomum aromaticum* Nees), garlic (*Allium sativum* L.), onion (*Allium cepa* L.) and coconut (*Cocos nucifera* L.). These and other food medicines are readily available in supermarkets, Latino grocery stores (bodegas) and botánicas (ethnic health shops) in New York City. The importance of food medicines seems to increase after a person immigrates to the urban environment: Dominicans in New York City reported on average significantly more food medicines than their peers in the Dominican Republic. Knowledge of

food medicines was similar in younger versus older Dominicans across rural, urban and transnational landscapes. Food medicines were used in versatile ways. For the majority of species, the edible plant part was taken internally, but the preferred mode of use for many other species was ingestion or application of the non-edible plant part. We hypothesize that the popularity of food plants being used as medicines is due to their general availability in rural as well as urban environments, versatility of use, cost effectiveness, non-proprietaryness, and/or importance as markers of ethnic identity. These results demonstrate the resilience of cultural plant knowledge about food plants, even in challenging times of general loss of traditional knowledge worldwide. The results further show that the importance of agrobiodiversity extends well beyond the field of nutrition to incorporate other essential aspects of human well-being, such as healthcare.

31. Ethnobotany of Mexican bamboos: an important resource

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Mexican bamboos are represented by more than 40 native species, and 15 are endemic. They are distributed in tropical and temperate forests. In

addition, eight exotic species have been introduced as ornamentals or as plantations. Bamboos are used in multiple ways, and some regional uses have not yet been documented. Objectives: To determine the bamboo species utilized in Mexico as well as to describe the way they are used to elaborate crafts. Methods: Bibliographic references, as well as herbarium specimens were utilized to identify which bamboo species were used. A data base called BAMBusos was built to store bamboo uses information. Results: In Mexico, bamboos have been used by various native and rural communities to satisfy basic necessities: shelter, fuel, as well as construction of musical instruments and crafts. Traditional bamboos uses play an important role in the totonaca ceremonies. More than 100 crafts were registered and stored into BAMBusos database. Information on: bamboo taxonomy (scientific name, vernacular name, botanical description, distribution in Mexico and selected bibliography), morphological structure used (rhizome, culm, branches etc.), type of uses (crafts, rural house, ornamental, furniture, ceremonial etc.) and images of the craft or uses were collected. Methods to elaborate selected crafts and furniture were obtained from Monte Blanco and Cuetzalan communities. Conclusion: Bamboos are a natural forest resource in Mexico with a high potential to satisfy basic necessities. Traditional bamboo uses still play a strong role in the traditional communities and they are an example to sustainability of natural resources.

32. Native plant names and uses known to school children in 5 countries: Guatemala, Dominican Republic, El Salvador, Nicaragua and United States (Crow and Lakota)

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During 2007 and 2008 surveys were taken in 7 schools located in 5 countries. One survey was done in Guatemala (n = 41), El Salvador (n=170), The Dominican Republic (n=86), a Lakota school (n=178) and a Crow school (n=109). Two schools were surveyed in Nicaragua (n=58). Objective: The objective was to compare local plant use knowledge among children (8-18 yrs.) from different countries and from different ethnic groups. In addition to documenting plant uses, the indigenous plant names known by students were tallied and compared. Methods: The same survey questions were asked in each school. Students were asked to free-list 3 native plant species they knew were used for medicine and another 3 used for food. Results: The number of native medicinal plants species listed ranged from 10 species among Crow students to 26 species in Nicaragua. The number of native edible plants listed ranged from 10 species among Lakota students to 37 species in El Salvador. The use of indigenous plant common names (Náhuatl, Taíno, Mayan, etc.) was most prevalent for food plants in El Salvador and Nicaragua (86%) while indigenous common

names for medicinal plants were more prevalent in the Dominican Republic (78% of names listed). In contrast, the only indigenous plant name listed by Crow students was shússhua (tea). Comparisons of the most utilized plant species and the most prevalent plant uses in each school are also summarized. Conclusions: The Dominican Republic and 3 Central American students had a greater knowledge of indigenous plant names and plant uses than did Native American students in the United States. Plants used to treat ethnomedical syndromes such as "mal de ojo" and "aire" were most prevalent among El Salvador students.

33. Integrating ethnobotany with cultural landscape protection in the Amalfi Coast (Southern Italy)

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The main instruments to protect cultural landscapes should be related to agriculture, since the role of farming is generally crucial in these landscapes. In Amalfi Coast people still have a close relationship with their land and agriculture is mainly practiced on terraces with traditional methods. Unfortunately, in the last decades agriculture has become to decline and many terraces have been abandoned. Objectives: To evaluate the economic impact of some

native species of Amalfi Coast with naturalistic value and/or with traditional uses within a model integrating landscape elements with economic issues. Methods: A preliminary ethnobotanical survey was necessary to understand practices and traditions related to plants. Data were collected through random semi-structured interviews based on a preformed questionnaire (years 2006-2009). An experimental field was set in order to test the cultivation needs of 13 native plants with either ethnobotanical uses or naturalistic values. Data on physical factors were collected during previous researches. The relationships among the different factors which may affect the cultivation of terraces were hypothesized within a model built using Vensim®. Results Many plants (179 species) have an ethnobotanical use: many uses are still actual (464) while others (104) are probably disappearing or disappeared (199). Many native plants are gathered or cultivated in home gardens, some are widely used (traditional dishes, handicrafts, agricultural practices), and others are appreciated for their aesthetic value. The cultivation of the selected native plants in the experimental field gave encouraging outputs. Within the model, "fires" is the factor that affects the most the stability of abandoned terraces, while "crop selection" and "distance to market" are the factors which mainly influence the maintenance of cultivation. The experimental cultivation of the native plants turned out to be cheap and not demanding and thus, a potential successful strategy. Conclusion The cultivation of terraces in Amalfi Coast with local plants is a multifunctional system since agricultural practices imply economic production,

the preservation of some traditional practices but also the maintenance of the cultural landscape and of the hydrogeological equilibrium provided by terraces. Possible scenarios generated by the model may be useful for planning actions.

34. Wild Edible Plant Knowledge by the Turumbu, Mbole and Bali ethnic groups, District Tshopo, Oriental Province, DR Congo

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Documenting and revalorizing the rapidly disappearing indigenous knowledge on wild edible plants (WEP) is essential to promote health and preserve diversity. Until now, only a few fragmented studies have been conducted on WEPs in and around Kisangani (capital of the Oriental Province with a population of mixed ethnic origins). No specific ethnobotanical data could be found for most of Tshopo District's indigenous populations. Objectives: 1) Document and compare WEP knowledge of the Turumbu, Mbole and Bali. 2) Identify local species preferences for further study and domestication. Methods: To document maximum diversity in plant species and utilisations, we selected 3 different tribes in 3 different territories of Tshopo District. Focus group discussions were

organized in 3 villages per ethnic group. Village inhabitants were asked to cite all edible plants they know and use without cultivating them ('free listing'). Per plant, plant parts used, preparation methods, availability, other-than-food uses and commercial potential were discussed. Participatory ranking exercises were organized in separated gender groups to evidence local preferences in wild fruits and vegetables. Results: We documented in total 166 WEPs (165 species and 2 varieties) in 71 families. The Turumbu know and use 85 WEPs, the Bali 86 and the Mbole 99. Jaccard similarity indices between 2 villages of the same ethnic group were significantly higher than those between 2 villages of different ethnic groups. The 166 WEPs have 198 different plant parts that are used for 228 different specific food uses. *Tetracarpidium conophorum* and *Landolphia owariensis* are sold in all villages, *Piper guineense* in 8 of the 9 villages and *Megaphrynium macrostachyum*, *Cola acuminata*, *Dioscorea praehensilis* and *Anonidium mannii* in 7 of the 9. Over all villages, we recorded 57 use reports for *Aframomum laurentii*, 47 for *Canarium schweinfurthii*, 46 for *Laccosperma secundiflorum*, *Costus lucanosianus* and *Piper guineense*, 44 for *Megaphrynium macrostachyum* and 42 for *Landolphia owariensis* and *Anonidium mannii*. Conclusion: WEP knowledge is still very active in Tshopo District and closely related to cultural identity ('biocultural heritage'). Inventories and preference rankings should be complemented by nutritional analyses and market studies to set priorities for further study and participatory domestication.

35. Integración al mercado local y biodiversidad: Grupo de herbolaria "Hamelia"

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Desde un enfoque de género, la empresa rural puede ser una instancia para el empoderamiento social y económico de las mujeres, así como para que éstas participen en la conservación de recursos biológicos. La inclusión en el mercado de las empresas rurales de mujeres implica grandes retos, algunos de los cuales pueden ser abordados con la planeación estratégica. En este contexto, el grupo de productoras "Hamelia" de la Reserva de la Biosfera "Los Tuxtlas" en Veracruz, elabora productos cosméticos y medicinales usando conocimientos etnobotánicos y es un ejemplo de las circunstancias que experimentan estas empresas. Objetivos: Analizar la organización y determinar la dinámica del grupo de herbolaria "Hamelia" desde un punto de vista de género y de la planeación estratégica. Además de esbozar elementos que contribuyan a su competitividad en el mercado. Métodos: La metodología consistió en la realización de entrevistas estructuradas y semi-estructuradas, y la observación participante para obtener informa-

ción sobre elementos administrativos del grupo y sobre la situación de género, el uso de plantas y aspectos socio-económicos de la comunidad "El Pescador". Así mismo se aplicó un análisis de planeación estratégica. Resultados: El grupo de herbolaria "Hamelia" es un agente hasta cierto grado exitoso para asegurar el bienestar y conservación de recursos etnobotánicos. Las mujeres de "Hamelia" han vivido un proceso difícil al modificar sus roles de género tradicionales, aumentar sus responsabilidades y tener que equilibrar sus actividades reproductivas y laborales, lo cual ha condicionado su participación en la producción y la administración de la empresa. No obstante, el análisis estratégico realizado demuestra que las fortalezas del grupo tales como la división del trabajo, la adecuada administración de recursos y su conocimiento etnobotánico, han contribuido a su éxito. Conclusión: El análisis destaca la necesidad de fortalecer la planeación estratégica del grupo "Hamelia" para establecer procesos de control de calidad y de manejo de inventarios que garanticen una producción constante, lo cual sumado al conocimiento empírico y las habilidades de sus miembros, habilitará al grupo para incursionar en mercados especializados con mayor valor agregado, acceder a mejores fuentes de financiamiento y ser más competitivo.

36. Environment and gender: Nipa roof shingles from *Nypa fruticans* (Arecaceae), in Palawan, Philippines

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This study looks at house construction, particularly the roofing, of Nipa huts in the Philippines. Nipa palm, *Nypa fruticans*, (Arecaceae), is a mangrove species distinct from many other mangrove species, because it is in the palm (Arecaceae) family. *N. fruticans* grows amongst other mangroves in Asia, Oceania and the east coast of Africa. Used for house construction throughout Southeast Asia, this case study area is in the village of San Jose, on Busuanga Island, located in the Calamian Group of Islands, at the northern tip of Palawan in the Philippines. Objectives: To understand how people use nipa and the environmental and gender issues that relate to the utilization, cultivation and harvesting of this plant. Furthermore, the research looks at the effects of society where external factors influence traditional labor forces. Methods: 15 families in San Jose were chosen in order to do an in-depth study about the palm and the plants' role in the culture. Data were collected through semidirective interviews, and plant collection. Results: Men harvest the fronds from the palms, and also usually remove the leaflets. Women do the weaving or sewing of the leaflets to make the shingles. These are for personal use and also for selling. Most material is collected from wild palms, although some come from plantations. The plantations in San Jose are owned by the women of the family. The shingle industry is threatened by environmental dangers and also the growing

tourist industry. Conclusion: The role of women within the family structure is shifting as a result of the nipa shingle industry changes. As women sell fewer shingles, they reduce their income and thus reduce their power within the family. People are searching for a balance between taking advantage of new economic opportunities and maintaining a traditional industry.

37. Past, present, and the future of a magical cactus from Mexico

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The peyote cactus (*Lophophora williamsii* (Lem. ex Salm-Dyck) J.M. Coul., Cactaceae) has been consumed by people since ancient times because of its marked effects on perception and consciousness. It grows in the Chihuahuan Desert from central Mexico to West Texas and into the Tamaulipan Thorn Scrub of South Texas. This paper will review the archaeological record, the ethnographic present, and provide a perspective on the future of this magical plant. Objectives: To discuss the importance of the peyote cactus among the indigenous peoples of Mexico throughout history and to consider the future of its use in Mexico and beyond. Methods: This review is based on over thirty years of field work with the Huichol Indians (Wixárika) of the states of Jalisco and Nayarit, Mexico, as well as the litera-

ture on the prehistoric and historic uses of peyote and on its legal and environmental issues. Results: Peyote was revered and used since ancient times. The Huichol Indians of Mexico continue to collect it on an annual religious pilgrimage and consume it in rituals. The future of its continued use is legally uncertain, and there are concerns about protection and conservation of the species. Conclusion: The peyote cactus is central to Huichol cultural identity. It provides a framework and context for religious traditions and serves to unify the disparate communities and groups that comprise the tribe. The future of peyote in Mexico and within the Huichol culture will depend on resolving legal and environmental challenges.

38. The diversity, economic and nutritional value of Totonac home garden produce and their links to food habits

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Totonac culture evolved across a broad altitudinal range and farmers achieved self sufficiency and resilience to environmental hazards by cultivating plots at different altitudes. At present, many inhabitants have lost their lands and land use has changed from a multifunctional management towards market oriented practices (monoculture and cattle ranching). Thus, home gardens have become important refuges

for semi-domesticated plants, providing key produce. Objectives To correlate nutritional and economic value of Totonac home gardens with changing food habits. Methods: Sixty women were interviewed about their everyday recipes, shopping lists, product prices and the plant lists of their home gardens, from this we estimated biodiversity and economic and nutritional values. Results Food habits are changing towards higher meat consumption, exotic vegetables (carrots and broccoli) and processed and fried foods. Children dislike traditional quelites, calabazas and chayotes and are eating more junk food. The new items consumed are the more expensive market products (e.g. pork, chicken, sausages, chorizo, jam, marmalade, packaged cereal). Nevertheless, the diversity of home gardens is still high and many plants have multiple uses. Throughout the year, several home gardens provided a constant supply of fruits, eggs, cooking spices and basic medicinal plants, and were an important source of vitamins, minerals and sugars. However, there is a lack of protein-rich products (except eggs) as historically proteins were usually obtained from bean crops, hunting and fishing. Conclusion: Although the trend is toward more urbanite food habits, there still exists an important pool of knowledge and useful biodiversity. Also, a proportion of the community is concerned about health issues and the loss of traditions. We believe that it is still possible to redirect current trends by investing social, biological and scientific capital in the development of a collaborative sustainability project, that mixes traditional knowledge with new technologies.

39. Knowing many ways: Engaging the diversity of plant knowledge within the Standing Rock Oyate

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Native communities throughout the northern Great Plains are experiencing high rates of diet-related disease. Local institutions and elders are promoting indigenous foodways in order to improve the health of their communities. Participatory action research with Standing Rock elders reveals a diversity of knowledge in the number of species of plants elders describe as well as the variety of knowledge individuals hold about particular plants. In academic circles, differences in knowledge within social groups are often interpreted as differences in accuracy or authenticity, and therefore indicate a loss of ecological knowledge or cultural consensus. Alternatively, Standing Rock elders explain differences in plant knowledge as differences in practice, which they attribute to personal ecological and social histories. Since the adaptive capacity of a community rests on a diversity of knowledge and practice within that community, researchers who question a broad range of knowledge holders can contribute to understanding of resilience. This paper employs narrative inquiry, ethnobotany, and seasonal rounds to engage a range of plant knowledge held within a community of elders. The narrative context of ethnobotanical information reveals the role of

knowledge diversity in adaptation to change. This work also demonstrates that by valuing differences in plant knowledge and employing methodologies that resist analytical reductionism, researchers can engage knowledge holders in community actions that respond to diet-related disease through the use of local plants.

40. The Genus *Agave* in the Huichol Sierra of Jalisco, Mexico

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The genus *Agave* (maguey) contains a many species with traditional uses as food, beverage and fiber. This is certainly the case for the Huichol (Wixárika) Indians, an indigenous Mexican tribe from the rugged barranca zone of the Sierra Madre Occidental of western Mexico in the states of Nayarit and Jalisco. They still maintain many of their traditional beliefs and practices, including the exploitation of local *Agave* species for various purposes. Objectives: To identify and record traditional knowledge about the genus *Agave* in the Huichol Sierra including indigenous classification and uses. Methods: During two visits to the community of San Andrés Cohamiata during 2003 and 2006, the author conducted field work with the Huichol Indians, interviewing knowledgeable elders about the names and uses of *Agave* and looking for wild and cultivated plants in the local environment. Results: Seven

taxa of *Agave* were identified. Their local names and uses were recorded and most were photographed, and specimens were made. The author had the opportunity to document the traditional pit baking process for cooking *Agave* for food. My consultants recalled how, in the past, the baked agave hearts (pencas) were further processed into a distilled product (tuchi; mezcal) using a still with an anomalous incorporating an internal receiver. The equipment and processes were documented with interviews and drawings. Conclusion: *Agave* is still considered a very useful genus among Huichol Indians. The Huichols recognize seven ethnotaxa of *Agave*; the final resolution into Western taxa is pending. However, the processing of agave for food and alcoholic beverages is becoming less common; the latter might be considered archaic. My consultants were still able to recount the design and use of the traditional Huichol still for production of a distilled alcoholic beverage; another local plant, *Dasyllirion* (sotol), is used in similar way.

41. Conocimiento, uso y manejo de la flora silvestre y semicultivada útil, en tres comunidades cafetaleras de Veracruz

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La flora silvestre y semicultivada útil representa un componente central en el conjunto de estrategias e insumos que conforma la sobrevivencia de las co-

munidades rurales (Chambers y Conwawy, 1992). Objetivos: Documentar el conocimiento y las prácticas de manejo que llevan a cabo las comunidades de Texín, Las Lomas y San Isidro sobre la flora silvestre y semicultivada con fines medicinales, mágico-religiosos y que prestan un servicio ecológico identificado por la gente. Estimar los efectos que el uso y manejo de estas plantas pueden tener sobre las poblaciones vegetales. Métodos: Se realizaron 52 cuestionarios-entrevistas en hogares seleccionados bajo criterios establecidos. Se colectó la flora reconocida por los entrevistados en época de lluvias mediante recorridos con informantes clave, el proceso de herborización se realizó en el Herbario XALU. Se detectaron las especies en riesgo de disminuir sus poblaciones mediante el software SPSS 14.0. Resultados: Se registró un total de 149 nombres comunes en las entrevistas, de las cuales 89 fueron colectadas pertenecientes a 48 familias y 80 géneros, siendo las familias Compositae, Lamiaceae, Leguminosae y Solanaceae las más representadas. Se registraron 114 especies medicinales, las cuales se asocian con las estrategias de cuidado y atención a la salud que se desarrollan al margen de los sistemas formales, 33 especies fueron asociadas a rituales mágico-religiosos que permiten a las comunidades conformar un capital simbólico y 24 especies resultaron prestadoras de servicios ecológicos en cafetales, las cuales pueden entenderse como parte de su sistema de manejo de recursos naturales. Se detectaron 20 especies en riesgo de disminuir sus poblaciones. Conclusión: Diversas especies presentaron más de un uso y se localizan princi-

palmente en acahuals y cafetales bajo sombra. El manejo sustentable de esta flora evitaría la pérdida del conocimiento tradicional permitiendo el desarrollo local de las comunidades.

42. Las palmeras en humedales veracruzanos: Usos y tradiciones locales

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Las palmeras en los trópicos son la segunda familia botánica en importancia económica, cultural y ritual después de las gramíneas. Las palmeras han sido usadas tradicionalmente para cubrir múltiples necesidades que abarcan desde satisfacción alimenticia y de vivienda, hasta el refinado gusto de condimentar la comida, o de adornar los hogares. En las zonas de humedales de Veracruz, crecen varias especies de palmera pues toleran la inundación. Asimismo, se ha observado que la gente las usa cotidianamente. Sin embargo, el desarrollo social y tecnológico durante las últimas cinco décadas ha eliminado cada vez más las diferencias entre las zonas rurales y las ciudades. Entonces, el conocimiento tradicional sobre usos de las palmeras se va perdiendo. Por ello se requiere de investigación y difusión para que no desaparezca esa parte de nuestra cultura, que en nada esta reñida con el

desarrollo de las comunidades rurales. Objetivo: Conocer los usos tradicionales de la gente hacia las palmeras en humedales veracruzanos. Método: Este trabajo se llevó a cabo en la planicie costera de Veracruz, en comunidades usuarias de humedales de los municipios de Alvarado, Jamapa, Tecolutla y Tuxpan. Utilizamos la metodología de investigación cualitativa. Se realizaron entrevistas basadas en un cuestionario con preguntas específicas y con opción de respuesta libre y abierta. También se realizó observación participante y talleres participativos. Resultados: Se realizaron 60 entrevistas, de las cuales la gente mencionó cinco especies de palmeras que utilizan: *Cocos nucifera*, *Sabal mexicana*, *Attalea liebmanii*, *Acrocomia mexicana* y *Roystonea dunlapiana*. Los usos registrados fueron: alimento, construcción, artesanal y religioso. En el caso de *Cocos nucifera* se aprovecha mayormente el fruto, mientras que en las otras cuatro palmeras se utilizan más las hojas y el tronco. Conclusiones: El uso de palmeras por pobladores de comunidades rurales es una actividad que se mantiene en los humedales de la planicie costera de Veracruz. Sin embargo, el aprovechamiento de algunas partes de las palmeras ha disminuido en las nuevas generaciones. Por lo tanto, es importante fomentar el uso y la conservación de las palmeras para que el conocimiento tradicional, así como las especies, no se pierdan.

43. Especies de *Peperomia* Ruiz et Pavón (Piperaceae) comestibles de Oaxaca, México

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En México, diversos grupos étnicos conocen, usan y manejan varias especies de *Peperomia*; por ejemplo, las incluyen en sus rituales, atribuyen características sobrenaturales, nombran en su lengua materna, usan como alimento, medicina y ornamental, recolectan y comercializan. Objetivo: Identificar las especies del género *Peperomia* utilizadas en la alimentación de los grupos étnicos de Oaxaca, México. Métodos: Se realizó trabajo de campo en los mercados de Oaxaca y en las localidades de donde proceden las especies comestibles de *Peperomia*, se colectó, herborizó e identificó el material etnobotánico. Se consultó bibliografía especializada para comparar los usos históricos y actuales de *Peperomia* spp en México. Resultados: En Oaxaca, los indígenas hablantes de chatino, chinanteco, mazateco, mixe, mixteco y zapoteco (de la Sierra Sur y de la Sierra Norte) consumen siete especies de *Peperomia*: *dendrophila*, *edulis*, *maculosa*, *obtusifolia*, *peltimba*, *pseudoalpina* y *quadrifolia*. Cada especie recibe un nombre local y se emplea como condimento, consumiéndolas crudas o cocidas. Generalmente se recolectan en los bosques templados húmedos y cuatro se comercializan en los mercados locales de Miahuatlán, Huautla y la ciudad de Oaxaca. Conclusión: En Oaxaca, México,

siete especies de *Peperomia* procedentes de los bosques templados y húmedos se consumen como alimento por siete grupos étnicos.

44. Cacao, bu'pu, chiro, popo: cuatro nombres, una sola bebida

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Raramente se encuentra, en las investigaciones etnobotánicas, un conocimiento compartido por diversos grupos culturales en una extensa zona geográfica. Éste sería el modelo ideal para toda investigación de este tipo pues permitiría la posibilidad de teorizar acerca de la antigüedad del conocimiento, su trascendencia cultural y el papel que juega en la conservación de los recursos. En este trabajo se presenta un ejemplo de una investigación que cumple con estas características, tomando como punto de partida una bebida tradicional del sureste de México. Se llevó a cabo una amplia revisión bibliográfica y se realizó trabajo de campo en los estados de Oaxaca, Puebla y Veracruz. Se desarrollaron entrevistas semiestructuradas con personas expertas en la elaboración de la bebida y en la utilización de las plantas usadas como ingredientes. Se encontró que esta bebida está presente en una amplia zona geográfica que abarca

gran parte del sureste de México y que coincide con la región donde se ubicaba el área prehispánica de Mesoamérica. Aunque es denominada con distintos nombres, se observó que la bebida comparte elementos en varias localidades, incluyendo el uso de ingredientes que cumplen funciones similares (obtención de sabor y aroma, producción de espuma), la trascendencia cultural, el arraigo de la tradición y la preservación del conocimiento por la población femenina. Destaca la importancia cultural de las semillas de *Theobroma bicolor*, tan apreciadas como las de *T. cacao*; sobresale también el uso de, al menos, tres especies de plantas para la producción de la valorada espuma, elemento que ha sido concebido tradicionalmente como un símbolo de riqueza, prosperidad, lujo y bienestar. Esta investigación permitió analizar la trascendencia cultural de una bebida cuyas características sugieren que tiene un origen prehispánico. Asimismo, reveló la falta de investigaciones relacionadas con el uso y la conservación de plantas asociadas con *T. bicolor* y *T. cacao* y que representan recursos con potencial comercial por sus propiedades medicinales y alimenticias.

45. Valoración social de plantas en una comunidad indígena (Veracruz, México)

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El trabajo se realizó en una comunidad indígena populuca ubicada en la zona de amortiguamiento de la Reserva de la Biosfera Los Tuxtlas, bajo la premisa de que la percepción cultural es un componente importante en el uso de los recursos naturales y su conservación. Objetivos: Conocer la valoración social de los recursos naturales, así como la forma en que esto se refleja en el uso y manejo de las especies vegetales del solar y el cafetal. Métodos: Se realizaron seis entrevistas a profundidad con actores clave y conversaciones informales durante un año de trabajo de campo. Se analizaron los discursos ambientales para caracterizar la transformación y problemática ambiental local. Se aplicaron cincuenta cuestionarios para determinar la importancia cultural de especies vegetales de solares y cafetales, considerando: usos, frecuencia de uso, parte de la planta utilizada y preferencia de uso sobre otras especies con la misma utilidad. Resultados: Se observaron procesos de pérdida organización social tradicional y de trabajo comunitario, así como pérdida de conocimiento acerca del uso de plantas medicinales, disminución de diversidad de la milpa y de especies silvestres útiles; esto debido a la influencia de programas gubernamentales y de líderes políticos y religiosos. Se señalaron 183 especies de las cuales: 103 fueron mencionadas para el solar, 30

para los cafetales y 50 para ambos. De las especies encontradas, 100 tienen un uso alimenticio, 58 medicinales, 50 frutales y 26 maderables. Entre las especies de mayor valor de importancia encontramos principalmente Árboles maderables, frutales y sombra del cafeto. Conclusión: Tensión entre la importancia de uso como un motivo para la conservación, pero también como uno de los principales elementos que ha llevado a la pérdida de dichas especies. Existen especies de importancia cultural como *Astrocaryum mexicanum* que no obtuvieron valor de importancia alto debido a la disminución de sus poblaciones; y otras que, debido a sus numerosos usos, obtuvieron un valor de importancia alto aún cuando su frecuencia de mención fue muy baja; por lo que, las estrategias de conservación biológica y diversificación productiva deben poner atención en estas especies.

46. Helechos arborescentes usados en la producción de maquique en el centro del estado de Veracruz, México

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Especies de helechos arborescentes forman una trama de raíces adventicias a lo largo de su caudex o "tallo", sobre el cual crecen diversas epífitas. Por esta peculiar característica en nuestro país, estos helechos son utilizados en la elaboración de artesanías para sustrato de plantas conocido con

el nombre de 'maquique', 'maquiqui', 'malque', 'malquiqui', 'pesma', 'xaxim', 'chachi', 'parásita', 'mexifern' o 'raíz de helecho', aunque las figuras y macetas elaboradas con esta fibra, de tienen mucha demanda, la venta de 'maquique' es una actividad ilegal pues los helechos arborescentes se encuentran amenazados y están protegidos por la NOM-059-ECOL-2001 (Norma Oficial). La zona de estudio es La ciudad de Xalapa (19°32'24" latitud Norte, 96°55'39" longitud Oeste y 1427 ms.n.m.) y alrededores. Se visitaron los mercados de la ciudad de Xalapa, Coatepec y alrededores, se entrevistó a los vendedores, se tomaron fotografías en varios de ellos, se logró entrevistarlos y se contactó con algunos y hubo oportunidad de conocer los sitios de corte que ellos visitan (cada uno de ellos visitan de 2 a 5 sitios de extracción de maquique). Tanto vendedores como cortadores saben que esta práctica es ilegal, y alternan esta actividad con la temporada del corte de café. Se ha encontrado que *Alsophila firma*, *Cyathea bicrenata*, *C. costaricensis*, *C. fulva* y *Dicksonia sellowiana* y *Sphaeropteris horrida* son utilizadas para extraer 'maquique'. Sin duda la conservación de estas especies depende de la concientización y de la participación de quienes extraen el maquique del campo, así también, consideramos se deben de ofrecer alternativas de sustratos para evitar el uso del 'maquique' y/o enseñarles a cultivar los helechos arborescentes para hacer plantaciones. Financiado por Conacyt (1360-N9206 / 4102P-N9607 / 35123-V), Conabio (J009, W041) y del Instituto de Ecología, A.C. (902-14).

47. Horizontal traditional knowledge transmission balance the generational knowledge loss among mushroomers

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The loss of traditional ecological knowledge (TEK) is a big concern that threatens the survival of traditional systems of resource management (Eyssartier et al., 2008). Despite this, there is scarce information on the forces that driven the loss of TEK or its recovery (Benz et al., 2000). Using the transmission of traditional mycological knowledge among mushroomers as a model, we measured the intensity of vertical knowledge transmission (between generations) and assessed how horizontal transmission (across the same generation) balance acculturation. We conducted the study in San Pedro Nexapa, Estado de México, México; a small town where many people (mushroomers) traditionally recollect wild mushrooms for sale. Twenty-seven interviewees (60% of total mushroomers in town) were asked about traditional knowledge transmission events (learn, teach, interchange) with all possible involved people (grandparents, pa-

rents, aunts and uncles, brothers and sisters, nephews and nieces, cousins, grandsons, spouses, in law relatives, friends, neighbors). Knowledge transmission was recorded in five different generations of mushroomers. Significant differences were found between learning and teaching of traditional knowledge. This demonstrates that traditional knowledge is apparently being lost because the mushroom gatherers learn more than they teach about mushrooms. The transmission of the traditional mycological knowledge was stronger with the parents, grandparents, sons, neighbors and spouses. Indeed the frequency of learning events within the same generation was as strong as with grandparents and parents. Thus horizontal knowledge transmission plays a key role in maintaining a balance of knowledge in the community because even if children are not taught about mushroom recollection, they learn it during its mature life thanks to same-generation knowledge interchange. Finally we discuss how these findings could be used to reinforce same-generation mechanisms of knowledge transmission as workshops, participative field trips, mushroom fairs, etc.

48. El manejo tradicional y el mantenimiento de la diversidad vegetal: el caso de *Oecopetalum mexicanum* en la Sierra de Misantla Veracruz, México

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INECOL

El aprovechamiento de los recursos forestales no maderables altera de diferentes maneras la estructura y diversidad de la vegetación original. Esta alteración no necesariamente tiene impacto negativo sobre la diversidad, en algunos casos promueve la conservación natural y cultural de los bosques. En la sierra de Misantla, en el estado de Veracruz, México, se distribuye el "cachichin" (*Oecopetalum mexicanum*). Este árbol prospera en ecotonía de bosque de niebla y selva alta subperennifolia. Localmente es apreciado por su semilla comestible que tiene un mercado regional importante. Además es un elemento cultural para los habitantes de la sierra. En esta área se han detectado tres manejos en donde el cachichin se recolecta: I) cafetales tradicionales de sombra, II) cachichinales (bosques enriquecidos con cachichín) y III) bosques conservados. En estos escenarios determinamos el impacto del manejo asociado al cachichin sobre la diversidad vegetal y potencial de regeneración de estas. Nuestros resultados indican que *O. mexicanum* presenta altos valores de importancia tanto para el bosque conservado como para el cachichinal, mientras que estos valores se reducen en los cafetales. Asociado a esto observamos una alta retención de biodiversidad, la cual, fue mayor en bosque, seguida por cafetal y cachichinal. Asimismo encontramos una alta retención de especies localmente útiles la cual fue mayor en el cachichinal, seguido por el cafetal y bosque. Muchas de estas especies útiles en cachichinal

son nativas y solamente el cafetal muestra una alta proporción de especies exóticas. Presentamos a los cachichinales como un esquema de bosque enriquecido que tiene la capacidad de ser reservorio de biodiversidad natural y retener una gran variedad de especies útiles de importancia económica-cultural.

Contributed papers

49. Implementing a new, integrated approach to the conservation and use of agricultural biodiversity at the international agricultural research centers of the CGIAR

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Beginning in the 1970s, the independent Centres of the Consultative Group on International Agricultural Research (CGIAR) have been at the forefront of global efforts to conserve crop diversity *ex situ*. These germplasm collections currently contain over 655,000 accessions which are held in-trust by the Centres as global public goods, thereby ensuring that they will be forever available to all users for research, breeding and educational purposes. These collections now form the centerpiece of the multilateral system of access and benefit sharing established in 2006 by the International Treaty of Plant Genetic Resources for Food and Agriculture. While the genepools of most major crops are now reasonably well conserved and studied, the genetic resources of farm animals, trees, fish, microbes and invertebrates are still at great risk of genetic erosion, but are nonetheless important to the

nutrition and livelihoods of millions of people. These threatened and unique genetic resources require immediate attention on a global scale to provide the basic research, policies, and capacity building needed to enhance their use and avert their genetic erosion. The International Centres are uniquely positioned to respond to this problem. The CGIAR reform process currently underway offers an opportunity to significantly improve the Centres' ability to address this challenge—both individually and as a system—by adopting a coherent, coordinated, and integrated research programme that embraces the genetic resources of fish, forest trees, livestock, microbes and invertebrates, as well as crops. This integrated approach takes advantage of the commonalities and complementarities across all sectors of agricultural biodiversity, enabling each sector to benefit from the experiences and solutions of other sectors. Key research areas of common interest include increasing our understanding of agrobiodiversity, improved conservation technologies and strategies, bioinformatics, capacity building, public awareness, economic analysis, and the development and promotion of science-based policies conducive to the conservation, access, equitable exchange and increased use of genetic resources for food and agriculture. This integrated approach will build on current partnerships and pursue new opportunities for engaging national and regional partners in greatly expanded collaborations that help ensure the success of our national partners and the farmers they serve.

50. The population ecology of *Securidaca longepedunculata* Fresen.: An aphrodisiac amongst the Vhavenda people of Limpopo Province, South Africa

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Understanding the population ecology of indigenous plants that are of economic importance to local communities is very much crucial in rural development strategies. Indigenous plants contribute in the economy through their various forms of utilizations. *Securidaca longepedunculata* (Polygalaceae family) is a plant species that is being utilized for medicinal purposes as an aphrodisiac by the local Vhavenda people of Limpopo Province in South Africa (Mabogo 1990). It has found its way into the local muthi (herbal) markets. This species is amongst nine commonly traded medicinal plants around Thohoyandou muthi (herbal markets due to its high demand by the local communities (Tshisikhawe 2002). The species is now becoming threatened with extinction because it is only collected from the wild.

51. Soil modification in pre-contact Māori kūmara gardening: Use of charcoal?

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Recent interest in biochar for carbon-sequestration has highlighted the use of charcoal for soil fertilisation in the terra preta soils in the central Amazon basin. There is evidence that pre-European contact Māori in Aotearoa/New Zealand used charcoal for soil modification in kūmara gardening. Objectives: To investigate whether the addition of charcoal was a common soil modification technique used by pre-contact Māori during kūmara gardening. Methods: A review of early published accounts and research papers on Māori kūmara gardening for evidence of the deliberate addition of charcoal. Results: There were strong cultural prohibitions on the use of animal manures and an extensive vocabulary of terms for different soil types. The addition of coarse sand and fine gravel was widespread in Māori kūmara gardening and the remains of numerous borrow pits at many garden sites attests to this. The deliberate addition of charcoal is described and recorded at a few garden sites but was not universally described. Conclusion: The deliberate addition of charcoal could not be regarded as a universal standard practice in Māori kūmara gardening. Charcoal found in most historic garden soils resulted from burning during initial land clearance but there were local instances where extra charcoal was added as part of the soil modification process during pre-contact Māori kūmara gardening.

52. Ecoregional distribution of potentially useful species of Araceae and Bromeliaceae as non-timber forest products in Bolivia

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In Bolivia, the plant families Araceae and Bromeliaceae offer numerous non-timber products, including ornamental plants, medicines, foods, and fibers. The economic potential for the utilization of these resources depends critically on the distribution of potentially useful species in different ecoregions in Bolivia. We conducted both a bibliographical revision of uses and ecological field work at 43 sites in the Bolivian Andes and lowlands to assess the potential for sustainable use as suggested by the Rapid Vulnerability Assessment method. The ecological criteria used for the evaluation were abundance (frequency), life form, geographical distribution, and habitat preference. We found that Bolivia has a striking number of potentially useful species of both families but that their potential use differs among ecoregions. Araceae were most species-rich and frequent in the humid lowland and montane forests. In these ecoregions, this family has a particular local importance mainly as traditional medicines and a great potential as ornamental plants. In contrast, economically useful bromeliads are best represented in

seasonally dry forest habitats, especially for the production of fibres. Many species of bromeliads, which also occur in humid montane forests, although rare, are potentially important for commercialisation as ornamental species. This study shows that the uses of Araceae and Bromeliaceae are manifold and could be greatly increased through efficient management, although with different strategies according to the different ecoregions.

53. Was the Kiso-hinoki cypress preservation movement effective during historical period?

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Kiso-hinoki (Kiso Japanese cypress) forest is considered to be one of the most beautiful forests in Japan. It is located in the central uphill of Honshu island. From the old time, utilization of the forest has been severe and it is said that it was severely damaged in the late 16th Century and the early 17th Century and the restoration and reforestation movement during Edo period (from the early 17th Century to the late 19th Century) made the recovery of the forest. The survey of the number of cypress trees supports this. However, few studies have been done about the vegetation history of Kiso-hinoki

forest. This study test the hypothesis that the restoration and reforestation movement during Edo period (from the early 17th Century to the late 19th Century) made the recovery of the forest. Several cores were recovered by a Russian peat sam-pler from Shirasu Lake in Kiso Mountain range, Nagano prefecture, Japan and two cores with good condition were analyzed. The core samples were from ca. 1000BC to present. Pollen analysis was performed on this core to reconstuct the vegetation change. Dominant pollen taxa were Cupressaceae and Quercus subgen. Lepidobalanus type. The pollen decrease of Cupressaceae was detected about the start of Edo Period and recovered temporarily. Recently it decreased again It seems to support the hypothesis. However, the pollen concentration diagram indicates that the decrease started much earlier than 16th Century and the recovery of the cypress forest could not be detected. Just after Edo period, the production of charcoal became ac-tive in this region. Because Quercus trees were utilized for charcoal production, the percentages decrease caused by the charcoal production and Cupressaceae relatively increased. The decrease of cypress trees in the central uphill region started in much earlier than 16th Century. It continued to be low pollen concentration until recently. The recovery of the forest cannot be detected by pollen analysis. Although the number of trees increased after the sever deforestation in the late 16th Century and the early 17th Century, the productivity of the forest may have changed.

54. Candy Barrel Cactus: A traditional Mexican plant resource subject to uncontrolled extraction and browsing

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The “candy barrel cactus” or “biznaga dulce” (*Echinocactus platyacanthus* Link et Otto) is an endemic Mexican cactus used as an ornamental plant, fodder and for human consumption. Although it is illegal to harvest it, many candy barrel cacti continue being destroyed *in situ* by both gathering and livestock grazes. Objectives: Describe how people use this species and know some aspects of the biznaga’s wild populations and their environmental in central Mexico. Methods: In order to estimate density, percentage of damaged cactus, and height of candy barrel cactus, censuses were carried in stands of 2,500m². The anthropogenic disturbance in each site was estimated by an environmental disturbance index (DI). Results: The state of Hidalgo has the best conserved population (mean density = 1,111 ind/ha, stratus height = 137 cm and only 2% of the total cacti injured). Populations in Puebla represent an intermediate state of conservation, while Querétaro has populations with the lowest density (435

ind/ha), the shorter height stratum (62 cm), the highest foraging (18%) and the greatest DI (71.30). Conclusion: Biznaga’s population conservation is complicated given its low growth rates, long life and low recruitment. We recommend implementing livestock exclusion areas and preventing extraction by humans in order to protect this species, and compare its conservation problems and perspectives using demographic and population genetics data of other non-timber forest products of México, including other cacti and Agave.

55. Stinging nettle cream for osteoarthritis

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Native American Indians (known as the Ohlone) of the central coast of California utilized a diverse herbal “pharmacopeia”. *Urtica dioica* is a nettle native [according to Matthews] to this region and was used by the Ohlone to treat skin conditions and also the pain of arthritis. The latter treatment consisted of lightly beating the aching joint with the stinging leaves of the plant. Similar practices occurred in other Native American cultures and indeed in other parts of the world. In a previous clinical trial, whole intact nettle leaves were found to reduce pain and disability scores when used topically. Multiple potential chemical modulators of pain/

inflammation are found in either the stinging hairs or the plant tissues of nettle that could account for a variety of possible mechanisms of action, if efficacy can be proven for this treatment. In our study we chose to test a cream containing nettle concentrate, as this is a more tolerable and pragmatic way to use nettle in most clinical settings. We found that the treatment was well-tolerated and led to decreases in pain scores.

56. First Contact in Hawaii (1778) - The impact of globalization in the first two decades

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Polynesians were the original inhabitants of the Hawaiian Islands. The Hawaiians had developed sophisticated agricultural, land, and ocean systems, which enabled them to provide a more than adequate diet, and to be able to devote time and energy to the arts. Globalization began with "Captain James Cook's Third Voyage of Discovery" on Jan. 18, 1778 (-Feb. 12, 1778; and Nov. 26, 1778-Feb. 4, 1779). Objectives: To identify how the Hawaiians coped with, and reacted to globalization, and how their agricultural systems were modified. Methods: With advent of Google books, the careful scanning and the digitization of public domain materials from major university libraries (e.g., Harvard, California-Berkeley, and Michigan), the original

texts are now searchable and readily available in one's office and home. The digitization of Hawaiian texts (www.ulukau.org) has also begun, albeit slower, and some of these early documents provide, after the Hawaiian language became a written one, observations by the indigenous peoples. Results: This is the first of a Works in Progress to document the effects of globalization on Hawaiian ethnobotany and environment after 1778.

57. Recolonization of vascular epiphytes in shaded coffee agroecosystems

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Shaded coffee plantations with diverse canopies are an important refuge for biodiversity. The epiphytes form a significant component of these systems. Their removal is common practice in Latin America yet, while the severe impact of this practice on other organisms has been recognized, the effects on the epiphytic community have so far not been analyzed. Methods: We assessed the recolonization patterns, diversity and accumulated total dry biomass of all vascular epiphytes in shade trees, 8-9 years after complete epiphyte removal, and in control sites in a shaded coffee agroecosystem in Mexico. Four plots were established to evaluate the effects of epiphyte

removal (E-) and controls (E+), two plots of reach treatment. Results: Epiphyte dry biomass per tree was significantly higher in E+ ($37.31 \text{ kg} \pm 1.01$; $N=10$) than in E- ($13.26 \text{ kg} \pm 1.78$; $N = 10$); 8-9 years after complete removal, 35% of the epiphyte biomass had recovered. We registered 55 epiphyte species; 40 species and 1 morpho-species were found in E-, and 48 species in E+. Six species, belonging to the families Bromeliaceae, Orchidaceae, Cactaceae and Araceae accounted for 76% of the biomass in E+ while six species of bromeliads accounted for 75% of the biomass in E-. Conclusions: We found that the rate of vascular epiphyte community recovery, in terms of biomass and diversity, is considerably higher than reported previously for other tropical ecosystems. Epiphyte recolonization patterns reflect both the abundance of species in the surrounding matrix, and their specific requirements for establishment. This study contributes to the development of sustainable practices for epiphyte harvesting in coffee plantations. Recommendations for the sustainable management of epiphytes in coffee plantations are outlined.

58. Evaluación de la diversidad de especies útiles para leña y de los gases que afectan la salud de los usuarios de la misma en Tenosique, Tabasco, México

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En México alrededor del 70% de la población rural depende de la leña como principal fuente energética, liberando una enorme cantidad de contaminantes y causando estragos en la salud de mujeres y niños, quienes son los más vulnerables. Objetivo: Este trabajo tuvo como objetivo identificar las especie útiles para leña y las emisiones de CO y SO₂ que produce cada especie al arder dentro de los ambientes semicerrados de las cocinas rurales, midiendo el tiempo medio de exposición de las usuarias a estos gases. Métodos: Se realizaron 30 entrevistas semiestructuradas a pobladores mayores de edad en la comunidad. Se colectó leña de cada especie enumerada y por medios controlados se midió la temperatura y emisiones de gases utilizando un analizador de gases de combustión. Resultados: Se reportan 35 especies útiles para leña, de ellas 10 son leguminosas. *Manilkara zapota* (chicle) es la especie de mayor preferencia por las usuarias, pero ésta es escasa y difícil de conseguir. La leña proviene mayormente de la selva, complementada en potreros y acahuales. Las personas están expuestas a los gases tóxicos entre 1 a 3 horas diarias. El guácimo, el caracolillo, el popistillo, el chicle, tamarindo y palo amarillo produjeron las menores cantidades de

CO, y el guapinol, coralillo, cornezuelo, amargoso y pimienta las menores cantidades de SO₂. Todas las especies mostraron emisiones promedio de CO por arriba de los 11 ppm que es el mínimo establecido por la norma para la salud (NOM-CCAM-001-ECOL/1993). El nanche, escobillo, guayaba, chachahuanté, teca y chicle registraron los mayores valores promedio de SO₂ (10 ppm). A nivel de familia, las leguminosas mostraron menores emisiones de gases. Estos valores, junto con las horas de exposición al humo nos permiten determinar cuales especies son recomendables como leña. Conclusiones: Mientras la leña siga siendo el combustible principal en el medio rural, es necesario implementar técnicas para la selección, manejo y reproducción de las especies utilizando criterios de su toxicidad.

59. Sustainability of an Appalachian herb, black cohosh, *Actaea racemosa* L.: determining factors of habitat and abundance in western Maryland

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Black cohosh, *Actaea racemosa* L., is an understory perennial herb found in the mountains of Appalachia in the Eastern United States. Current increasing demand is as a natural alternative for hormone therapy for menopausal women. Sustainable harvesting of non-timber forest products (NTFPs) requires information on the current abundance in the wild and the impact of management regimes on abundance. Objectives: of this study are to INCREASE THE understanding of habitat requirements for black cohosh, including guiding forest management plans for NTFPs. Objectives also include evaluation of ecological communities in which the plant is found, current availability, health and reproduction of the resource. Methods: Known populations of black cohosh in western Maryland were analyzed for various plant health factors and environmental factors including site conditions and companion plants. Based on known occurrences, Mahalanobis distance techniques were used to determine the potential location of additional populations. Results: 115 black cohosh populations were found in Potomac/Garrett State (PGSF), Savage River (SRSF) and in Green Ridge (GRSF) State Forests in western Maryland. Mahalanobis distance was calculated for populations and randomly selected locations. 73% of the observed locations were classified as ideal habitat. Model testing using bootstrapping resulted in a predication accuracy of 82%. Ideal habitat occurred on lower slopes, higher values of topographic convergence index, smaller "distance to stream" values and marginally higher pH than average. Up to 30% of SRSF and PGSF are considered suitable

habitat, while GRSF, with steeper drier slopes, has less than 10% suitable. Community importance values for overstory species were highest for sugar maple (*Acer saccharum* Marsh.), eastern hemlock (*Tsuga canadensis* (L.) Carrière), and American basswood (*Tilia americana* L.) at SRSF and PRSF. GRSF had highest importance values for northern red oak (*Quercus rubra* L.), white oak (*Quercus alba* L.), and black cherry (*Prunus serotina* Ehrh.). Significant differences existed between the state forests in terms of overstory species composition. Conclusions: Characterization of important habitat variables will assist in sustainable management. This information is applicable to related species facing declines, including *Actaea rubifolia* (Kearney) Kartesz and *Actaea podocarpa* DC.

60. Effect of domestication on the germination of columnar cacti from the Tehuacan Valley

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Previous studies of columnar cacti have identified artificial selection processes through *ex situ* and *in situ* management and different degrees of morphological, physiological and genetic divergences between populations under different intensities of artificial selection (Casas et al. 2007).

Objectives: Seed mass and germination of wild and cultivated populations of columnar cacti species (*Polaskia chende*, *Escontria chiotilla*, *Myrtillocactus schenckii*, *P. chichiye* y *Stenocereus pruinosus*) representing a gradient of management intensity were compared. We hypothesized that seeds from cultivated populations would be more susceptible to low water availability than those from the wild and that differences between wild and cultivated populations would be stronger in species more intensively managed. Methods: We measured seed size from wild and cultivated populations and evaluated their germination rate under water potential treatments (0.0, -0.2, -0.4, -0.6, -0.8, and -1.0 MPa). Results: In all the species studied, seeds from cultivated populations were larger than those from the wild. Each species showed different susceptibility to low water availability treatments. *S. pruinosus* and *P. chende* had the highest and the lowest susceptibility, respectively. In all the species studied the treatment with the highest water availability determined that seeds from cultivated populations had higher germination rates than seeds from the wild, whereas treatments with low water availability determined the contrary. Differences were stronger between populations of the species more intensively managed. Conclusion: Artificial selection favoring larger fruits had affected the seed mass and in turn the germination rate.

61. The Domestication and Use of Sumpweed (*Iva annua*) in Eastern North America

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I examine the domestication, use, cultivation of, and demise of sumpweed (*Iva annua*), an oily-seeded member of the Asteraceae with a rich archaeo-logical record. Kernels and cypselae have been recovered from archaeological sites over a 7,600-year period, from Middle Archaic to the Contact period, ranging over much of the eastern United States and into southern Canada. The remains include charred specimens from midden, as well as desiccated kernels and cypselae recovered in storage contexts in dry rockshelters and in human feces and intestines. Domesticated sumpweed, now extinct, was grown for 3,600 years, fading out of use in various areas between the thirteenth and eighteenth centuries.

62. Flora vascular con características potenciales para el aprovechamiento y conservación de los fragmentos de selva en el municipio de Atzalan, Veracruz

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Las selvas tropicales a lo largo del tiempo han representado una fuente de recursos valiosos para la humanidad. Sin embargo, están desapareciendo a una velocidad alarmante, quedando sólo fragmentos aislados en zonas de difícil acceso y próximos a desaparecer junto con el germoplasma original que contienen. **Objetivo** El objetivo de este estudio fue identificar las especies vegetales de la selva mediana perennifolia y vegetación secundaria derivada con características potenciales de uso, en el municipio de Atzacan, Veracruz. **Métodos** Para lo anterior, se realizó un inventario florístico en fragmentos de selva y acahuales derivados. Mediante entrevistas semiestructuradas se generó un listado de la flora útil y se identificaron los factores socioeconómicos que influyen en el uso de la flora. Las especies potenciales se determinaron sobre la base de la revisión bibliográfica, las entrevistas y las características visuales y morfológicas que presentaron. **Resultados** Se registró un total de 338 especies, 210 géneros y 89 familias en 0.56 ha. También se identificaron ocho especies amenazadas y una endémica al estado de Veracruz. Se logró detectar que la población conoce y usa el 47% del total de especies registradas. La mayoría de las plantas útiles pertenecen a los acahuales, principales proveedores de medicinas y forrajes; mientras que la selva lo es de maderas, alimentos y combustibles. De acuerdo a los datos, más del 60% de la flora presenta usos potenciales para la zona, principalmente como ornamentales y medicinales. **Conclusiones** Se logró confirmar que el conocimiento botánico tradicional se incrementa conforme se incrementa el aislamiento geográfico de las poblaciones locales.

63. Evaluación de la actividad antimicrobiana de cuatro plantas utilizadas contra infecciones gastrointestinales en Tacotalpa, Tabasco, México

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Villahermosa, Tab. 86108

Las familias que habitan alejadas de los lugares donde no se encuentran médicos han utilizado ancestralmente plantas contra las infecciones gastrointestinales en donde son responsables bacterias tales como *Salmonella* spp, *Escherichia coli*, entre otras. Es sorprendente como en los últimos años ha surgido un gran interés por las plantas medicinales que rodean nuestro entorno. La importancia en el estudio de estas especies se basa en evaluar la eficacia de su uso como remedios caseros tradicionales haciendo una contribución a su validez científica y legislativa. Una de las ventajas del empleo de las plantas medicinales es que poseen un amplio rango de actividad antimicrobiana, debido a que contienen una gran cantidad de principios activos que las hacen tóxicas para los microorganismos. **Objetivo:** Evaluar la actividad

antibacteriana de extractos crudos de cuatro plantas medicinales de uso tradicional contra afecciones gastrointestinales. **Métodos:** Se colectaron hojas y corteza de las especies *Psidium friedrichsthalianum*, *Pterocarpus hayesii*, *Tynanthus guatemalensis* y *Spondias purpurea*, se seleccionaron, limpiaron y deshidrataron a temperatura ambiente en sombra y se molieron. Se realizaron extractos con etanol y hexano y se evaluó la actividad antibacteriana, la concentración mínima inhibitoria (CMI) y la concentración mínima bactericida (CMB) de cada extracto contra *Salmonella typhi*, *Bacillus cereus* y *Staphylococcus aureus*. **Resultados:** Los extractos etanólico y hexánico de hoja de *P. friedrichsthalianum* inhibieron el crecimiento de *S. aureus* y *B. cereus* y la Concentración Mínima Inhibitoria (CMI) fue de 1.92 mg de extracto seco ml⁻¹ de solución para los extractos etanólico de hoja y hexánico de corteza contra *B. cereus* y *S. typhimurium*, respectivamente. Para los extractos etanólico y hexánico de hoja de *P. friedrichsthalianum*, hexánico de hoja de *P. hayesii* y hexánico de corteza de *S. purpurea* se encontró una CMI de 7.50 mg de extracto seco ml⁻¹ contra *S. typhimurium*. Se encontraron diferencias significativas entre los diferentes tratamientos tanto en la planta estudiada, el solvente usado para hacer los extractos como en la interacción entre ambos factores. **Conclusión:** El conocimiento ancestral de las plantas utilizadas tradicionalmente contra afecciones gastrointestinales es corroborado al identificar las propiedades antimicrobianas de las mismas.

64. Loss of genetic structure in a traditional crop variety over a large and heterogeneous area: The effect of market seed

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In traditional seed management, farmers save their own seed stocks and when these are insufficient (e.g. after a drought year), they obtain seeds from other farmers or local markets. This practice could result in the periodic influx of migrant genes into local landrace populations. Despite this potential, traditional seed management by farmers in the past has maintained genetic differentiation of traditional crop variety subpopulations, probably due to strong selection and limited gene flow between isolated populations. The recent development of more advanced transportation infrastructure may, however, have led to an increased movement of seeds (gene flow) between formerly remote areas, and thereby altered genetic structure. We used genetic marker data to test this hypothesis. We studied population structure of barley (*Hordeum vulgare* L.) over space and time in Northern Morocco, a region where access to remote areas has increased

significantly in the past few decades. Microsatellite marker data was used to genotype historic seed samples collected in 1985, and again from the same sites in 2008. From these data we calculated allelic diversity and partitioning of diversity within and among populations (F_{st}). There were no significant differences in allelic diversity between samples from collected from past and present populations. However, we observed a decrease in F_{st} values from 0.11 to 0.02 between 1985 and 2008. These results suggest that despite continuing traditional seed management in the study region, there has been a significant decrease in genetic structure over a large and geographically heterogeneous area, likely attributable to more effective gene flow between landrace populations. Previously distinct subpopulations are now indistinguishable from a large, panmictic population covering the entire region. We discuss the implications of this finding for agrobiodiversity conservation in a region that is considered a secondary center of diversity for barley.

65. Forest conservation in Chiapas, Mexico from the perspective of alternative coffee growers

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By analysing the environmental conditions of coffee-growing communities from three coffee producer organizations from Chiapas, Mexico, this paper makes an informed critique of the claims put forward by Alternative Trade Organizations (ATO's). Instead of assuming that economic improvements favour natural resources conservation in a top-down manner, this analysis will look at the environment through the lens of local organisation practices. Data show a web of interactions between economic equity and social wellbeing that influence, and are influenced by the quality of the environment, as understood by local producers. A combination of issues where families of coffee growers are transforming and influencing their surrounding environment was selected. Attention was directed towards the environmental health of rural families (proximal environment) and to the quality of the agro-ecosystem and forest ecosystems (environmental setting). Specifically we will discuss the quality of the agro-ecosystem and forest ecosystems. Land-use indicators were developed. Questions were elaborated in terms of a 20-year period (10 years into the past and 10 years into the future). The selected environmental indicators covered a broad spectrum, where changes in land use were dealt with in order to consider the intergenerational equity dimension of sustainability. Conservation and coffee systems were analysed by focusing on the interrelationships between local coffee growers and coffee plantations as part of a wider ecosystem. The results argue that, however ethically and environmentally conscious they may be, ATO's have missed to engage

with coffee ecosystem dynamics influenced by the decisions that campesinos make in their properties, embedded within local organisational practices.

66. Regiones mezcaleras y usos del maguey en Michoacán

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El aprovechamiento de los agaves en Mesoamérica por parte de los pueblos originarios se remonta a casi 10 mil años y la destilación de agaves con fines ceremoniales, a más de 3 mil. Junto con la conquista española llegaron a México las técnicas y herramientas de destilación, como los alambiques del tipo filipino y árabe. En Michoacán, como en muchos pueblos mezcaleros de México, la destilación de agaves tiene especial importancia para la vida económica de las comunidades rurales, además de una larga tradición cultural. Objetivo: Registrar regiones mezcaleras, vinatas y productores, e identificar características distintivas en la producción de mezcales y usos del maguey en Michoacán. Método: Seis regiones productoras de mezcal en Michoacán fueron delimitadas en función de su proximidad geográfica y similitudes en las técnicas y métodos

de destilación. Mediante entrevistas guiadas, registros fotográfico y de video se identificaron procesos, materiales e insumos, las especies de agave y paisajes donde crecen. Resultados: Los maestros mezcaleros destilan los fermentos del maguey aprovechando la leña, el agua y los agaves de cada región. En Michoacán crecen cerca de 15 especies de agaves, de las cuales siete se utilizan para elaborar mezcales. Además de la ancestral elaboración de pulque, las comunidades rurales aprovechan los agaves como alimento, medicina, cerco natural o fibra; para la construcción, forraje u ornamento. Por otra parte, la inulina de agave, empieza adquirir importancia económica y busca expandirse a mercados foráneos mediante la presentación de diferentes productos derivados. Los magueyes son elementos fundamentales de la dinámica económica de las comunidades rurales de Michoacán, que incluye la compra-venta, el trueque y el autoabastecimiento de plantas para elaborar diferentes productos. Conclusión: Los agaves, el conocimiento y las técnicas para su aprovechamiento sustentable representan una porción fundamental del patrimonio natural y cultural de Michoacán. La tradición mezcalera de las regiones michoacanas se sustenta en la historia, la calidad y las singularidades de sus mezcales.

67. Diversity in breadfruit seasonality: A resource for year-round production

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Breadfruit, *Artocarpus altilis* Parkinson (Fosb.), is an important staple food throughout Oceania and much of the tropics. However, the seasonal production and short shelf life of the fruit restrict its availability to a limited season in most locations. The current study was undertaken to evaluate the phenological variability among traditionally bred cultivars and to identify those that could be used to extend the breadfruit growing season in the tropics. Methods: A total of 219 breadfruit trees representing at least 120 different indigenous cultivars were collected across Oceania, grown to maturity and maintained by the National Tropical Botanical Garden's Breadfruit Institute in the Kahanu Garden, Hana, Hawaii. The presence of male flowers, young, full size, mature and ripe fruit were recorded for each tree at approximately 2 week intervals from 1996 to 2005. Seasonality profiles were developed for each cultivar representing the male flower and fruiting seasons and grouped by k-means cluster analysis. Results: Across all of the cultivars examined, the general season of male flower production was from March to October and fruit was produced most frequently between August and December. However, there were noticeable differences in the duration of the breadfruit season from year to year and among cultivars. Over the 10-year period, 14 cultivars did not reliably produce fruit; most of this group were "ulu afa" trees collected from Tokelau. About 24 cultivars exhibited very little seasonality

and produced fruit throughout the year during the study period. The rest of the cultivars could be clustered into groups with characteristic fruiting seasons. While individual cultivar seasonality profiles may shift when planted in new locations the patterns appear to remain consistent relative to one another. Trees asexually propagated from this collection and planted in Kiribati exhibit similar seasonality profiles as in Hawaii except that the season begins about 3 months earlier (Redfern, 2007). Conclusions: There is significant phenological variation in seasonality among breadfruit cultivars. By planting cultivars that exhibit complementary phenologies the breadfruit production season can be extended, potentially enabling year round production.

68. Anti-biofilm activity of *Rosa canina* galls: a Turkish traditional medicine

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Staphylococcus aureus is a common bacterial pathogen, responsible for high rates of morbidity and mortality in both hospital and community

settings. Biofilms produced by *S. aureus* are extremely difficult to eradicate and are the wearisome source of recalcitrant infection. Natural products from medicinal plants used in managing infections may be useful in combating biofilm formation. Galls found on the stems or roots of *Rosa canina* L. [Rosaceae] are prepared by infusion to treat bacterial infections in Central Anatolian ethnomedicine. Extracts from the galls of this plant are evaluated for their anti-biofilm properties. Objectives: To examine the antibiofilm potential of MeOH and aqueous extracts from *Rosa canina* galls using in vitro models for biofilm-associated infection. Methods: Plant materials were collected in Turkey, extracted in MeOH or H₂O, lyophilized and stored at -20 °C. Voucher specimens were deposited at Gazi University's Eczacılık Fakültesi Herbaryumu, in Ankara, Turkey. Dose-response susceptibility studies were conducted using in vitro methods (Quave et al. 2008) for biofilm formation with clinical isolates of *S. aureus* (UAMS-1 and UAMS-1782). Results: Both MeOH and aqueous extracts from *R. canina* galls are effective in limiting bio-film formation at a MBIC of 50 µg/ml. Conclusion: These findings validate the use of this traditional medicine in the treatment of certain bacterial infections. Furthermore, the substantial in vitro activity of this extract makes it a good candidate for in vivo studies regarding the treatment of catheter-associated biofilm infection.

69. Photographic survey of Assumption Day herbal bouquets in Poland

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Bouquets containing medicinal herbs and crop plants have been blessed on Assumption Day in European churches since medieval times. Later in the year they served as a reservoir of medicinal plants and/or as objects with apotropaic properties. This tradition has survived in a few countries e.g. Poland, Germany and Austria. In 2008 a research project was started (Łuczaj 2009), using digital photos to document the bouquets blessed in Polish churches. This presentation is a report from the progress of the project. Most of the Carpathian region (S and SE Poland) has been documented so far, as well as some areas of E and NE Poland. In addition to the aforementioned project, two local, more focused, studies have been completed. In the first study a photo inventory of the bouquets in SE Poland (etic perspective) was compared with questionnaires, in which people freelisted the plants blessed, and those which are not blessed any more (emic perspective). The second study encompassed thirteen villages near Cracow. They hold a special place in Polish ethnobotany as their bouquets were documented by Seweryn Udziela at the end of the 19th century using voucher specimens. These two studies show some transformations of the traditional bouquets: the smaller presence of crops (e.g. cereals and vegetables) and herbs from pastures, and a larger presence of alien ornamentals. The medicinal herbs which still remain in the bouquets are usually ubiquitous ruderal plants, e.g. *Tanacetum vulgare* and *Achillea millefolium*.

70. Encouraging community involvement on the grass roots level for ethnobotanical research and outreach

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The Appalachian Center for Ethnobotanical Studies (ACES) is a multi-institutional program comprised of Frostburg State University, West Virginia University, and University of Maryland Biotechnology Institute. The mission of ACES stands at the intersection of tradition and science and it accomplishes this through research, community outreach and education, and regional economic development projects. ACES is committed to the preservation of Appalachian culture by exploring the relationship of individuals and communities to the cultural uses of plants, sustainable medicinal herb cultivation, and the protection of rare species in the Appalachian region. These efforts rely heavily on community participation. One method of encouraging this necessary participation has been to develop projects that encourage Students of the Ethnobotany major at Frostburg State University to gather community input from local crafts people, musicians, growers, and suppliers

in Appalachia and the mountains of western Maryland. These students have been involved in gathering data on local farmers markets, dulcimer artisans, maple syrup producers, medicinal herb growers, and non timber forest product harvesters. Another strategy has been the implementation of the Mountain Herbalist Series which has been successful at generating an awareness of the traditional uses of herbal medicines and Appalachian botanicals on a local level, while providing an opportunity for community dialogue to identify the needs and the values reflective of a longing to reconnect with a sustainable and natural model of self care rooted in local resources. These efforts have led ACES to strategies procedures for service to the community's needs. In addition a creative plan for the implementation of k-12 programming which will allow schools, teachers, and children in the area access to ethnobotanical information, ACES also seeks to address the needs of local small businesses and initiates this year the Maryland Medicinals Economic initiative which intends to provide support for local growers and natural product craftspeople by providing access to cooperative resources, facilities, packaging supplies, marketing support, and hands on experience in exchange for participation in ACES ongoing research. The intention of this paper is to share this model of community and institutional cooperation with others seeking to strengthen community ties through local and grass roots efforts.

71. Cooling teas of Barbados – Therapeutic and market potential

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The use of medicinal teas is a rural tradition in the island of Barbados. Years of colonial economic activity based on sugar cane agriculture and production have led to the dwindling of plant biodiversity, and access, with the concomitant decline in the tradition. In a survey carried out in 35 rural communities, knowledge regarding the use of local plant species for the brewing of "cooling teas" was reserved within the female population in the >45 yrs age group. The results of the survey unearthed 34 plants, belonging to 22 families, which are used in making single or multi-component cooling teas. The concept of a cooling tea was not clearly explained by participants in the survey, being considered useful for removing heat stress from the body while being administered. Thin Layer chromatography, TLC, and assessment of antioxidant potential of plant extracts showed them to be rich sources of polyphenols and to be of content similar to that found in green tea. Green tea is known to contain the polyphenol flavonoids, including the catechins, which exhibit a variety of physiological activities including antioxidative, anti-hypertensive, anti-inflammatory, anti-prolifer-

rative, anti-thrombogenic, and lipid lowering effects. The health benefits of these traditional cooling teas maybe linked to the physiological action of the cocktail of flavonoids naturally produced in the medicinal plants. Further study of these traditional cooling teas could lead to the development of nutraceutical teas which are garnering significant shares of the health and wellness markets.

72. Domestication and herbivore-induced volatile emission in tomato plants

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The domestication syndrome can be used as a model to test for differences in plant traits related to plant defense against herbivores. One mechanism by which plants become less susceptible to herbivores is the recruitment of natural enemies of phytophagous insects via herbivore-induced plant volatiles (HIPV); such a mechanism is predicted by the Indirect Defense Hypothesis (IDH). IDH states that plants should give natural enemies a reliable signal to facilitate prey/host finding to reduce herbivory. Some arthropod pest species induce increased volatile emissions in the cultivated tomato varieties they attack. This has lead to spe-

culation that induced volatiles in tomato plants are for biological control purposes. Induced resistance allows plants to respond dynamically to changing attacker identities and it is more effective than possessing no resistance, and more flexible and less costly than possessing high constitutive resistance. Here, we will discuss the association of domestication status and herbivore feeding on plant tissue on HIPV. We performed a series of experiments damaging cultivated tomato varieties (*Solanum lycopersicum* L.) and wild tomato populations (*S. lycopersicum* var. *cerasiforme*) with a phloem-sucking insect (*Bactericera cockerelli* (Sulc.), Homoptera: Psyllidae) and *Lepidoptera* larvae (*Trichoplusia ni* Hübner and *Spodoptera frugiperda* Smith, Lepidoptera: Noctuidae). Constitutive emission values were correlated with the difference between induced and constitutive volatile emissions in order to find a possible trade-off between the two emissions. We used a before-and-after attack experimental approach for each individual plant, which allowed us to control for natural constitutive variation. An effect of induction treatment and domestication status of plants was found in HIPV. Cultivated plants significantly reduced their volatile emission after induction with psyllids and larvae; just one variety significantly raised its emission after induction with *T. ni*. Our results show that HIPV are herbivore-specific and depend on the domestication status of the plant. Regardless of the direction of the response (higher or lower volatile emissions after induction), domestication homogenizes HIPV and exerts a cost on its emission.

73. Domestication processes of the tropical tree *Chrysophyllum cainito* L. (Sapotaceae)

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The process of incipient crop domestication includes an initial choice among available local species, followed by anthropogenic selection and spread of particular genotypes, against the backdrop of gene flow between cultivated and wild individuals. For most of our fully domesticated species, we see only the final product of hundreds to thousands of years of evolution and human-assisted migration. A unique opportunity is provided by species that are actively utilized by human communities but that also persist in wild, unimproved populations. In such species, we can study the evolution and spread of distinct lineages, and we can characterize traits under anthropogenic selection. The plant family Sapotaceae contains many woody species of economic and ecological importance in the American tropics. This work investigates the evolutionary dynamics of domestication in the neotropical tree *Chrysophyllum cainito* (Sapotaceae). Commonly known as cainito or star apple, *C. cainito* is cultivated throughout the Antilles, Central and South

America as an edible fruit. Its geographic origin has been debated in the literature. Phylogeographic approaches were used to investigate the origins of extant cultivated and domesticated forms of *C. cainito*. Data from intraspecific haplotype variation, based on nucleotide sequences, and from genotypes inferred from microsatellite markers were collected for wild and cultivated accessions. Results of both distance and Bayesian clustering analyses of both microsatellite and DNA sequence variation among individuals from populations in the Antilles, Mexico and Central America suggest a major split between most material from Panama and most material from the other areas. Phylogenetic studies within *Chrysophyllum* section *Chrysophyllum* were conducted to infer relationships among *C. cainito* and its close relatives and to provide an evolutionary context for understanding the origin of this species. These molecular results suggest that *C. argenteum* is the closest relative of *C. cainito*, contrary to the popularly held idea that *C. mexicanum* is the progenitor species of cultivated caimito.

74. Plants up for adoption: Why do southeast Asians so readily accept introduced plants into use, especially those from the Neotropics?

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Many food, ornamental, psychoactive and cosmetic plants that one finds in use in Thailand and Laos originate in Latin America, such as chili, tomato, papaya, pineapple, peanut, cashew, corn, tobacco, rubber, pitahaya, culantro, and sapodilla. They are adopted so extensively that most people, not just SE Asians, think these crops originated in Asia. Yet there is very little flow of plant use in the other direction from SE Asia to the Neotropics, with rice, mango, cilantro, and citrus being the main exceptions. Conversely, some Neotropical plants that grow easily in SE Asia have been ignored by the Thai and Lao, such as cacao, soursop, and allspice. Is this difference in transpacific introduced plant adoption rates due to colonial history, modern economics, qualities of the introduced plants, or SE Asian cultural values? To answer this question, we mined books from the 1600's to the present for information on introduced plants in SE Asia, performed market surveys, and interviewed Isan plant experts (herbalists, fiber workers, farmers, cooks) in Thailand, Laos and Oahu, Hawaii. The Isan are a large ethnic group spanning Northeast Thailand and Laos, many of whom have emigrated to Hawaii at various times in the last century. The Isan immigrants brought with them a key subset of their plants to Hawaii that has largely remained frozen, giving an

excellent historical cross-section of Isan plant use at the time they left SE Asia. Additionally, they have often adopted to using many new plants they have found in Hawaii, a modern record of plant adoption and substitution for plants left behind in SE Asia. Preliminary results show that the Thai and Lao's strong adoption of neotropical plants stems from a combination of factors including selling price, pests, number of uses, efficacy, phylogenetic similarity, status of the introducer, familiarity and productivity of the plant plus founder effects, openness to other cultures (with Thai more than Lao), and agricultural programs. The model derived from this research can be used to predict how Thai and Lao might react to future plant introductions, in an area of important food plants and emerging diseases.

75. Stratification protocols and germination rates of black cohosh (*Actaea racemosa* L.) populations from western Maryland

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Black cohosh (*Actaea racemosa* L. fmr. *Cimicifuga racemosa* (L.) Nutt.) is a culturally and economically significant herb native to eastern forests of North America. Used historically by the Cherokee for many common ailments, it is used today as a dietary supplement to reduce menopause symptoms, especially hot flashes. As the popularity

of *A. racemosa* as an alternative to hormone therapy grows, plant populations face increased threats from wild harvesting and habitat loss. Black cohosh is endangered in Illinois and Massachusetts, listed as an "At-Risk" plant by United Plant Savers and as a top-ranked medicinal plant species of special concern by the Nature Conservancy. Objectives: To determine cultivation techniques currently employed by *A. racemosa* growers; to establish the seed viability and germination rates of wild-harvested populations and open-pollinated individuals; to ascertain links between germination rates and seed morphological characteristics; and to distribute information to the general public, including harvesters and growers, regarding proper species identification and cultivation techniques for locally-adapted seed. Methods: In the fall of 2008 and 2009, approximately 128,000 seeds were collected from individual open-pollinated black cohosh plants in different physiographic regions of western Maryland. In 2008, seeds from 92 parent plants were winnowed, counted, weighed, and sorted by buoyancy. In 2009, seeds from 65 parent plants were added to the study to compare yearly variation. Seed stratification was consistent with published techniques to break dormancy and germination trials were conducted. Results: Comparisons across years and populations detected significant variation in seed morphology, buoyancy, germination rate, and seedling characteristics. From the 2008 collection, 327 seedlings emerged after 30 days, only 0.5% of all seeds. Bleach treatments showed increased germination when compared to controls. Germination rates and heritability

across years will be investigated. Conclusion: Rigorous investigation of the stratification and germination requirements of black cohosh will be the first step in the domestication of a wild medicinal plant. Results will provide valuable insight into the utility of seed-based husbandry for growers, help to encourage cultivation of locally-adapted seed by growers of other medicinal herbs and specialty crops, and provide a potential method for cultivation of other *Actaea* L. species.

76. Caracterización de ecotipos de chile poblano (*Capsicum annum* L.) en Tlalancaleca, Puebla, México

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En el Estado de Puebla se han identificado diversas variedades locales (ecotipos) de chile poblano cultivadas bajo diferentes sistemas de manejo tradicionales. Los productores las identifican por las características físicas de los frutos como las formas, tamaño, grosor de la cutícula, color, lustre, pungencia, entre otras; y por las características de

las plantas como altura, porte, ciclo vegetativo, resistencia a plagas y enfermedades. La importancia del trabajo se centra en la realización del mejoramiento participativo orientado a mejorar las características antes mencionadas y a contrarrestar los efectos de "la secadera", enfermedad causada por bacterias, virus y nematodos (Rodríguez, 2004). Objetivo: Caracterizar los ecotipos existentes en el agroecosistema de chile poblano en San Matías Tlalancaleca, Puebla. Metodología: El proyecto de investigación se realizó en dos comunidades del Estado de Puebla, Juárez Coronaco y San Matías Tlalancaleca. El enfoque fue el de la Investigación-Acción Participativa (I-AP) orientada a detectar el conocimiento campesino y en el proceso de Planeación Estratégica para la parte diagnóstica. Se complementó la información con talleres para el intercambio de saberes, el seguimiento de procesos y la aplicación de una entrevista semiestructurada. Resultados: Se identificaron seis ecotipos conocidos localmente como: ancho, mulato, poblano, loco, botelludo y liso. Se describieron de acuerdo a las características particulares de cada campesino como rendimiento, sanidad, tamaño, porte de la planta, lisura, forma, color del fruto y hundimiento del pedúnculo. Conclusión: Los campesinos muestran más importancia a la siembra de ecotipos resistentes a enfermedades y rendimiento. Así también a las características más buscadas en el mercado, para la actividad culinaria como es tamaño, forma, color y sabor, ya que de éste producto dependen diferentes platillos tradicionales del Estado de Puebla como son el mole poblano y los chiles en nogada.

77. Bactericidal and bacteriostatic effects of 15 anti-diarrheal plants from central Anatolia

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Diarrhea is the second leading cause of death for children under the age of five. However, gastroenteritis is under-studied for several reasons. Research conducted on effectiveness of anti-diarrheal plants usually focuses on interactions between the gastrointestinal tract and the plant extract. However, instead of treating the symptoms of gastroenteritis, treating the causes could decrease the severity of infection and eliminate the spread of infectious agents. After viruses, bacteria are the leading cause of acute gastrointestinal disease. Objectives: In this study, the effectiveness of 15 Central Anatolian plant extracts is evaluated against ten bacterial strains that commonly infect the human intestinal tract and cause diarrhea. Methods: Ethnobotanical research and a thorough literature review were carried out in Central Anatolia for one year, beginning in September 2009. Plants used to treat diarrhea were collected with informants. Voucher specimens were deposited in Gazi University's Herbarium, in Ankara. Bulk specimens were collected and processed for 15

plants after a de-replication process. Methanol and aqueous extracts were prepared from ethnobotanically relevant parts of the plants for a total of 34 extracts. An antibacterial activity test was carried out using microtiter broth dilution methods against 10 standard strains of bacteria. Wells that showed inhibition of growth were then plated for growth to determine bactericidal versus bacteriostatic effects. Static effects were measured by CFU/mL. Antibacterial standards and appropriate controls were utilized. Results: A total of 95 interactions resulted in a minimum inhibitory concentrations (MIC's) of µg/mL or less, with 21 interactions showing MIC's of µg/mL or less. All had differences between bactericidal and bacteriostatic MIC's. *Vibrio cholerae* (RSKK 96023), *Staphylococcus aureus* (ATCC 25923), and *Enterococcus faecalis* (ATCC 29212) showed the most susceptibility to plant extracts from *Rosa canina* L., *Cydonia oblonga* Mill., *Hypericum perforatum* L., *Rhus coriaria* L., and *Rumex patientia* L. Conclusions Several anti-diarrheal plants from Central Anatolia have bacteriostatic activity against bacterial strains that are known to cause acute gastrointestinal illness. Further research for biologically active chemical constituents, cytotoxicity levels, and mechanisms of action could lead to a readily-available treatment for acute gastroenteritis in this region.

78. Variation of kernel anthocyanin and carotenoid pigment content in Arido-American land races of maize

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Traditional agricultural systems in diverse bioclimatic regions of Arido-America utilize numerous land races of maize. There is growing interest in the beneficial role dietary carotenoid and anthocyanin pigments may play in human health. Arido-American land races of maize display considerable variation for kernel color, but their pigment content has not been studied. Objectives: Our objective was to examine the kernel pigment content of representative Arido-American maize accessions. Methods: We examined kernel samples obtained using controlled pollination techniques on Native Seeds/SEARCH accessions planted in replicated nurseries at two locations in 2008. The racial identity of these accessions was unclear so morphological traits were also examined to assist in their classification. We examined ear, cob, plant and kernel traits including total carotenoid and anthocyanin pigment content. Results: The majority of samples had flinty, white kernels suggesting a possible regional preference for colorless food products. The second most abundant kernel types were yellow and floury, respectively. Samples with high carotenoid pigment content (i.e. above 40µg/g) were not in evidence whereas many accessions contained mixtures of red, purple

and blue anthocyanin pigments -- some with high concentrations (i.e. above 50 mg/100g). The accession with the tallest plants (mean 286cm) and longest ears (mean 26.3cm) was classified as race 'Onaveno' and 'Yoeme Blue' had the shortest plants (mean 104cm). Conclusions: We concluded that this germplasm does not possess high carotenoid pigment content, but some accessions have high anthocyanin content which may be beneficial for human health.

79. Inhibition of adipogenesis by saw palmetto extracts: A possible mechanism for its effects against BPH

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Extracts of the mature fruits of *Serenoa repens* (W. Bartram) Small (saw palmetto, Arecaceae) have a long history of use in the treatment of benign prostatic hyperplasia (BPH). The fruits are common in archaeological sites throughout the state of Florida and were an important food for indigenous peoples during historical times. Florida's indigenous Seminole and Miccosukee peoples called the plant sheope'n taale. Although it was an important source of food and materials, the palm was not a part of their pharmacopoeia. Moreover, there is no reliable information to suggest that the fruits

were used medicinally prior to the late 1800s. Recent publications in the New England Journal of Medicine and the Cochrane Review cast doubts on the efficacy of the fruits in alleviating the symptoms associated with BPH. This may be due, in part, to the uncertainty of BPH pathology. At least 10 different mechanisms may be effective in reducing BPH symptoms. Here, we report another mechanism. Ethanolic and hexane (but not aqueous extracts) of field-collected saw palmetto fruits administered with a fibroblast differentiation factor (DF) and DMSO inhibited adipogenesis in a dose-dependent fashion at concentrations of 0.312 to 1.000 mg/ml. Higher doses were also inhibitory but could not be distinguished from cytotoxic effects. Neither oleic, stearic or lauric acids (major constituents of saw palmetto fruits) singularly or in combination nor olive (*Olea europea*, Oleaceae) controls showed activity against fibroblasts. Some evidence suggests that saw palmetto extracts are effective in treating prostatic cancer. Inhibition of the differentiation of fibroblasts into adipocytes may explain this effect as well as its activity against BPH.

80. Changes in amyl alcohols as compounds indicative of fermentation degree in *Theobroma cacao* L var. forastero in Tabasco Mexico

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Fermentation of cocoa beans is a needed process to develop aroma precursors for chocolate. During these process amyls alcohols arise from Strecker degradation or biodegradation of free amino acids. In cocoa, these compounds are related to fermentation process. The concentrations ratios of these compounds are already used as a measurement of fermentation degree (Oberparleiter and Ziegler, 1997). For the agro-industrial, easier control methods are needed to evaluate the fermentation degree. Objectives: To evaluate the evolution of amyls alcohols and acetates compounds from Forastero cocoa beans during fermentation. Methods: The amyl alcohols and acetates compounds during fermentation cocoa beans, were extracted by the solid phase microextraction in the headspace (SPME-HS) and analyzed by chromatography/mass spectrometry (GC-MS). Results: The amyl alcohols and acetates obtained from cocoa beans during fermentation were 2-methyl-1-propanol, 3-methyl-1-butanol, 3-methyl-2-butanol, 2-pentanol, 3-methyl-1-butyl acetate, methyl acetate and isobutyl acetate. The concentration ratios of methyl-1-butyl acetates to methyl-1-butanols from 2 to 8 day of fermentation were 0.41, 0.60, 0.84, 0.64, 0.99, 1.95 and 1.68. Conclusion: If a concentration ratio of methyl-1-

butyl acetates to methyl-1-butanols is higher than 1.5 indicates over fermentation (Oberparleiter and Ziegler, 1997). Therefore, it is recommended to stop fermentation by day 6, when the ratio is lesser than 1.5. It is important to stop the fermentation process at this moment because amyl alcohols are esterified to amyl acetates; the presence of this compound and low concentrations of methyl-1-butanols may be an index of flavor defects.

81. How woody vegetation mosaic contributes to maintain biodiversity in grazed pastures of Central Veracruz, Mexico?

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Although small-scale agroforestry systems are important reservoirs of biodiversity in cloud forests, there has been a poor attempt to describe them. In central Veracruz, the landscape is dominated by livestock systems, which model the biodiversity and structure of remnant forests and create new woody vegetation systems. Objectives: Describe four different woody vegetation types preserved

in ten livestock farms with semi-intensive management in Acatlan, Veracruz. Methods: The characterization consist in sampling the trees and shrubs with DBH >0.3 cm and >1.3 m height in 0.4 ha of forest fragments (FF) and secondary forests (SF); 1.62 ha of pastures with low density of trees (PT) and 1500 m of live fences (LF). The presence of regeneration was obtained by sampling 640 m² in both forest types and 240 m² in LF. Different biodiversity and structural descriptors were obtained in addition to the seedlings composition and density. Results: The inventory found 2915 individuals, 46 families, 64 genera and 119 species. The FF maintain a high number of species (93); the SF and LF presents intermediate richness values (41 and 31 spp.) and 14 species were found in PT. Non parametric estimators indicate that more sampling effort is required. Shannon and evenness show that FF are more diverse and equitable ($H' = 3.562$; $E = 0.786$) followed by LF ($H' = 2.617$; $E = 0.762$). High complementarity between systems (>70%) explain that biodiversity of trees and shrubs in livestock farms is given by the addition of the richness found in each woody land use type, and not by a sampling site in particular. The FF presents more biomass (91.46 ± 13.23 m²/ha) followed by LF (70.07 ± 10.65 m²/ha). FF presents high proportion of primary species seedlings (50%) and high density (3.7 indiv/m²) while secondary forests and live fences show a high proportion of secondary species seedlings (81 and 86%) and low density (1.7; 1.2 indiv /m²). Conclusions: High number of seedlings and saplings in FF and SF highlight the importance of these

sites for future rehabilitation or restoration projects, while the lack of PT and LF are an opportunity to create new agroforestry systems that preserves biodiversity outside pristine forest.

82. Estudio del uso potencial de *Peperomia* (Piperaceae) en el estado de Veracruz, México

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El género *Peperomia* es el segundo más grande de la familia Piperaceae, siendo *Piper* el género con más especies y de mayor importancia económica por *Piper nigrum*, la fuente de la pimienta negra y blanca, así como *Piper auritum* (acuyo o hierba santa) conocido en México como planta medicinal y condimento. En México, el género *Peperomia* se distribuye principalmente en las regiones tropicales y se encuentra representado por aproximadamente 120 especies, siendo Chiapas, Oaxaca y Veracruz los estados con el mayor número de especies en el país. El presente estudio pretende explorar y analizar el potencial de uso del género *Peperomia* en el estado de Veracruz, a base de una revisión bibliográfica y de fuentes en el internet, información de ejemplares depositados en diferentes herbarios

nacionales, exploraciones de campo, así como confrontando las especies nativas de este estado con los usos que se les da en otros estados de México o países neotropicales. De las 63 especies de *Peperomia* que actualmente se tienen registradas para Veracruz, se reportaron 16 especies útiles en cuatro categorías de usos principales (ceremonial, comestible, medicinal y ornamental), donde cuatro especies tienen más que un solo uso, destacando la especie *Peperomia blanda* con tres diferentes usos. La mayoría de estas especies solo son mencionadas como parte de diversos listados florísticos y etnobotánicos, sin embargo, sus usos son poco estudiados en Veracruz, por lo que se requiere la realización de nuevas investigaciones y mayores exploraciones de campo, adquiriendo información actualizada de diferentes regiones donde se distribuyan dichas especies. En especial, se requiere una mayor prospección acerca del mercado y el cultivo de las especies silvestres que son usadas como saborizantes (cilantro de monte). Por otro lado, resalta el potencial ornamental de varias especies por lo peculiar de su follaje. Además, la facilidad de su reproducción vegetativa y cultivo podrían ofrecer una alternativa sustentable para su aprovechamiento como recursos forestales no maderables.

83. Bocaiúva (*Acrocomia aculeata* (Jacq) Lodd ex Mart; Arecaceae): an alternative for income generation for traditional communities in Brazil

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The results of a study about the exploration and commercialization of *Acrocomia aculeata* - a native palm tree from the Pantanal region (Brazil) are presented. From interviews with representatives of the distinct segments related with the productive chain, it was possible to identify: 1) no statistical information on harvesting, processing and commercialization; 2) Strong wild harvesting activity and absence of commercial plantations in the region; 3) incipient activity of fruit processing mainly for liquor, flour and ice cream production 4) intense informal commercialization of fruits in natura in fairs and markets between November and December; 5) reasonable market access from harvesting areas including airport facilities for export products; 6) high potential as an alternative for income generation for traditional communities in the region. The identified situation could be optimized by the systematization of the productive chain through joint actions among the government, society and the agencies of research. In this perspective, some proposals are discussed.

84. Desarrollo empresarial comunitario como estrategia de conservación: el caso de la vainilla en la región Totonaca, del estado de Veracruz, México

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Diversos registros ancestrales han proporcionado indicios sobre la estrecha relación de las comunidades y sus recursos naturales. Informes del Banco Mundial (2004) estiman que la subsistencia e ingreso del 90% de los más pobres, depende en gran medida de los bosques. Bajo estas premisas, En diferentes partes del mundo se han desarrollado estrategias o procesos de intervención buscando dar valor agregado a los productos forestales maderables y no maderables que han derivado en el uso, manejo y conservación de los recursos naturales con un enfoque de sostenibilidad. La vainilla es un producto que surgió del manejo cultural Totonaco de sus selvas y acahuales; sin embargo, en la actualidad los pequeños productores carecen de la infraestructura para dar valor agregado a la vainilla mediante un beneficio enfocado en la calidad, que exigen los mercados que valoran económicamente el

conjunto de elementos que caracterizan a este emblemático producto de la región, de una muy alta demanda a nivel nacional e internacional. Objetivos: Proporcionar elementos clave para el disminuir la pobreza en comunidades indígenas y motivar a la conservación del germoplasma nativo de la región Totonaca del estado de Veracruz, México; a partir del desarrollo de actividades empresariales comunitarias. Métodos: La estrategia de intervención sienta sus bases en un modelo que traduce los conceptos de productividad ecosistémica en estrategias para el desarrollo empresarial comunitario. La propuesta metodológica se complementa con la transferencia tecnológica de un sistema de beneficiado a baja escala, que permite obtener vainilla de muy alta calidad, reduciendo el tiempo y la complejidad del beneficiado a gran escala. Resultados: El modelo teórico-conceptual proporciona elementos para el desarrollo empresarial rural de pequeños productores; así como para el uso, manejo y la conservación de la vainilla, y de los acahuales en los que se cultiva.

85. Could doubling the maize harvest be a bad thing? Economic rationality in mixed cropping systems

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Low-input, traditional mixed farming is often viewed as an obstacle to improving farmers incomes and livelihoods, because of the relatively low yield of the principal crop. Frequently, the persistence of these practices are attributed to ignorance and lack of access to inputs. Numerous government and ONG programs aim to convince (and sometimes coerce) farmers to adopt monoculture and modern inputs. Data source However, several analysis (1, 2, 3) of most costs and benefits derived from traditional mixed maize systems (milpas) from the central highland of Mexico show these systems to be highly profitable under local conditions. Maize grain only contributes as little as 15-30% of the value of the whole harvest. Discussion Economic rationality depends mainly on opportunity costs - that is, the value of labor from the individual farmers' possibilities and point of view. In our examples, farmers would need to have alternatives at about the level of a salary of a recent university graduate in Mexico, in order for intensive, high-external-input cropping to be an economically rational alternative. A model for understanding farmers' decisions is presented. It integrates different types of products (selfconsumption, local/regional market with a mass value, local/regional market with a high value, international market), as well as different types of costs (labor, market access, inputs). Conclusions: The model shows that traditional mixed farming is the best economic alternative for many farmers.

86. Use and spatial availability of *Agave potatorum* in San Luis Atolotitlan, Puebla, Mexico

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This study was conducted in San Luis Atolotitlán, Puebla in order to analyze the process of extraction, traditional use and management of *Agave potatorum*, the process of artisan mezcal production and commercialization. The extraction of the reproductive agave individuals stems for mezcal takes place only in wild populations; this prevents sexual reproduction which in turn affects plant distribution and availability. Mezcal production and marketing are also curtailed, with an important impact on monetary incomes. Hypothesis: Local populations of *Agave potatorum* will present a fragmented distribution, isolated from others and threatened with local extinctions, putting the future availability of the resource at risk. Considering its actual availability, if present rate of extraction continues, it is predictable that the activity will not last a decade. Objectives: Document the processes of extraction, uses, traditional management practices of *Agave potatorum*, the process of mezcal production and commercialization, in order to analyze its economic importance, spatial availability and distribution, and the risks due to present use patterns. Method: To document uses, traditional

knowledge, cultural and economic value of *Agave potatorum*, interviews and households surveys where conducted; mezcal producers were also questioned in order to document production and commercialization processes. Extraction sites were visited, spatial availability was calculated using ecological sampling plots. Georeferenced presence points were taken to generate a potential distribution map using GIS. Results: The study identified the economic importance of *A. potatorum* in the mezcal production, which benefits 30% of local households. *A. potatorum* is also valued as food, medicine, fodder, and construction material. Annually, 11,975 stems of *A. potatorum* are needed for mezcal production in the village. While the extractable amount estimated is 7,296 within the village territory, among 4,000 and 6,400 are extracted, leaving a deficit of between 5,575 and 7,975 per year, which is extracted from neighboring villages, extending the impact to those communities. Although, mezcal production is not a sustainable activity, due to high social and ecological costs and low economic revenue, it will persist until the resource is extinguished.

87. The sustainable management and conservation of *Santalum yasi* (sandalwood) in Fiji and Tonga: A combined ecological and genetic approach

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Valued locally and internationally for the aromatic oil found within its heartwood, Sandalwood (*Santalum*, Santalaceae) is one of the most heavily exploited groups of plants across its range. Fijian/Tongan Sandalwood (*Santalum yasi*) has had a long history of extensive harvesting and may be threatened with extinction, yet it has been vastly understudied. Objectives: The aim of this study is to help develop sustainable management strategies for this culturally and economically valued resource. Methods: Population dynamics, current species distribution, and ecological threats were investigated, as well as a nuclear microsatellite analysis to shed light on genetic variability within and between populations on ten different islands. Interviews were carried out to ascertain past and current conservation practices—both government and local—for *Santalum yasi*. Results: The few remaining wild stands display discontinuous size class structures, extensive hybridization, regenerative stress, and significantly diminished natural distribution, even to local extinction in some areas. Genetic analysis results suggest that there is no significant genetic variation between populations, but that most of the genetic variation lies within populations. Varying degrees of conservation efforts have been implemented

at both the governmental and local levels with a range of outcomes. Conclusion: The observed population dynamics and ecological threats make it apparent that immediate action to regulate harvesting and to minimize other risks is critical for the conservation of *Santalum yasi*. The genetic analyses suggest that there is a significant level of gene flow between and among populations, most likely through human induced dispersal, showing a more panmictic trend than would be anticipated on an insular system and compared to other insular sandalwood species. This may provide molecular evidence confirming the oral histories of extensive interaction between Fiji and Tonga and their trade of plants and culture. Based on the findings of this research, it is suggested that governmental efforts should focus on the promotion of local involvement in assisted natural regeneration of wild stands and preservation of genetic variation through *in situ*, community-mediated conservation.

88. Chocolate and malaria: an evaluation of cocoa flavanols as an anti-plasmodial prophylaxis

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In 1577, Francisco Hernandez wrote that a beverage prepared from cacao beans was used to treat fever and liver disease in Mexico. While human malaria is thought to have reached the New World after

transatlantic contact with the Old World, cocoa flavanols exhibit a range of biochemical activities in plasma that could potentially affect blood stage *Plasmodium* parasites via indirect mechanisms that reduce pathogenicity. Objectives: To test whether cocoa flavanols disrupt blood stage *Plasmodium* growth and pathogenesis sufficiently to give host immune systems time to clear malaria infections-and also to identify the putative mechanisms for anti-plasmodial activity. Methods: In vitro trials using a murine malaria model with the pathogens *Plasmodium berghei*, *P. chabaudi* and *P. yoelii* were conducted with concentrated cocoa flavanols delivered continuously in drinking water. Complementary in vitro assays with human *P. falciparum* were conducted to measure disruption of adhesion of infected red blood cells to fixed endothelial receptor proteins. Results: Cocoa flavanols bind both fixed and soluble endothelial receptor proteins. This suggests that the compounds act on infected red blood cells by reducing the receptor sites available for parasites seeking to avoid the host immune system by sequestering. Concentrated cocoa flavanols in drinking water significantly reduced the virulence of parasite genotypes exhibiting late stage sequestering behavior. The inhibitory effect of flavanols on non-sequestering parasite genotypes was less pronounced. Conclusion: Most human adults in endemic *Falciparum* malaria areas have acquired a level of immunity to the disease, making it a chronic rather than acute condition. Mortality occurs primarily in child cerebral malaria and pregnancy associated malaria. The parasites responsible for

lethal cases typically exhibit sequestering behavior. Since sequestering can be attenuated by flavanols in blood plasma, cocoa beverages with high flavanol contents may have potential as a prophylaxis against severe malaria.

89. The principal flowers of ancient elite rituals at Copan, Honduras

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Copan was an ancient Maya city located in what is now western Honduras. Botanical imagery abounds at the site in elite contexts during the Classic period (A.D. 400-850), but little is known concerning actual plant use in these areas. Objectives: To uncover evidence of plant species favored by the Maya for elite rituals during the Classic period, and if possible to gain insight into the selection of each species. Methods: Residue samples were scraped from over 40 temple, tomb, and palace floors to search for information. The primary method of analysis was palynology. Results: The analysis of pollen residues from temple and tomb floors at the ancient site of Copan, Honduras has revealed a wide spectrum of plant species in ritual spaces. These botanical components of elite precincts were selected from the environment to act as offerings, tools and backdrops for ritual activities. Conclusion: Plants and plant products were used in the Acropolis to selectively simulate the natural world, recalling the mythic origins of the Maya.

Flowers and plants were chosen not only for their mythological associations, but also likely for appealing smells, colors, and tastes. Their presence would have endowed ritual areas with an array of attractive sensory experiences. Of the four species most commonly found in ritual areas, only one, maize (*Zea mays* L.), continues to play a widespread role in Mesoamerican ritual life.

90. The relationship of *Chenopodium domesticates* and a preliminary phylogeny of American *Chenopodium*

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Archaeological evidence suggests that domesticated *Chenopodium* arose in the New World by 3,500 B.P. Four domesticates have been recognized; *C. pallidicaule* and *C. quinoa* from South America, *C. berlandieri* ssp. *nuttalliae* from Mesoamerica, and the extinct *C. berlandieri* ssp. *jonesianum* recovered from archaeological sites throughout eastern North America. Researchers disagree about the relationship among these domesticates and the number of independent origins: 1) Smith (1984) asserts that the extinct *C. berlandieri* ssp. *jonesianum* was domesticated independently; 2) Wilson (1981) disagrees, suggesting *C. berlandieri* ssp. *jonesianum* represents an ancient introduction of the Mesoamerican domesticate, *C. berlandieri* ssp. *nuttalliae*; 3) Several researchers argue that *C.*

berlandieri ssp. *nuttalliae* is conspecific with *C. quinoa*; 4) Gandarillas (1968) proposed that *C. pallidicaule*, the only diploid domesticate, may have contributed one of the parent genomes of other domesticates (all tetraploid). We are reconstructing the phylogeny of New World *Chenopodium* to examine hypotheses concerning the number of domestication events, identify potential progenitor species, and to enhance our understanding of the domesticates. Phylogenetic analyses of DNA sequences of non-coding loci, nuclear (ITS) and plastid (trnQ-rsp16 and psbD-trnT), were conducted using parsimony, maximum likelihood, and Bayesian analyses. Taxon sampling includes *Chenopodium* species from North and South America, with focus on extant cultivated and wild varieties of the *C. berlandieri* complex. The six wild varieties of *C. berlandieri* could not be distinguished based on sequence data. However, *C. berlandieri* var. *sinuatum*, allies with *C. album* from Europe; suggesting a taxonomic reclassification. Sampled cultivars of *C. berlandieri* ssp. *nuttalliae* unite in a single subclade, nested within but distinct from the *C. berlandieri* complex. This demonstrates the Mesoamerican domesticate is genetically distinct from the other extant *Chenopods*. The identification of DNA characters unique to *C. berlandieri* ssp. *nuttalliae* means that these differences will be useful in future aDNA analyses investigating the relationship of *C. berlandieri* ssp. *nuttalliae* and *C. berlandieri* ssp. *jonesianum*. Interestingly, *C. quinoa* is nested within the *C. berlandieri* complex, but not

within the *C. berlandieri* ssp. *nuttalliae* subclade which is congruent with separate origins for *C. berlandieri* ssp. *nuttalliae* and *C. quinoa*.

91. Selection, management and diffusion of Açaí Branco by smallholder farmers in the amazon estuary

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Açaí, the purple fruit of the palm *Euterpe oleracea* Mart. serves an important function in the amazon estuary as both a staple food and a primary source of income amongst smallholder riverine farmers. Açaí branco, an ethnovariety that lacks the purple pigment, is considered sweeter and more easily digestible and is priced higher in the markets of Pará and Amapá. In response to surging global demand for purple açaí, standardized cultivars are under development. However little attention has been given to the selection efforts of its primary producers, smallholders, who play an important role in conserving diverse traits and varieties. Açaí branco provides an opportunity to explore the role of economic and cultural incentives in maintaining agrobiodiversity in a crop entering a phase of industrialization. Objectives: 1) Determine açaí branco production amongst smallholders in three estuarine communities across several seasons. 2) Describe applied silvicultural strategies in the

selection of açaí branco. 3) Trace the spatial and temporal diffusion of the variety through informal seed systems. Methods: Forty-two structured interviews, 14 questionnaires and 15 transect walks were conducted between three communities of Amapá and Pará, Brazil. Mapping of açaí branco distribution was conducted with a GPS unit and eight açaí agroforest plots were sampled to determine management intensity. Results: On average, 93.5% of households were producing or planting açaí branco, and production increased from the previous season in all communities. Of the fruit produced, 36% was sold and 64% consumed or gifted despite higher market prices. Propagation and regeneration techniques were more highly specialized in the case of açaí branco. Participation in seed exchange networks varied from 17% to 100% of participants between communities and was correlated with presence of pre-existing açaí branco, and community age. Conclusion: The low proportion of açaí branco being sold demonstrates that risk-averse strategies can be motivated by more than economic incentives alone. As a locally important variety of a globally marketed crop, the case of açaí branco demonstrates the importance of cultural preferences and local knowledge in driving innovations and technology transfers that promote agrobiodiversity through the diffusion and adoption of new crop varieties.

92. Traditional Reproductive Health, Fertility Regulation, and the Use of Hormone-Mimicking Plants among the Q'eqchi Maya in Southern Belize

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In the Q'eqchi Maya communities of Belize, practicing female traditional healers and midwives are becoming increasingly rare. However, one to several recognized male "ilonels" or "bush doctors" reside and practice in most villages in the southernmost Toledo District. Knowledge of traditional Q'eqchi remedies for women's health and fertility regulation still exist in the community, among individuals including male healers, non-practicing midwives, grandmothers, and mothers. Objectives: This study was conducted in conjunction with the Belize Indigenous Training Institute (BITI) in the hopes of comprehensively documenting traditional plant-based treatments for reproductive health, and revitalizing traditional Maya women's medicine in Belize. BITI shares an interest in further validating Q'eqchi traditional wisdom through verification of medicinal qualities of their plant medicines with relevant bioassays and literature research. Methods: Semi-structured interviews, forest and home garden interviews, photo elicitation, and plant collections were used to collect data with 32 Q'eqchi adults over a dozen fieldwork trips to Belize between 2007 and 2010. Results: The Q'eqchi in Belize utilize at least 70 plant species in 35 families for 47 conditions related to women's reproductive health. The highest numbers of species were used to treat heavy menstruation, for use as contraception, to treat infertility, for use during pregnancy, and for treating difficulties in menopause. Several

of genera and species used by the Q'eqchi for reproductive health and fertility regulation have been shown to be either estrogenic or antiestrogenic, further validating their medicinal efficacy and traditional usage. In addition to medicinal plants, healers use massage, prayer, and ritual in their ethnomedical treatments. Conclusions: Collectively, the Belizean Q'eqchi have an extensive pharmacopoeia of traditional plant-based treatments for reproductive health and fertility regulation. Interested and knowledgeable Q'eqchi women are being organized into a Maya Women's Medicine Collective for purposes of knowledge transmission and cultural revitalization. The Belize Indigenous Training Institute is maintaining a medicinal plant forest garden, where species used traditionally for reproductive health are being cultivated for ethno-medical treatments, conservation, research, and educational use for training younger generations of Q'eqchi Maya in Belize.

93. Conociendo las plantas de mi localidad. La botánica como una herramienta educativa

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En Veracruz, las comunidades rurales suelen ubicarse en zonas donde existe vegetación conservada con potencial para el hallazgo de nuevas especies y el registro de sus usos. Este conocimiento es relevante para la conservación de la diversidad biológica y cultural del estado. Para promover el interés por el conocimiento botánico se realizó, en el marco del proyecto "Atlas de la Flora Endémica, Notable y en Peligro de Extinción de Veracruz", un programa de talleres de educación ambiental que permitió establecer vínculos estrechos entre los investigadores y la población rural. En un principio, el programa consistió en la elaboración de un manual para profesores y alumnos, con fichas descriptivas de plantas notables y endémicas de Veracruz, que fue utilizado como herramienta para el desarrollo de los talleres en escuelas de educación básica y media. Durante los talleres se planteó el estudio de la botánica como una manera de aproximarse al quehacer científico al tiempo que se realizaron ejercicios didácticos que fomentaron el conocimiento de los recursos vegetales y las actividades de conservación que pueden ser desarrolladas por las propias comunidades. Posteriormente, se desarrolló un paquete informático que permite realizar una investigación de los recursos vegetales locales, al tiempo que enseña conceptos básicos de botánica, mismo que estará disponible en Internet para toda persona interesada. Por medio de un convenio

establecido entre la Universidad Veracruzana y la Secretaría de Educación de Veracruz, este paquete llegará a las comunidades rurales a través del Programa Vasconcelos que, mediante aulas móviles equipadas con computadoras y acceso a Internet, capacitará a profesores y grupos campesinos en el uso del material desarrollado por CITRO. En el futuro, este paquete permitirá el rescate de valiosa información científica. Considerando que, en numerosas ocasiones, las investigaciones relacionadas con la protección de la biodiversidad han subestimado el papel de las comunidades rurales en la conservación de las especies vegetales, la realización de este proyecto resulta de suma importancia para el estudio y conservación de la diversidad vegetal en Veracruz.

94. El uso del género *Beaucarnea* para conservar la selva seca en México

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Beaucarnea (Ruscaceae: Nolineae) es un género de plantas monocotiledóneas arborescentes de crecimiento lento con fuerte demanda como ornamentales en el mercado nacional e internacional, lo que ha provocado la extracción ilegal que aunado a la pérdida de hábitat pueden llevar a las especies de la categoría de amenaza a un estado de peligro de extinción. Objetivo: Conformar una Red para el estudio del género *Beaucarnea*, evaluar el estado de conservación y proponer estrategias de aprovechamiento. Metodología: Se hizo una revisión bibliográfica, visitas a herbarios y Jardines Botánicos para generar una base de datos de las áreas naturales protegidas que albergan el género y se evaluó el impacto de las prácticas de manejo. Se generaron nueve mapas fitogeográficos generales, uno por especie, relacionados con las provincias fisiográficas de México. Para conocer la densidad, demografía y biología floral se hicieron muestreos con transectos de 1000 m² (100 x 10 m). Resultados: Se reconocen 11 especies, 10 en México y nueve son endémicas al mismo. *Beaucarnea compacta*, *B. goldmanii*, *B. gracilis*, *B. guatemalensis*, *B. hiriartiae*, *B. inermes*, *B. pliabilis*, *B. pupusii*, *B. recurvata*, *B. sanctomariana*, *B. stricta*. Habitan en vegetación seca templada, cálida subhúmeda y templada subhúmeda. Se les reconoce con nombres como pata de elefante, soyate monja, apachite, y en países de habla inglesa como "ponytail palm". Varias especies son ornamentales en jardines botánicos europeos. En México se utiliza como ornamental, las flores de algunas especies son comestibles y con las hojas se hacen artesanías o adornos ceremoniales. Son una fuente de

precursores de hormonas esteroideas. La evaluación del estado de conservación del género se expresa en mapas de distribución actual y potencial; también se evalúa la representatividad de las especies en las colecciones nacionales y se colectó el germoplasma de cada especie. Conclusión: Se concluye que las especies del género *Beaucarnea* tienen importancia biológica y económica y pueden contribuir a la conservación del hábitat en el que distribuyen y proteger otras especies aún no estudiadas.

95. The role of primary and secondary crops in species and cultural conservation in Boumba, Niger

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Resilient African agriculture systems are a focus of much research and debate in both the science and development circles. In Niger, the main crop millet is often grown alongside secondary or adventitious crops, which have ethnobotanical uses. Objectives: This paper explores how the promotion of secondary crops or the weeds of agriculture can support social-ecological resilience and increase agrobiodiversity. We examine how current agriculture practices affect the biodiversity of farms and presence of socio-ecological keystone plants, and test the hypothesis that secondary crops can mitigate the loss of

resilience that occurs with conversion from natural to agricultural landscape. Methods: This research is based on participatory ethnobotanical research conducted in southwest Niger from 2005 until 2008, which employed farmer interviews and vascular plant surveys of the farms. Using species richness and diversity, percent land cover, presence of seedlings, and keystone species we compared cultivated and non cultivated areas. Results: The presence of secondary crops increased the socio-cultural land value, promoted cultural relationships. The effects on biodiversity directly were non-significant, but secondary crops were important to the dynamics of the system. Conclusion: This research demonstrates how by promoting certain key plants farmers have been able to increase cultural value of their farms, turned field borders into productive parts of the farms and mitigate loss of resilience within agricultural systems.

96. Modern trends of traditional psychoactive drug plant use in Micronesia

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The major traditional psychoactive drug plants of Micronesia include betel nut (*Areca catechu*) and its associated quid components which have been used for many centuries if not thousand of years in Palau, the Marianas Islands and Yap, and kava (*Piper methysticum*) which has or had been used ceremonially for centuries in Pohnpei and Kosrae.

In other areas of Micronesia such as Chuuk, the Republic of Marshall Islands and Kiribati, there is no record of traditional psychoactive drug plant use prior to contact with Western Civilization. During the second half of the 20th century and now in the 21st century, there have been significant changes in the consumption of these traditional drug plants in Micronesia, including the adoption of their use in one or more sub-regions where they were never used before, e.g., kava in Kiribati and betel nut in the Marshall islands. Other important changes in psychoactive drug plant use in Micronesia include the spread of ingestion well beyond traditionally restricted class, gender and age barriers. Although some of these modern trends have been documented, others have not, and no recent overview has surveyed and analyzed these changing geographical and cultural patterns of traditional Micronesian drug plant use. This paper describes and discusses these patterns in the context of their ecological, historical, social, health and legal ramifications.

97. The history of eggplant domestication: Phylogeographic relationships among candidate progenitors and asian landraces

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Eggplant appears to be the product of an unusual domestication syndrome in which the first uses were medicinal with a later shift to culinary use. Hundreds of landraces, which differ from each other in gastronomic and health-beneficial attributes, are still maintained by communities throughout Asia. We are using a collection of 200 landraces and wild relatives to study changes in regulation of the phenolic pathway that may be correlated with domestication and subsequent selection. To understand how these changes have occurred historically, we are using variability in several nuclear loci, as well as population genetic techniques including AFLP, to identify the closest wild relatives – an issue that has been in dispute partly due to taxonomic and phylogeographic confusion regarding putatively wild and semi-domesticated relatives. Phylogenetic analyses using ITS sequences show eggplants forming two separate clades, suggesting either that eggplant is the product of an ancient hybridization or that it was domesticated twice independently. The results also call into question the status of *S. undatum*, one candidate wild progenitor, as a single species. However, in contrast to the ITS data, AFLP show only partial separation of accessions representing these clades, and suggest that *S. undatum* is probably part of the domesticated *S. melongena* complex. Recent work in China and India has turned up evidence that *S. undatum* may not be distinct from *S. incanum*, another putative progenitor, which appears to be a single species widespread across Asia. Additional analyses are underway to clarify these relationships and the domestication history of eggplant.

98. Healthy kids, healthy forest program in Mexico and Guatemala

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Javier Cano**

The Equilibrium Fund

The Equilibrium Fund (TEF)'s mission is to find balance between people, food and forests in Central America, Mexico and the Caribbean. We teach communities to protect native Mayanut (*Brosimum alicastrum*) forests for food and income. Mayanut is an abundant rainforest tree whose exceptionally nutritious and delicious seed was a staple for pre Columbian hunter gatherers and critical to rural food security. Unfortunately knowledge about Mayanut has dropped to near zero with globalization and export crops and people cut and burn it for firewood. Healthy Kids, Healthy Forests (HKHF) is a strategy developed by TEF to quickly and permanently change rural people's attitudes toward rainforests. HKHF works by providing Mayanut lunches in schools of Mexico (Montes Azules Biosphere Reserve) and Guatemala (Peten) as a replacement for the unhealthy and often toxic corn and soybased snacks currently provided in these schools. Observing the dramatic changes in their children's health and resistance to disease, parents quickly become convinced and strive to protect existing trees and plant more. Participating communities commit to set up nurseries to establish "food forests" that can be planted on marginal lands or to protect watersheds and biodiversity. All lunch products are produced by rural women, thereby

providing dignified jobs and steady income for them, and learn skills like accounting, planning, nutrition and business management. The income generated is a major factor in the change of local attitudes toward the rainforest. HKHF ensures that all benefits (social, economic, and environmental) accrue directly to the participating communities. This serves to revitalize rural economies, stimulate cultural pride and restore the rainforests which provide ecosystem services and habitat for biodiversity. We aim to replicate HKHF in all the countries we work and to convince the Government Ministries of Education, Health and Environment to implement the program in wider areas. All TEF programs including HKHF have demonstrated positive and lasting impacts on: 1. Rainforest Conservation (at least 20,000ha of forest conserved and 800,000 trees planted to date) 2. Food security (50,000 people impacted) 3. Health and nutrition (visible improvements in maternal and child health) 4. Women's incomes (2,000 women now earning income from Mayanut).

99. Frutales silvestres poco valorados de la cuenca del río Nautla en el centro de Veracruz, México

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La cuenca del río Nautla se ubica en el centro del estado de Veracruz, posee una extensión de 5 900 km² (6.2 % del territorio estatal). La topografía del lugar permite una sobresaliente diversidad paisajística asociada a una alta riqueza biológica. En la zona se encuentran presentes 9 principales tipos de vegetación resguardando más de 2000 especies de plantas vasculares (25 % de la flora estatal). La riqueza biótica, así como la riqueza cultural (zona donde se asentó la cultura totonaca) indica una enorme diversidad del conocimiento de los recursos y por ende una enorme potencialidad de especies útiles a la sociedad. Como muestra de lo anterior, en este estudio se registraron 42 especies empleadas como frutales comestibles, agrupadas en 27 familias botánicas. Los biotipos más importantes en cuanto a número de especies utilizadas son los árboles con 26, seguido de los arbustos (9) y las hierbas (5). De las especies más destacadas se encuentran los zapotes (*Diospyros digyna*, *D. riojae*, *Pouteria sapota*, *Licania platypus*), anonas (*Annona glabra*, *A. globiflora*, *A. squamosa*), aguacates (*Beilschmiedia mexicana*, *Persea americana*, *P. schiedeana*), los nanches (*Byrsonima crassifolia*), guayabas (*Psidium guajava*), plátanos (*Musa mexicana*) la cual es la única especie de bananos nativos de México y los cachichines (*Oecopetalum mexicanum*). Las especies utilizadas para el autoconsumo familiar son la mayoría, sin embargo existen otras como los nanches, aguacates y cachichines (especie notable por su importancia cultural, domesticada en el sitio en la época precolombina) que generan ingresos económicos extra a las familias de las comuni-

dades rurales de la zona. Las especies frutales registradas aquí, solo representan una pequeña parte de las especies útiles existentes en el área. Debido a que se encuentran en estado silvestre en los ecosistemas, la conservación de las mismas aseguraría entre otras cosas, los medios alternativos de ingresos económicos que representan muchas especies y sobre todo la preservación de la variabilidad genética que garantice su potencial aprovechamiento futuro a diferentes escalas del mercado.

100. Genetic and ethnobotanic forest resources in the milpera region of Yucatan, Mexico

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In the Milpera region of Yucatan, Mexico there are areas of traditional forest reserves which have been established by farming communities. In these areas, the people of the region put into practice their own traditional conservation policies. This study shows the importance of the traditional management, knowledge and use of the forest genetic reserves. The study was carried out using the following methodology: the areas were determined through interviews and satellite images; tree measurements were taken using the sweeping

method; and random samplings in five communities were taken. With this information, the abundance of species, diversity index, vegetation structure and the use of plant resources were defined. Statistically, significant differences were observed between the communities studied with respect to tree composition, and a similar tendency was found among the areas upon comparing the different ways the wood is used. In the correlation analysis, a continuous relationship was found between abundance and plant diversity among the sites studied.

101. Conocimiento local sobre el manejo de leña en tres comunidades cafetaleras del centro de Veracruz

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De todo el país, las comunidades del centro de Veracruz representan el área con alta prioridad de consumo de leña, simultáneamente, esta zona presenta Bosque Mesófilo de Montaña, el cual es una fuente significativa de recursos para los habitantes; para que el aprovechamiento del bioenergético sea racional, la gente emplea ciertos conocimientos para usarlo y manejarlo. Objetivos: Describir y analizar los conocimientos que sobre

el manejo de leña desarrollan los pobladores de tres localidades ubicadas en el centro de Veracruz (Las Lomas, Coatepec; Texín, Teocelo; y San Isidro, Jilotepec) considerando factores sociales que intervienen en el proceso. Métodos: Se seleccionaron 45 hogares, se aplicó a un integrante por hogar un cuestionario y entrevista semi-estructurada con el fin de identificar las especies que se emplean como leña, conocer magnitudes y frecuencias de consumo, entender reglas sociales y valores implícitos en las prácticas de uso y manejo de la leña. Resultados: Se identificaron 31 especies que se emplean como leña. Las decisiones de los usuarios para la selección de especies estuvieron determinadas principalmente por el desempeño de la leña durante el proceso de combustión. El 71 % de colectores obtienen la leña de las fincas cafetaleras y el 29% lo hace en combinación con relictos de bosque mesófilo de montaña. El 81% de hogares ocupan leña en combinación con gas LP, ya que toman como estrategia de medios de vida el recurrir al capital natural para aminorar sus gastos monetarios. Las especies presentan de uno a tres usos antropocéntricos adicionales. Existe división genérica de tareas en torno al manejo de leña. En los hogares estudiados se observó la existencia de integrantes con migración hacia EEUU, esta característica influyó sobre el uso de leña. Conclusión: Las fincas cafetaleras representan la principal fuente de abastecimiento de recursos naturales consolidándose en la comunidad como el agroecosistema de riqueza de flora útil. El conocimiento local sobre las especies da a los habitantes noción sobre el futuro de los recursos

con los que cuentan y las herramientas necesarias para saber en qué casos las especies les pueden servir para cubrir sus necesidades básicas.

102. Ethnomedicinal knowledge in traditional management of human ailments in Lake Victoria Basin, Kenya

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Uses of plants in the indigenous cultures of developing countries are numerous and diverse. This indigenous knowledge evolved for along time through trial and error. Though the majority of people in the Kenyan Lake Victoria Basin rely on ethnomedicinal plant species to manage a wide range of human ailments, a lot the indigenous knowledge largely remains undocumented. An ethnobotanical study was conducted on medicinal plant species used to manage human ailments at the Lake Basin. During interviews with herbalists from the region, thirty four ethnomedicinal plant species distributed within twenty one botanical families were reported to be useful in management of human ailments. The plant family reported with highest number of medicinal plants was Compositae, followed by Leguminosae then Labiatae. Traditional healers administered treatment mainly by concoctions, decoctions majorly through oral and dermal routes to treat

ailments such as typhoid, malaria, and chest and skin related complications. It was also noted that most herbalists preferred using herbal preparations consisting of more than one plant to treat one or a number of human ailments. Preliminary phytochemical and bioactivity analyses of these herbal plants showed that they were active against fungi. It is hoped that this project will be able to bring about value addition of the most important herbal plants so as to make them accessible, safe and efficient.

103. Quantitative analysis of Yucatec, Mopan and Kekchi domestic gardens as biodiversity hotspots

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Maya domestic gardens have long been recognized as repositories of native plant species and the ethnobotanical traditions that pertain to them. We examine the alpha and beta diversities of 10 Yucatec, 10 Kekchi and 10 Mopan Maya domestic gardens in western and southern Belize, in order to quantify their value as refuges for flowering plants. In all, our data set contains 37,700 individual plants consisting of 645 species, 515 of which are native to Belize. These gardens not only serve as

extractive reserves, but have the ancillary value of being botanical "conservation hotspots" (albeit anthropogenic ones) that are richer in native species of flowering plants than the subtropical forests that surrounded them. They are derived from an admirable biophilia, sustained by indigenous language, that we regard as being as great a legacy as classic Maya mathematics, architecture and astronomy. We also address the abiding question of whether Maya gardens may be the antecedents of the contemporary Maya Forest, making that forest, in effect, a feral domestic garden. Using nonmetric multidimensional scaling ordination and indices of similarity to compare the species compositions of woody plants in 10 Yucatec Maya gardens vs. those of three nearby samples of forest, we affirm the feasibility of this hypothesis. However, when we examine the shade tree species in 10 Yucatec Maya pastures, we find that traditional Yucatec Maya criteria for selection of those trees provided an equally parsimonious explanation for the composition of the feral forest. In other words, the feral forest may be, to a significant extent, a post-colonial phenomenon.

Presented Posters

Importancia cultural de los recursos vegetales de Asunción Cuyotepeji, Oaxaca, México

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Se realizó un estudio en el municipio de Asunción Cuyotepeji, Oaxaca, donde se analizaron aspectos culturales y ecológicos de los recursos vegetales útiles para los habitantes de la población. Se reconocen el bosque de Quercus, bosque de Juniperus, bosque tropical caducifolio, vegetación riparia, matorral xerófilo y vegetación secundaria. Se registraron 269 especies de plantas útiles agrupadas en 84 familias y en 206 géneros botánicos. 172 especies crecen de manera silvestre y 97 son cultivadas. Se distinguen 15 categorías de uso, siendo las medicinales (27.2%), comestibles (21.7%) y ornamentales (12.3%) las más abundantes. En la percepción de la gente dominan las plantas medicinales (45.3 %) y las comestibles (28.3 %). El 65.6% de especies silvestres de utilidad son toleradas, el 22.9 % son trasplantadas, el 5.1 % son protegidas y el 4.4 % son fomentadas. 36 especies silvestres son sometidas a un cultivo incipiente *ex situ* en huertos familiares. En los bosques los individuos

de las especies dominantes presentan valores bajos de densidad y cobertura observándose pocos individuos jóvenes de reemplazo. La composición florística de los mismos presenta pocas especies de la vegetación primaria y varios elementos de la vegetación secundaria.

Helechos ornamentales que se comercializan en el centro de Veracruz, México

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El comercio de vida silvestre es una de las actividades que más amenaza la diversidad biológica en el mundo. En países como México se ha estimado que el tráfico ilegal de vida silvestre supera los ingresos del narcotráfico y las exportaciones legales de algunos grupos (e.g. orquídeas). A pesar de estar regulado, el comercio ilegal de flora silvestre ocurre regularmente y se mezcla con comercio legal. Un grupo históricamente apreciado en el comercio hortícola son los helechos. Reciente investigación en el centro de Veracruz los señala como un grupo poco comercializado entre las epífitas, pero este trabajo ignoró a las especies terrestres y se concentró en un punto de muestreo, aunque señaló que la extracción de otras epífitas como bromelias y orquídeas afectaba su flora acompañante. En este

trabajo se hizo una revisión de ca. 60 herbarios y visitas esporádicas a ca. 20 mercados, viveros y puntos de venta informal en Xalapa-Coatepec y alrededores. El estado de Veracruz, es una región con una gran diversidad de especies de helechos y plantas afines a helechos (e.g. licopodios). De las ca. de 600 especies de helechos que crecen en el estado de Veracruz se encontró que ca. 30 especies (5%) se comercializan y se encuentran en los mercados; unas 25 especies que también se comercializan son introducidas. Se venden plantas que vienen de la Ciudad de México, del estado de Morelos y de diversos poblados de los alrededores del centro de Veracruz. Además *Macrothelypteris torresiana*, *Nephrolepis multiflora* y *Thelypteris dentata* son especies introducidas y naturalizadas. Los precios, varían mucho, dependiendo de la especie y del tamaño de la planta (\$30.00 y 40.00 pesos mexicanos, 3-4 US\$). Con la información hasta ahora presentada respalda la interpretación de que el centro de Veracruz es una zona de tráfico de vida silvestre y muestra que información previa había subestimado la importancia de esta actividad para los helechos y licopodios. Para controlar esta actividad es necesaria vigilancia, el desarrollo de mecanismos de aprovechamiento sustentable y profundizar en el estudio de este fenómeno para entender su importancia para las poblaciones naturales. Los comerciantes impactan negativamente las poblaciones de algunas especies de helechos y licopodios. Se sugiere hacer

estudios para promover el cultivo y la propagación de especies locales de helechos (entre viveristas) y que sea una forma de promover los cultivos (de follaje) en los cafetales, coadyuvando así a la conservación de este cultivo, a la conservación del arbolado de sombra, así como, de las especies que se propaguen.

Participative conservation strategies for Chicahuastle (*Antirhea aromatica*), a timber endemic tree of Jalcomulco, Veracruz, Mexico

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The tropical forests are an important source of natural resources for local people throughout the world, which is being destroyed at an dramatic pace due to human activities. The formulation of plans for the conservation, restoration or management of these natural resources is critical to ensure its sustainable use. However, the success of these programs depends on a combination of factors including the biological knowledge of the ecosystem and species of particular interest, local knowledge and community involvement. This research aims to propose strategies for

the conservation and participatory management of *Antirhea aromatica* Castillo-Campos & Lorence (Rubiaceae, Guettardeae) with an integrated view of the biological, ecological and social issues related to the species. *Antirhea aromatica* is an endemic tree associated with the semi-deciduous forest in the municipality of Jalcomulco, Veracruz. This species is currently threatened with extinction due to its very restricted distribution, timber use and pressure by the destruction of its habitat caused by human activities. We will analyze the population structure of the species, structure and composition of its associated plant community, as well as assess the current and potential uses of the species. The biological and ecological study is being realized in 67 sample plots (6.700 m² in total) in five populations of *Antirhea aromatica*, in which we are collecting information on biological and ecological aspects. Ethnobotanical and social data will be obtained through key informant inter-views and surveys. Among the preliminary results highlight the presence in the studied populations of 175 species of plants belonging to 59 families. The average density of *Antirhea aromatica* is between 247 and 910 individuals / ha, with significant differences between populations. The populations differ as well in their conservation status and intensity of use. It is noted that the use of the species is enhanced in individuals with diameter larger than 3 cm. From this diameter on we found 60% of individuals with one or more cuts in three of the five populations studied. According to information from local people, the wood is used in the construction of housing for its hardness

and resistance to insect attack. Management strategies will be developed based on the integration of knowledge of biological, ecological and ethnobotanical data to be obtained during the study, since there is very little information on the species. In a second step we will seek the appropriation of this knowledge by the community to ensure their conservation responsible.

Some benefits of community forestry in Mexico

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En este documento se explica en forma general lo que es el manejo forestal comunitario en México y su importancia para el presente y futuro de la actividad forestal en nuestro país. También se incluyen datos estadísticos sobre la extensión y actividades involucradas en el manejo forestal comunitario en México. Se hace énfasis en la importancia de las comunidades nativas para la implementación de empresas forestales comunitarias (EFC). A su vez, también se analizan ejemplos de estudios que proporcionan datos que permiten constatar, y por lo tanto proponer, que el manejo forestal comunitario es una estrategia que está dando excelentes resultados para la subsistencia y autonomía de las comunidades campesinas y la conservación de los bosques bajo su manejo.

Evolución del cultivo de cacao (*Theobroma cacao* L.) en Tabasco, México

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Introducción Mesoamérica representa uno de los nueve centros de origen de la domesticación en el planeta (Diamond, 2002). Una de las especies domesticadas mas importantes es sin duda *Theobroma cacao* L. El cultivo del cacao representa uno de los sistemas agroforestales mas sofisticados debido a que la domesticación implica no solo la especie de interés sino al resto de las especies acompañantes. El cacao era utilizado desde épocas pre-hispánicas como alimento, medicina e incluso como moneda (Ogata, 2006; Millón, 1955). De acuerdo con Millon (1955) & Bergmann (1968) las áreas de producción mas importantes correspondían a lo que hoy son los Estados de Tabasco y Chiapas. La producción de cacao fue muy importante en esta región hasta mediados del siglo XX (López, 1987). Sin embargo, el pasado reciente de la producción de cacao ha descendido de manera alarmante en especial en los últimos cinco años (SAGARPA, 2009) con la llegada de nuevas enfermedades, introducción de otros cultivos y problemas socioeconómicos ligados a la caída de los precios. Paradójicamente, estas circunstancias están provocando la desaparición del cultivo precisamente en el sitio de origen de su domesticación. Objetivos: Describir la evolución histórica del cultivo de cacao en el Estado de

Tabasco, México y la situación actual en el Estado. Métodos: Se describirá el desarrollo del cultivo desde épocas pre-hispánicas basado en documentos históricos y trabajo de campo en los principales municipios productores de cacao en el Estado de Tabasco. Resultados: Se describen las zonas de mayor producción de cacao en épocas pre-hispánicas así como la evolución del cultivo en el siglo XIX, XX. Finalmente, se presenta una perspectiva actual de la producción de cacao en el Estado de Tabasco, considerando la introducción de nuevos cultivos, los cambios en la demanda de cacao en el mercado, la llegada de nuevas enfermedades y la influencia de eventos socio-económicos como la migración y el desarraigo por el cultivo. Conclusiones: La producción de cacao en el país se encuentra en serios problemas de desaparecer provocando con ello la desaparición de patrones culturales asociados al cultivo. Es necesaria una revaloración del cultivo de cacao como una alternativa económica, de conservación y arraigo a los patrones culturales asociados a este cultivo.

Uso de vegetación secundaria por los Mayas de Quintana Roo: estudio de caso X-hazil sur y anexos

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El uso de biodiversidad de las selvas tropicales, es una práctica importante para la subsistencia de la gente local. En la Península de Yucatán, la cultura maya desarrolló un proceso de aprovechamiento como la recolección de materiales de construcción, plantas medicinales, combustibles, madera comercial y ornamentales (Palma, 1993). El 70% de la cubierta vegetal esta en sucesión, lo que requiere valorarlas, con el fin de fomentar proyectos viables acorde con la experiencia local. En este estudio se obtuvo información sobre el uso tradicional de las plantas en vegetación secundaria derivadas del sistema agrícola tradicional en el ejido X-hazil Sur y Anexos. Materiales y métodos: La metodología utilizada se baso en Hernández X. (1985), se aplicaron cuestionarios, entrevistas y pláticas con gente del ejido, seleccionando a doce informantes claves, reconocidos por los pobladores. Resultados: El uso de la biodiversidad es muy grande, la gente local usa y aprovecha más de 160 especies leñosas, principalmente para obtener materiales de construcción, plantas medicinales, madera comercial y leña. El uso está vinculado con la edad de la vegetación, pues las plantas medicinales solo se extraen en vegetación menor de 15 años. Además la gente reconoce las etapas de desarrollo de la vegetación de acuerdo con características de los árboles, la altura y los residuos de la milpa presente en los primeros tres años. Conclusión: Se debe valorar y aprovechar la vegetación secundaria menor de 20 años, debido a que se le da mayor diversificación de uso, de ellos se aprovechan la flora y fauna, pudiéndose implementar las unidades de manejo

de vida silvestre. Además se encontró una estrecha relación entre la estructura y composición con el aprovechamiento, pues las especies dominantes son aprovechadas con mayor frecuencia.

A Research tool for creating rapid floras and monographs from field to publication: The atrium biodiversity information system at the Botanical Research Institute of Texas (BRIT)

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Despite more than 250 years of systematic biology, the floras and monographs available fall far short of a modern description of the flora of the world. Traditional floras and monographs require decades from field data collection to species identification and publication, especially for biological hotspots and large, complex families of plants. The sharing of many sets of duplicate gifts or loans for determination with experts worldwide is expensive and time-consuming, yet has been requisite for receiving confirmed identifications that contribute to the validity of the final floristic publication. Data management is time-consuming and specimen, images, and descriptions are often not easily linked and integrated. Objectives: To create a digital workflow from specimen collection

in the field to publication that will greatly reduce the time required to produce annotated checklists, floras, and monographs. Methods: The Atrium Digital Herbarium and the new Atrium Digital Flora module allow authors to bring dynamic data and images together with static text and images for the production of any desired format of digital to print publication output, including image guides, annotated checklists, diagnostic field guides, full floras and monographs, and even coffee table books. Atrium also provides powerful data management features. Taxonomic experts can identify specimens online from high-resolution images and directly update determinations or add other kinds of annotations. Botanists can search and browse collection data and images and fill in taxonomic descriptions and other related data through online forms. The Atrium Digital Flora module then combines all this information into a professionally formatted, ready to print book. Results: Atrium is currently being used to produce the Flora of the Aguajal Wetlands of Madre de Dios, Peru with more than 500 species represented by 1670 collections and 3900 images from the field and herbarium. Conclusion: The Digital Herbarium, Digital Flora and Digital Book modules of Atrium provide a full suite of technological tools required for projects related to floristic, economic botany, and ethnobotanical studies. Utilizing this digital workflow, raw data are most efficiently and effectively synthesized for consumption by botanists, policy-makers, and the general public.

El ecoturismo como forma de valoración económica del bosque de niebla: una experiencia en el centro de Veracruz

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El proyecto Gestión integral de la cuenca del río Pixquiac se desarrolla desde 2006 en una de las cuencas que abastecen de agua a la ciudad de Xalapa. En el marco de este proyecto se desarrollan varios programas de conservación, restauración y desarrollo de alternativas productivas con orientación de sustentabilidad. Objetivos: En este marco se desarrolla el Proyecto de Ecoturismo comunitario del ejido San Pedro Buenavista en la cuenca del río Pixquiac. Los objetivos de este proyecto son de generar ingresos alternativos al uso tradicional del bosque que en esta zona se realiza de manera no regulada y no sustentable. Métodos: Se implementó un programa de capacitación que incluyó Talleres de interpretación de la naturaleza lo que permitió integrar el conocimiento local con el de los investigadores en lo que se refiere al bosque de niebla. De este modo se pudieron desarrollar los senderos para recorridos con sus cédulas informativas. Resultados: Actualmente tres comunidades del ejido SPB ofrecen recorridos ecoturísticos en los cuales se destaca la importancia del bosque de niebla desde el punto de vista de la biodiversidad y de los servicios ambientales hídricos que proporciona a los usuarios del agua

en la ciudad de Xalapa. Conclusiones: Los acuerdos comunitarios de destinar áreas forestales a conservación y de desarrollar ecoturismo como una actividad alternativa son la base necesaria para que esta propuesta pueda desarrollarse exitosamente. El conocimiento de la región a través de esta actividad contribuye a una mayor conciencia de los habitantes de la ciudad sobre el origen del agua que consumen y fortalece las medidas para su uso racional.

Traditional use of medicinal plants by the Tippra ethnic group in Rema-Kelenga wildlife sanctuary of Habiganj District, Bangladesh

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Bangladesh is a land of forests. The health, wealth, and happiness of Bangladesh depend on her forests. Rema-Kelenga Wildlife Sanctuary is one of the important and well-reserved forests in Bangladesh. The forest is home to a fantastic variety of plants, birds & animals and is considered to be of great ecological importance. One important ethnic

group can be found living within the boundaries of the forest – the Tippra. Objectives: The present study were conducted an ethnobotanical survey amongst the Tippra ethnic group healers of the area and noted that their formulations contain a number of medicinal plants not usually used by traditional healers in other regions of Bangladesh. Methods: Information was collected after obtaining informed consent with the help of a semi-structured questionnaire and guided field-walk method, where the informant pointed out the various medicinal plants and described their uses to treat colds, fevers, dysentery, diarrhea, hepatitis, ulcers, diabetes, chickenpox, male and female weakness, snake-bite and skin disorders are covered in this report. All medicinal plants were photographed, collected, identified, and vouchers were stored at the Bangladesh National Herbarium; under the first author's collector series. Results: The traditional use of forty-eight medicinal plants belonging to thirty-six families was documented in the Tippra ethnic group of Habiganj district in Bangladesh. The medicinal plants obtained in this ethnobotanical survey included *Emilia sonchifolia*, *Aristolochia indica*, *Hemidesmus indicus*, *Centella asiatica*, *Carica papaya*, *Cassia fistula*, *Coccinia cordifolia*, *Achyranthes aspera*, *Vitex negundo*, *Wedelia chinensis*, *Scoparia dulcis*, *Ricinus communis*, *Phyllanthus reticulatus*, *Kalanchoe pinnata*, *Hedyotis corymbosa*, *Ficus racemosa*, *Ocimum tenuiflorum*, *Justicia adhatoda*, *Withania somnifera*, *Azadirachta indica*, *Curcuma longa*, *Terminalia arjuna*, *Andrographis paniculata*, *Asparagus racemosus*, *Swertia chirata*, *Tamarindus indica*, *Zingiber officinale*,

Abrus precatorius, *Nymphaea nouchali*, *Citrus acida*, *Aloe barbadensis*, *Cocos nucifera*, *Saccharum officinarum*, *Rauwolfia serpentina*, *Piper nigrum*, *Paederia foetida*, *Musa sapientum*, *Clerodendrum indicum*, *Brassica napus*, *Amaranthus viridis*, *Dioscorea bulbifera*, *Leea macrophylla*, *Aquilaria agallocha*, *Calamus rotang*, *Smilax zeylanica*, *Mimosa diplotricha*, *Syzygium aromaticum*, and *Nigella sativa*. Conclusion: The study thus underlines the potentials of the ethnobotanical research and the need for the documentation of traditional ecological knowledge pertaining to the medicinal plant utilization for the greater benefit of mankind.

Wild vegetable use by Vhavenda in the Venda region of Limpopo Province, South Africa

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The Vhavenda people are the inhabitants of southern Africa living mostly near the South African-Zimbabwean border. Wild vegetables have been used from time immemorial by the indigenous people all over the world. The present investigations indicated that Vhavenda people still use the wild herbs in their culinary. Objectives: The primary concern of this study was to assess the marginal utilisation of wild indigenous plants that are not cultivated for commercial purposes. The

present investigation was undertaken with a view to record the knowledge of bio-diversity of wild herbs and its possible economic importance of Venda region, South Africa. Methods The project was conducted in the Venda region of Limpopo Province. Information was collected through a series of interviews with villagers, rural and urban people. Field notes were recorded on the wild herbs and their uses, following the methodology of Bhat et al.(1990) and Martin (1995).The identified specimens were stored at the University of Venda Herbarium housed in the Department of Botany. Results: The present investigation recorded the uses of 38 wild vegetables belonging to 20 families of angiosperms in the predominantly Vhavenda occupied region of South Africa. The plants collected are categorised into leafy vegetables, flowers, fruits and tubers. With regard to the study conducted in different areas, there were variations in the consumption level of these wild vegetables. Conclusion: The plants are identified as under exploited and need to be popularised so that the use of these plants can be utilised fully. Vitamin A, Iron, Calcium and protein have been found in all species of wild vegetables in Africa (Weber and Van Staden 1997). Motivation for the use of wild vegetables will not only help the poor, unemployed people, but will also increase the selection of the rich. The increased use of these wild vegetables will encourage the farmers to produce them on a large scale which will also create new job opportunities.

Coronas navideñas como producto forestal no convencional: una experiencia de participación social en la conservación de bosques de *Abies religiosa* en el parque nacional Cofre de Perote

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El trabajo científico ocasionalmente requiere del desarrollo de actividades de trabajo paralelas donde se involucra a las poblaciones humanas que utilizan a las especies o que habitan las zonas de estudio, promoviendo acciones de manejo que generen un beneficio económico concreto. En la búsqueda de alternativas para la conservación del bosque de oyamel (*Abies religiosa*) en un ejido, ubicado dentro del Parque Nacional Cofre de Perote, se integro esta perspectiva partiendo de la premisa que, para la conservación exitosa de los recursos forestales es necesaria la participación de los habitantes con acciones concretas, para pasar a ser actores y no solo ejecutores de iniciativas gubernamentales o de organizaciones civiles. Sin embargo, lograr la participación activa de estos pobladores ha representado y sigue representando un reto. Algunos obstáculos que deben resolverse tienen que ver con la dinámica interna de las propias comunidades, tales como la escasa organización social, la tradición de

recibir dádivas gubernamentales, la discriminación de género, la división y desconfianza entre grupos internos, dificultando estos procesos. Un grupo importante en las comunidades rurales, escasamente reconocido y poco remunerado, son las mujeres. Tradicionalmente con ellas se promueven actividades relacionadas con la cocina, costura, artesanías, medicina tradicional, etc., y pocas veces se integran actividades vinculadas con los recursos forestales. El objetivo del presente estudio es documentar una experiencia de trabajo con mujeres en la elaboración de un producto forestal no convencional para la generación de ingresos. Se describe la experiencia de un grupo de mujeres que en 3 años duplicó su número (de 30 a 65), iniciando con una labor artesanal, la elaboración de coronas navideñas con ramas de *A. religiosa*, para involucrarse en acciones de conservación del bosque *in situ*, algo poco común en el panorama forestal nacional.

Bioassay guided profiles and conservation of economic plants of Botswana

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Indigenous plants of Botswana represent important sources of health improving remedies, beverages, food recipes and cosmetic formulations. Economic

analysis has shown that medicinal and food plants have considerably contributed to the welfare of people by providing and generating reasonable income. Some villagers in Eastern Botswana have established Women Community Groups that gather medicinal and food plants and convert them into cash generating products (Motlhanka, 2009). The burden of pressure exerted on these plants by their non-sustainable harvesting practices places them at risk of depletion and species extinction. Many plants used by native people as sources of food or medicines often show activity when tested using laboratory biological assays (Motlhanka, 2009). Objectives: To assess biological activity and adopt strategies for conservation of indigenous plants with medicinal and nutritional value. Methods: Plant specimen collection, DPPH free radical scavenging assays Results Bioassay guided investigations using Di-phenyl-picryl-hydrazyl (DPPH) free radical scavenging assay led to the isolation of 4'-O-methyl-epigallocatechin from crude water extracts of *Cassine transvaalensis* roots (used to treat backache, Motlhanka et al, 2008). Crude extracts of *Ozoroa paniculosa* (used to treat uterine and menstrual pains) and *Myrothamnus flabellifolius* (used to treat diabetes and hypertension) exhibited free radical scavenging potencies of 90-91% using the DPPH free radical scavenging assay. Wild edible fruits of Botswana such as those sourced from *Adansonia digitata*, *Sclerocarya birrea*, *Strychnos spinosa* and *Vangueria infausta* are valuable sources of vitamins and minerals in rural areas where exotic species are limited (Amarteifio & Mosase, 2006). Conclusion: These economic plants are important elements

for ascertaining food security and improving health. Their domestication is important for both conservation and health improving strategies.

Sustainable production of amate paper: Local knowledge about plants used by ñahñus for amate handicraft production in San Pablito, Puebla, Mexico

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The indigenous paper called "amate" has been elaborated in Mexico since prehispanic times using the internal bark (phloem) of tropical tress. During the 60's the ñahñus of San Pablito started producing amate as handicraft for commercial purposes. As the demand increased ecological, social and economic aspects were affected, as well as the local knowledge about the tree species used for its production. Objectives: To study the changes regarding the knowledge of elders and young generations about the species used for "amate" production and carry out activities to revitalize the knowledge of traditionally used tree species. Methods: Formal interviews were conducted to analyze the distribution of local knowledge regarding the plant species used for amate production and especial activities were develop-

ed to strengthen the traditional knowledge about tree species, especially among the youngsters. Results: We identified 15 plants species used as raw material for the manufacture of amate paper, the commonly known species is *Trema micrantha*, while *Morus celtidifolia* and *Ficus padifolia* which correspond to the two species used since prehispanic times are only known by elders. The most widely used species are *Trema micrantha* and *Thypha dominuensis*, being also those of most recent introduction. Conclusion: The knowledge about tree species and traditional manufacturing processes varies among generations, elders being the most knowlegable, youngsters however demonstrated a very deep interest to learn about their own history and past. The introduction of new species has been a process of experimentation and search for the new alternatives to maintain the production of amate paper. Nevertheless the demand has caused the reduction of the population of some plant species and the gradual loss of knowledge about the management and use of traditional species.

Agricultural diversity in a rural scenario in transformation: will anyone be left to care for the crops?

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In the Cuiabá Lowlands, Mato Grosso state, in central western Brazil, traditional communities of small farmers maintain a wide diversity of manioc and other crops. Farmers exchange information and germplasm among themselves and with other communities; they are also not isolated from nearby urban centers (Amorozo 2000). Nevertheless, nowadays, the fast pace of transformation in rural areas may prevent the maintenance of these systems, which depends on various factors; one of the most important is whether or not young people will remain in the countryside to work. Objectives: To discuss the question of the substitution of generations and their implications for the continuity of agricultural activity and conservation of agrobiodiversity in subsistence farming communities in the Cuiabá Lowlands. Methods: Extensive fieldwork was carried out in three communities in the region over a period of 18 months, from 1991 to 1994, focusing on agricultural systems and subsistence activities. Participant observation, interviews, botanical collections, and cropland mapping were used (Amorozo 2000). Beginning in 2005, sporadic visits have been made to follow the changes that are occurring. Results: The movement of some family members from rural to urban areas, and vice versa, and also to frontier agricultural areas, is not new in the region, and can be short or long term. Despite this relative mobility, these farmers have conserved a large collection of germplasm of crop plants. However, it was observed that some of the domestic units are currently unable to replace the workforce

due to the migration of youth and/or their involvement in non-agricultural activities. The ways this is reflected in the size of the cultivated area, the circulation of germplasm for planting and/or trial of new varieties through the social network, and complete abandonment of farming activities are discussed. Conclusion: There is a pressing need to establish public policies that include conservation of agrobiodiversity, value traditional modes of production, and encourage young people to remain in their communities of origin.

Sustainable production of Amate Bark Paper: Growth of *Trema micrantha* (L.) Blume, the tree that feeds Amate

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Using bark of tropical trees, the indigenous handmade paper known as "amate" has been elaborated in Mexico since prehispanic era. During the 60's the ñahñus of San Pablito in Puebla started producing amate as handicraft for commercial purposes. As the demand increased also ecological, social and economic aspects were affected, as well as the local knowledge about the tree species

used for its production. This work focuses on growth of the tree *Trema micrantha*, which is currently used to produce 80% of the paper. Objective: To study the growth rate of *T. micrantha* and explore interests of growers to improve its production. Methods: We studied 28 coffee-producing farms and interviewed their owners to learn how they managed *T. micrantha* and discuss farmers' interests in "planning and organizing" bark production. Within those farms 400 trees for which farmers were able to estimate their age were measured. Results: *T. micrantha* grows in a variety of environmental conditions and reaches a diameter of 15 cm within 3 to 5 years, depending on the slope, elevation and soil. Farmers can use this to "plan and organize" the production of bark. About 60% of the farmers would like to intentionally managing *T. micrantha* in their farms. Conclusions Knowledge of the growth rate of *T. micrantha* and how environmental conditions influence that rate will help coffee producers "plan and organize" the production of bark. The cultivation of this species within the shaded-coffee systems can be an economical alternative and a way of protecting biodiversity.

Usos y vulnerabilidad de la flora leñosa en la Reserva Cañón del Usumacinta Tenosique, Tabasco, Mexico

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El área natural protegida Cañón del Usumacinta conserva un relicto de selva mediana subperennifolia de alta diversidad de flora y fauna que mantiene continuidad con la selva del Petén en Guatemala y La Selva Lacandona en Chiapas. Objetivo El objetivo del estudio fue, el conocer los usos que la población local asigna a la flora arbórea y arbustiva en la zona montañosa de Tenosique y documentar las características biológicas y condiciones ecológicas en la que esta se desarrolla. Métodos: Se utilizó el método de acción participativa, la cual incluye entrevistas semiestructuradas y recorridos con los ejidatarios por los agro-ambientes de la zona de estudio. Resultados: Se reconocen cinco ambientes: montaña, acahuales, potreros, milpas, bordes de arroyos y ríos, siendo la montaña el sitio del que se extraen más especies útiles. El colectivo local reconoce 168 especies de flora leñosa, distribuidas en 19 formas de usos. De estas, 70 especies se usan para leña, 68 como materiales de construcción, 62 son medicinales y 55 como cerco vivo. De las especies reconocidas, 99 presentan más de tres formas diferentes de utilización y corresponden a especies silvestres. *Tabebuia rosea* y *Manilkara zapota* son las especies con mayor número de usos (10 y 11 respectivamente). De las especies multisusos, 24

son de crecimiento rápido, 25 tienen alta a media capacidad de rebrote y 17 especies son muy abundantes variables que se utilizaron para generar un índice de vulnerabilidad. Treinta especies resultan altamente vulnerables, y 27 y 42 con vulnerabilidad media y baja respectivamente. Conclusión: La mayoría de la flora útil silvestre se encuentra amenazada ya que no cuenta con algún tipo de manejo que favorezca su permanencia. Los resultados obtenidos generan bases para promover programas de manejo y conservación de la flora leñosa de la reserva.

Ethnobotany and traditional use of herbal greens by the Gond tribes in Bilaspur District Chhattisgarh, India

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Herbal medicine has been widely practiced throughout the world since ancient times. These medicines are safe and environmentally friendly. According to WHO about 80% of the world's population relies on traditional medicine for their primary health care. Objective: This paper concerned with the use of herbal green plants and related lay of traditional health knowledge and their practices among the Gond tribal community in Bilaspur district of Chhattisgarh, India. Methods: An analysis

of information obtained from questionnaire and interviews with medicine-man, experienced older native inhabitants of the tribal areas of the Bilaspur district. Result: The present study deals with 175 Angiospermic plants belonging to 155 genera, 175 species and 69 families has been gathered by the extensive field survey. Conclusion: The newly formed Chhattisgarh state of India has a tremendous biological wealth and valuable heritage of herbal remedies. The district is inhabited by many tribes. Gonds are the dominant tribes of the district. Most of them are dependent on the surrounding forests for their day-to-day needs. They utilize a number of medicinal plants like *Abrus precatorius*, *Andrographis paniculata*, *Alesteria scholaris*, *Tinospora cordifolia*, *Holarrhena antidysenterica*, *Acorus calamus*, *Lucas aspera* etc. to treat a wide range of discomforts like fever, cough/cold, skin diseases, rheumatism, snakebite, jaundice, dysentery, snake bite, asthma, etc.

Identification of main yeasts involved in the traditional fermentation process of *Theobroma cacao* L in Tabasco, México, using RFLP (Restriction Fragment Length Polymorphism)

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Cocoa has been used as food, beverage and medicine for over 2,000 years. The fermentation of cocoa in Tabasco is a traditional process, accomplished by yeasts, acetic acid and lactic acid bacteria. Due to the spontaneous nature of the process, fermentation is heterogeneous. At the end of fermentation, fungi start to develop, which is a downgrade for cocoa quality. Identification of main yeasts would be a first step for the standardization of the process, shortening fermentation time and making a more homogeneous product. Even though this study has been realized in several countries, there are differences in the microflora encountered. Objectives: To identify the majority yeasts species involved in the cocoa fermentation process in Tabasco, in order to propose a yeasts inoculum for a more standardized final product. Methods: Sampling took place in Tabasco. Six fermentation boxes were studied for four days at different fermentative stages in order to have a scanning of the eight days process. Once in the laboratory, we isolated the yeasts and proceed to DNA extraction for the PCR-RFLP analysis. Afterwards, the band patterns were compared to a database build in CIATEJ in order to identify the different yeasts². Results: We found that *Issatchenkia orientalis*, *Saccharomyces cerevisiae*, *Hanseniaspora guilliermondii* and *Saccharomycopsis crataegensis* are present during several days of the fermentation process, being the majority of the isolated yeasts. All band patterns were already archived in the database with the exception of *Saccharomycopsis crataegensis*, which DNA was sequenced. Conclusion: There are various yeasts

present in the fermentation of cocoa in Tabasco, but only *Issatchenkia orientalis* is present during all fermentation, which could be due to a better adaptation to the process as well as certain thermo tolerant characteristics. In order to obtain the same quality in fermented cocoa beans, an inoculum of these four yeasts could be used as a first step for the standardization of Mexican fermented cocoa beans.

Agrosystem knowledge: between local and external practices

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Today, the functioning of the agrosystems of Zoque-popoluca and Nahua, from the south-east of Veracruz (Mexico) result from a mix of local and industrial knowledge and techniques. The maize, which constitute the main production, should be considered to lies halfway between self sufficient farming and a cash crop system. This could be a result of national politics and local adaptation to agricultural innovation. Objectives: The main objective is to analyze the two indigenous agrosystems in order to understand the influence of external knowledge and techni-

ques, as well as the cultural aspects that contribute to preserve ancestral agricultural practices. Methods: Qualitative anthropological research was performed between March and June 2009, including participation and observation of agricultural practices during the field work, interviews with peasants, and analysis of national and regional politics. Results: There is an over-evaluation of industrial agricultural knowledge and techniques, which is perceived by the low production of local maize varieties (10% of 10 varieties). One of the factors that encourage the adoption of agricultural innovations is the transformation of social structure, new agricultural practices seen to be a palliative of social change. Conclusion: Both peasant groups, Nahua and Zoque-popoluca, have social and cultural characteristics that encourage the introduction or the rejection of new agricultural techniques and varieties. This process involves an evolution of local knowledge, which leads to an agrosystem that is more profitable and sustainable for the peasants' families.

Effect of the Agave species in the volatile compounds production during mezcal

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The *Agave* genus is a biodiversity part of the most extensive ecology zone in Mexico: the arid and semiarid, comprehends 45.3% of the national territory. Most of these species has economical importance, since they are the raw material for the traditional alcoholic beverages (tequila, sotol, bacanora, pulque and mezcal) production. Objective: Analyze the impact of three different *Agave* species in the mayor volatile compounds production during the mezcalt fermentation using two native yeast strains. Methods: Three different agave musts were used, *Agave cupreata*, *Agave durangensis* and *Agave tequilana* Weber blue variety, as well as two *Kluyveromyces marxianus* native strains from the spontaneous fermentation of San Luis Potosí (SLP1) and Guerrero (OFF1). The volatile compounds analysis was accomplished by Head Space Sampler coupled to a Gas Chromatograph. Results: Important variations in the production of volatile compounds were observed in the three different raw materials with both yeast strains, the acetaldehyde formation was three-fold higher in *Agave cupreata* than in the two others must, besides in *Agave durangensis* the ethyl acetate production was two-fold higher than the others two musts, nevertheless the higher alcohols formation was influenced by the combination of the must and the yeast strain. Conclusion: The use of different agave species and yeasts strains influenced the volatile compounds production, affecting the flavor and aroma of the final product. This study points out the conservation importance of traditional raw materials (different *Agaves* species) in the mezcal production.

El “orégano de Nuevo León” *Poliomintha longiflora* Gray, en las áreas montañosas del norte de Nuevo León México

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Las plantas aromáticas usadas como saborizantes tienen una concordancia muy singular y estrecha con el hombre a través del tiempo. El orégano *Poliomintha longiflora* Gray, llamado comercialmente “orégano de Monterrey” u “orégano de Nuevo León”, forma parte de la cultura tradicional de colecta de material vegetativo y consumo por los campesinos en varios municipios de Nuevo León. Objetivos: Determinar la forma de aprovechamiento, comercialización, distribución y hábitat del orégano en Nuevo León. Método: Se visitaron las áreas naturales de distribución de las poblaciones de orégano, recabando información *in situ* del hábitat de distribución de las poblaciones. Además de indagar la forma de cosecha en los núcleos de campesinos, se realizaron encuestas etnobotánicas sobre las actividades del proceso de fechas de colecta, formas de colecta, selección de material vegetativo, proceso de secado y sistemas de comercialización. Resultados: El trabajo de colecta y procesado del orégano para su comercialización se hace a nivel familiar como una fuente adicional

de ingresos para los campesinos, que alternan esta colecta con actividades agropecuarias. Esta planta es muy comercializada en los centros comerciales y mercados del Área Metropolitana de Monterrey y otras ciudades del noreste de México. Su hábitat de distribución natural se localiza en laderas y cañones de las Sierras de Picachos, Gomas y El Fraile. Crece en suelos delgados y pedregosos con pendientes hasta del 40 %, son parte del matorral submontano y bosque de encinos. Se encuentra desde los 800 hasta los 1,400 msnm. Las poblaciones naturales de la especie están amenazadas por la sobreexplotación, empobrecimiento del suelo por ausencia de materia orgánica *in situ* (al cosechar las hojas y ramas jóvenes), el sobrepastoreo, los incendios y las heladas que pueden dañar la planta. Conclusión: Este orégano es muy apreciado sin embargo la cosecha de esta especie involucra una serie de problemáticas, que deberán de ser atacada con programas integrales de manejo-propagación-cosecha-comercialización, incluyendo el cumplimiento con las normas oficiales mexicana sobre el aprovechamiento de esta especie, por los colectores de este recurso natural.

Effect of the age on enzymatic activity of 1-FFT and soluble carbohydrate concentration in *Agave atrovirens*

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In the elaboration of pulque the genus *Agave* is used, principally of the species *atrovirens*, which store high carbohydrate concentrations (Srinivasan and Bathia, 1953), identified like fructans, that they can be used in the food industry like additives, nevertheless do not exist data on the changes in the concentrations of these compounds during the growth of the plant, that allows to identify best stage of development for its extraction. Objectives: To determine the effect of the age of the agave, on the activity of the 1 fructan-fructan fructosyltransferase (1-FFT) enzyme in the leaves and the concentration of carbohydrates, Plants of *Agave atrovirens* of 3, 6 and 9 years of age were used. Methods: The purification of the enzyme was realized by sequential chromatography, of affinity and ionic interchange, the molecular weight was considered with SDS-PAGE and the carbohydrate quantification with HPLC, coupled to a detector of light scattering. Results: The molecular weight considered for the enzyme 1FFT isolated was of 75, 57 and 20 kDa, which could indicate that the enzyme exists in native form like trímero. The age of the plant had influence on the enzymatic activity, being greater in the leaves of the agaves with an age of 6 years (125 nkat/mg of protein), as well as on soluble carbohydrates in the leaves, since in high maturity, the number of these compounds tends to

diminish, as well as their concentration, being main in the 3 and 6 years of age saccharose, glucose and fructose, whereas to the 9 years, only appears fructose and glucose. Conclusion: Is possible to be established that the age have influence important in the composition of the *Agave atrovirens*, affecting the activity of enzyme 1FFT and the composition and concentration of carbohydrates

Metabolic profiling of in vitro cultured medicinal plants

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The herbaceous plant *Actaea racemosa* L. is native to the Eastern U.S. and is important medicinally. The rhizome of this plant is used for a variety of medicinal purposes, chief among them for alleviating menopausal symptoms. Growth of *A. racemosa* in greenhouse and laboratory settings may be used to develop more sustainable methods of production that could reduce demand on wild populations, which are currently the main source of materials used in dietary supplements. If specific genetic strains of *A. racemosa* with desirable profiles of bioactive constituents can

be identified, then propagation of those selected genotypes through cloning may contribute to consistency of phytochemicals in extracts. Objectives: This study sought to develop protocols for establishment of in vitro callus cultures from excised tissues of racemes and leaves of *A. racemosa*. The primary goal was to use micro-propagation techniques to generate callus tissues that could be used for liquid-suspension sub-culturing. Long-range objectives include use of these cultures for analysis with ultra high pressure liquid chromatography coupled with mass spectrometry (UHPLC/MS) to assess accumulation of secondary metabolites. Molecular detection of expression of specific genes in these liquid sub-cultures coupled with the metabolite profiling may reveal key insights into the processes of the cell. Methods: Excised tissues of racemes and leaves of *A. racemosa* were cut into 0.5cm pieces and surface sterilized in 0.5% NaOCl and 0.1% Tween-20 for 5 minutes, washed for 5 minutes three times, and inoculated on MS media with growth hormones thidiazuron (TDZ) and 1-naphthaleneacetic acid (NAA) ranging in concentration from 0.5 μ M to 5.0 μ M arranged in a two-dimensional concentration matrix. Results: The first series of plates of racemes was observed after one week with fungal contamination in twelve of the sixteen plates. The experiment was repeated with a concentration of 1.0% NaOCl and the infection reoccurred in all of the raceme plates. The leaf explants developed callus. Conclusion: This study is part of a larger effort investigating the specific genes and metabolic pathways responsible for the production of

secondary metabolites. Research into the genetic aspects may provide background for various other research projects.

Herbal landscape as a model for ethnobotanical analyse

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The mechanisms by which humans identify and choose such specific resources like medicinal plants, remain largely unknown. Seen as a physical part of the traditional landscape, medicinal plants have never been described by researchers as an integral part of a (wild)cultivated field perceived as a well-stocked pharmacy available at hand. Objectives: To fill in this epistemological gap, we introduce the idea of the herbal landscape, which provides ethnobotanists with a new model for understanding the mechanism of perception of medicinal plants. Methods: The argumentation in this poster is based primarily on HERBA (the database on digitized Estonian herbal lore, ca 7 800 texts) and the personal fieldwork of the authors during the summers of 2007–2009 in several parts of Estonia. Results: The herbal landscape can be divided into specific smaller units according to several natural and cultural boundaries. The natural boundaries are, for example, the habitat (community) and geographical range limit of plants.

Cultural boundaries are, for example, the cultural space that influences the person, the peculiarity of a given language, and the availability of education, popular books and other media regarding plant use. Conclusion: Herbal landscape can be defined as a mental field associated with plants used to cure or prevent diseases and established within specific cultural and climatic zones either personal or shared within certain group of people. Taking this into account can help to explain why original knowledge of plants gleaned by one set of inhabitants may be clearly distinguished from that of close neighbors.

Analysis of dulcimer makers in Appalachia

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The Appalachian dulcimer is a folk instrument that has been prevalent in Southern Appalachia for centuries (A. W. Jeffreys 1958). First known in the Southern Appalachian Scotch-Irish tradition of the early 1800s, the Appalachian dulcimer is most likely a product of several musical lineages converging in rural Appalachia. The production and form of Appalachian dulcimers is highly variable, as is the sound and style of play. An Appalachian dulcimer is a chordophone that belongs to a class of instruments called zithers. It is also referred to as the plucked dulcimer or the mountain dulcimer

and has a distinctive and charming sound that no other instruments can produce (Ritchie 1964). It is historically made of local woods such as pine, spruce, poplar, hickory, birch, maple, and walnut by rural woodworkers with simple hand tools (Seeger 1985). The dulcimer has a plethora of rich cultural heritage surrounding its craftsmanship and use. Ethnographic research will be conducted by students at Frostburg State University on dulcimer makers throughout the Appalachian region. Interviews will be conducted for local craftsman and a questionnaire will be utilized for those that can only be contacted over the phone and or through the mail. This research will document preferences for specific tree species based on tonal quality, as well as other factors such as convenience, price, and availability. The Appalachian Dulcimer is a very unique and diverse musical instrument and those that create these beautiful instruments are just as unique and diverse as the instruments they create. Each dulcimer maker has their own style and each may have acquired these skills in different ways. Another goal of this project is to acquire background about dulcimer makers, including how they developed and acquired their skills. Determining lineages of dulcimer making and relationships between makers and musicians will be another component of the research. The overarching goal is for preservation of cultural knowledge around this folk craft. The projected results will help document tree species vital for the cultural traditions and promote sustainability in resource use.

Genetic diversity of *Manilkara zapota* (chicozapote) from Veracruz-Mexico using microsatellite markers

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Manilkara zapota is a popular fruit species belonging to the Sapotaceae. It is native of Mexico and Central America and is cultivated throughout the world in tropical countries. Previous work has documented variability within this species mostly using morphological characteristics, yet the genetic diversity has not been studied using co-dominant molecular markers. Objectives: To study genetic diversity in *Manilkara zapota* for selecting highly variable individuals for a long term crop improvement program. Methods: Levels of polymorphism were evaluated in 20 adult trees collected along the state of Veracruz. Twelve microsatellite loci, originally developed for *M. huberi*, were tested in *M. zapota*. Microsatellite loci were amplified using polymerase chain reaction (PCR). Reaction products were separated on polyacrylamide gel and visualized by silver staining. Results: Among twelve microsatellite loci, two were monomorphic and three did not amplify. Seven polymorphic

loci were selected for further genetic analysis. Levels of variability detected in these loci were moderate, with the number of alleles ranging from six to seventeen. Only five loci were heterozygous. Observed heterozygosity was very low with a mean value of 0.154. An average of 11.85 alleles per locus was detected, and expected heterozygosity ranged from 0.909 to 0.970. Conclusion: These microsatellite loci represent a powerful tool in investigating genetic variation in *M. zapota*, which is needed to implement reliable management.

Ethnobotany and vegetation mapping of Laguna Chachua National Park Oaxaca, Mexico

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This study proposes the use of GIS ArcMap tools, ethnobotanical survey and vegetation mapping to initiate conservation monitoring within Laguna Chachua National Park, Oaxaca, Mexico. Specifically the project objectives include the creation of a high resolution map delineating vegetation class boundaries, surface area, and botanical list of species identified. In addition an ethnobotanical survey will be carried out using transect and walk-in-the-woods methodology. Areas of high anthropogenic activity and NTFP harvest regions will be mapped and suggestions for management in these areas will be provided to Park staff. The

vegetation analysis will take place in June 2010. The ethnobotanical survey will be concluded by November 2010. Results will be written in English and Spanish, providing a copy of this work to the Laguna Chachua National Park director.

Producto nutritivo a base de hortalizas del huerto escolar

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La elaboración de productos alimentarios a base de hortalizas permite una mayor conservación y aprovechamiento de los nutrimentos útiles para la alimentación familiar. La creación de huertos escolares es una alternativa que permite a los alumnos educarse en el campo de la producción de alimentos. Objetivos: Crear un huerto escolar para la obtención de hortalizas y elaboración de un producto alimenticio nutritivo para beneficio de la población en general. Métodos: Se trabajó en la adecuación del terreno para el establecimiento del huerto escolar en el que se sembraron las hortalizas. Se realizó el cuidado de las hortalizas hasta la cosecha. Se realizó una mermelada base de hortalizas obtenidas del huerto. Se determinó el contenido nutrimental de la mermelada a base de hortalizas. Se realizó prueba sensorial del producto a base de hortalizas en una población infantil. Resultados: El producto elaborado fue una mermelada a base de zanahoria,

acelga y betabel. El contenido nutrimental de la mermelada fue: 154.58 calorías, 29.9 g de Carbohidratos, 1.02 g proteínas, 0.01 g, lípidos, 1.63 g fibra, 699.15 mg de vitamina A, 2.4 mg de vitamina C, 33.78 mg de ácido fólico. 0.76 mg, de hierro y 118.9 mg de potasio. En la prueba sensorial el 90% de los participantes consideró aceptable el sabor de la mermelada Conclusiones: La propuesta de elaboración de una mermelada a base de las hortalizas zanahoria, betabel y acelga obtenidas en el huerto escolar es una alternativa para el fomento del consumo de verduras y aprovechamiento de los nutrimentos en la población en general especialmente los niños.

Participatory evaluation of varieties of maize landraces in the state of Paraíba, Brazil

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The production system of family farming in northeastern Brazil (87% of its territory in semi-arid climate) are characterized by the use of traditional practices such as polyculture, animal traction, and the use of seed of landraces. In the state of

Paraíba family farming is predominant. During long periods of drought households consume their seed stocks by the urgent need to feed them. Governments, as political emergency, distributing seeds of maize and beans. However, the seeds donated are not always adapted to the soil and climate and local productive systems. The Network of Seeds of Paraíba is composed of organizations of farmers, and advice. In order to reduce the problems of drought and maintain the diversity of seeds adapted, there are currently 205 Community Seed Banks (CSB) in 3700 working with families members. Was identified in the network need to know and evaluate the varieties kept in CSB and compare them with the varieties provided by government programs. The objective this work was the participatory evaluation of 12 varieties of maize (*Zea mays*), with 11 locals varieties and variety Caatingueiro (widely distributed by government programs and semi-arid zones is characterized by early). The trial was conducted in the municipality of Casserengue the state of Paraíba in Agrarian Reform Settlement Santa Paula, in a randomized block design with three replicates and means were compared by Tukey test at 5%. There were qualitative assessments (quality of plant, ear and straw) and quantity (related to production). For the installation, monitoring and participatory evaluation of the test formed a group of farmers, researchers, teachers, technicians and students. In analyzing the qualitative data, it is observed that the group identified the varieties Jaboaão LS and Vermelho as the best, while those of lower quality were the two varieties of white maize. In

analyzing the data related to production, stood out positively varieties Pernambuco, Vermelho and JaboaãoLS and negatively the two varieties of white maize and yellow maize as well. Variety Caatingueiro intermediately positioned itself in almost all variables (qualitative and quantitative), however in the production of straw positioned itself among the worst.

The gourd tree *Crescentia cujete*: phylogeography and ethnobotany of a useful fruit in Mexico

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Gourds made from the hard-shelled fruits of *Crescentia cujete* have been documented in Mexico since 1200 BC from archaeological studies and historical documents. The species grows in the wild where it is dispersed by water and mammals and is cultivated in homegardens in Veracruz, the Yucatan peninsula and the Isthmus of Tehuantepec. Indigenous names for these gourds have been recorded in at least 22 languages of Mexico. Morphological differences between wild and cultivated trees and its long history of use suggest that artificial selection and human-

mediated enlargement of its area of distribution have occurred. Objectives: To reconstruct the geographic history of *Crescentia cujete* and the genetic relationships between wild and cultivated populations. To assess forms of management and artificial selection to analyze its domestication process. Methods: Eight to sixteen trees were sampled from 20 localities throughout Mexico, from homegardens as well as grasslands and seasonally flooded savannas. Five chloroplast microsatellite loci were analyzed and organized in a haplotype network. Interviews were applied to 44 owners from eight localities to document varieties of cultivated trees and propagation practices. Results: Cultivated trees presented three exclusive haplotypes, the remaining five were found only in wild populations. Five different varieties of gourds were identified which differ in form, color, size and usage according to the interviewed persons. Cultivated trees are propagated by seeds and cuttings; some were planted from propagules brought from localities 25 to 100 km away. Conclusions: Cultivated populations were more related to each other than to any wild population, something that together with the movement of germplasm between localities suggests that gourd trees have been selected and continue to be propagated from specific genetic pools. However, varieties could not be differentiated with the genetic markers used. Future interviews on selection criteria and measures on fruit traits will be conducted to identify the targets of artificial selection.

Fungi biodiversity and ethnomycology for students of different ages: classroom and field experiences in Sicily (Italy)

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Fungi are the most under-exploited biological group, counting the widest range of potential uses and applications for sustainable development, even if it is probably considered less appealing by students. There are many interesting fields of research within folklore, artistic, religious, culinary and medical uses and applications. Moreover, fungi have a symbolic value as they are mentioned in many texts, but they also are a principal subject in literature, painting, sculpture, popular imagination, cinema, etc. More than 1,600 taxa have been recorded in the Sicilian territory. They represent a wide source of biodiversity within many habitats and especially in woods. The study of the traditional use of fungi has to be transferred to new generations: educational activities for students of different ages are essential to the preservation of this knowledge. Objective: Exploring the educational value of practical activities (especially on the field) to teach the importance of fungal biodiversity and ethnomycology. Methods: Activities on the field were organized during 2000/€2009 for students of elementary schools, high schools and university with different purposes: teaching biodiversity and environmental protection, or just showing the secret life of a wood environment to the students

coming from cities. Laboratory activities usually preceded activities on the field and were useful to introduce some general concepts to the students who often pay attention to teachers only when they are in a classroom. Results: The experience on the field together with the laboratory activity proved to be important to create a scientific awareness. The students generally showed more attention and curiosity during the practical activities, when they tended to ask a greater number of questions. Students from elementary and high school showed their enthusiasm in their first approach to natural environment, while older students were ready to ask more specific questions. Conclusions: Fungal biodiversity and the ethnomycology may contribute to the development of rural and urban societies, thus the awareness of their importance should be transmitted to younger generations. Spreading these teaching activities may be a useful tool to preserve and transmit the ethnomycological knowledge through generations.

Aroma compounds from “Rosita de cacao” (*Quararibea funebris* (Llave) Vischer; Bombacaceae) a flower used in a prehispanic beverage in South Mexico

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Rosita de cacao (*Quararibea funebris*) is a plant that grows from south of Mexico to Centroamerica the flowers are used by the inhabitants of State of Oaxaca for adding flavor to a traditional beverage, which is prepared with cacao, corn meal and mamey seeds, and dry flowers of *Q. funebris*, all ingredients are grounded and mixed, water is added subsequently be to get a drink, locally known as tejate. The beverage is actually consumed by people in the region and tourists but little is known about the aromas and flavors that provide the rosita de cacao to this beverage. Objectives: To identify the mains aroma compounds from Rosita de cacao which give a special flavor to prehispanic beverage known as tejate. Methods: Aroma compounds of dried flowers were analyzed by Gas by Chromatography using solid-phase microextraction and carotenoids by Raman spectroscopy Results: The main compounds detected by GC were: 3, hidroxy-4-5-dimethyl 2(5H) furanone (sotolone), 3 hidroxy dihydro-3 hidroxy 2(3H) furanone, acetic acid, 2-methyl, 2-butanoic acid etc, where it was found that this compounds are in fenugreek too. By Raman spectroscopy were detected some carotenoids like beta-carotene Conclusion: Rosita de cacao is a plant used in a traditional drink, which is important principally in Oaxaca Mexico, the compounds found are similar to those of fenugreek, which in combination with cocoa, corn meal and seeds of mamey give a pleasant, refreshing flavor. It is important to maintain the tradition of prehispanic beverage consumption and additionally from their nutritional value as is the case of tejuino and pozol this beverage has a special flavor and aroma.

Anthelmintic screening of Sub-Saharan African plants used in traditional medicine

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More than a quarter of the people worldwide are infected with soil-transmitted helminthes (STH), and these infections exacerbate malnourishment and can lead to severe anemia, retarded growth, and mental incapacity (Keiser and Utzinger, 2008). Since intestinal worms are endemic to Africa, new anthelmintic compounds should be found in the plants used by traditional healers for treating worm infections. Objectives: This study screened for anthelmintic activity of plant species traditionally used in the treatment of intestinal parasites and their symptoms in Sub-Saharan Africa in an effort to confirm their local use and aid in the search for new compounds since resistance is a growing concern. Methods: Aqueous and organic extracts of 33 plant parts from 17 plant species traditionally used in the treatment of intestinal infections in Sub-Saharan Africa were evaluated for

their anthelmintic activity. This activity was assessed using a standard motility assay against a levamisole resistant strain of the nematode *Caenorhabditis elegans*. Results: Anthelmintic activity was confirmed in 12 plant species. Of these, eight showed strong evidence of activity ($p < 0.0001$), one exhibited moderate evidence of activity ($p < 0.001$), three demonstrated weak evidence of activity ($p < 0.05$), and five plants showed no evidence of activity. The eight species with the strongest evidence of activity were *Acacia polyacantha*, *Anogeissus leiocarpus*, *Bridelia micrantha*, *Cassia sieberiana*, *Combretum nigricans*, *Grewia bicolor*, *Strychnos spinosa* and *Ziziphus mucronata*. Conclusion: The activity demonstrated against the levamisole resistant strain of *Caenorhabditis elegans* and the presence of molecules in these plants known or suspected of having a broad spectrum of activity provide support for further study of these plants and their compounds as possible treatments for parasitic worm infections.

Estudio del uso potencial de Bromeliaceae en el estado de Veracruz, México

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La familia Bromeliaceae está restringida al Nuevo Mundo, con excepción de una sola especie, *Pictainia feliciana*, que se ubica en África. México, al ser uno de los centros de distribución y riqueza de bromelias, posee 23 de los 56 géneros y 350 de las aproximadamente 3000 especies de esta familia. En Veracruz se encuentran 14 géneros y 91 especies, siendo junto a Chiapas y Oaxaca uno de los tres estados más ricos. La especie de mayor importancia económica dentro de la familia es la piña (*Ananas comosus*), de la cual Veracruz es el principal productor en México. Otras especies con buen potencial económico consideradas como Recursos Forestales No Maderables (RFNM) son *Aechmea magdalenae* utilizada por sus fibras (pita) para elaborar textiles y artesanías, así como varias especies epífitas del género *Tillandsia*, principalmente de uso ceremonial, navideño y ornamental. El presente estudio pretende explorar y analizar el potencial de uso de la familia Bromeliaceae en el estado de Veracruz a través de una revisión bibliográfica, consulta a ejemplares de herbario y diferentes bases de datos, así como confrontando las especies nativas de este estado con los usos que se les da en otros estados de México o países neotropicales. Se documentan 41 especies útiles en siete categorías de usos principales (bebida, cerca viva, comestible, fibra, forraje, medicinal y ornamental), donde 15 especies tienen más que un solo uso, destacando la especie terrestre *Bromelia pinguin* con seis diferentes usos, seguido por *Tillandsia prodigiosa* y *T. usneoides* (paistle) con cinco usos. Mientras que en Veracruz todavía no se aprovechan de muchos de los usos reportados, en otros estados como Oaxaca

y Chiapas se está dando un gran impulso al uso de estas bromelias como RFNM, para diversificar y apoyar la economía rural. Este estudio ofrece un listado de las especies con sus usos potenciales, de las cuales se requieren mayores estudios de la densidad poblacional, ecología, reproducción, cultivo y efecto de su extracción para validar su aprovechamiento de manera sustentable.

Concepts of gastrointestinal disease and its treatment among rural turkish villagers

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Acute gastrointestinal illness is a common, life-threatening complication for rural villagers of developing countries such as Turkey. When illness occurs, the mothers of a home are usually the first to dispense treatments. They use plants, functional foods, or other items around the home to treat their family members. Objectives: To identify and describe the classification scheme surrounding acute gastrointestinal illness and its folk etiologies and treatments. Methods: Informal, small group interviews were conducted with rural Turkish villagers in the spring of 2009. These villages were in the Central Anatolian region of Turkey and were conducted in Turkish. Participants were

given scenarios and asked about past experiences. Free-listing techniques and ranking were used for names of illness, types of illness, causes of illness, and possible treatments. Results: Different names for gastrointestinal illness were given, along with different types. The causes of illness were varied and included differing understandings of microbes, food preparation, evil eye, acclimatization to weather, and other folk theories. Common treatments included functional foods immediately available in the home as well as wild plants. Demographic differences in knowledge were analyzed. Conclusion: Central Anatolian peasants had a dynamic understanding of gastrointestinal disease, with younger mothers utilizing more information from WHO training courses and government-sponsored healthcare clinics. Older mothers knew more about wild plants for treating gastrointestinal disease and for selling in the market. These findings are evidence of a culture dealing with change at local, national, and global levels.

The influence of women empowerment on the home garden diversity in Campeche, Mexico

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Tropical home gardens are agro-ecosystems with high biodiversity that supply economic, nutritional and recreational benefits to the peasant families. The home garden diversity depends on the cultural background of the peasants and the power of women's decision-making. The women's decision-making and its influence on the home garden diversity was researched within Maya and Mestizo communities. Objectives: Identify the botanical composition in the home garden and analyze the process of empowerment of Maya and Mestizo women on the diversity and multiple uses of home gardens. Methods: From April until November 2009 an ethnobotanical survey was carried out on 66 home gardens in the municipalities of Calakmul and Hopelchen, Campeche, Mexico. Two immigrant communities (Maya-Ch'ol, and Mestizo) and one local community (Maya-Yucatec) were selected and invited to participate. Through inventories and interviews data was obtained on botanical composition, and abundance of species of the home gardens. Structured interviews were applied to find out about women's decision-making respective the management of the home gardens. The power of decision of women and other family members was investigated on: I) the selection and sowing the plants; II) the management of plants; and III) the exchange and sale products harvested from the home garden. To evaluate the diversity a Simpson index was applied and the interviews were analyzed with the ATLAS Ti 6.0 package. Results: The Simpson index was highest (0.84) in Mestizo home gardens than Maya-Ch'ol (0.90), and was similar to Maya-Yucatec (0.89) home gardens. The plant species

diversity in the home gardens was influenced by women's decision-making. Diversity was higher when women (48.2 species) or women together with their children (66.8 species) were empowered of decision-making. A high plant species diversity in home garden appeared when women were involved in exchanging plants and products with their neighbors (56.2 species when exchange vs. 38.4 species when no exchange). The age of the home gardens is not related with the plant diversity. Conclusion: The botanical composition of the home garden is related to the cultural background. The Mestizo and Maya-Yucatec home gardens were highest diverse than Maya-Ch'ol. This diversity is influenced by the women empowerment.

Consuming agrobiodiversity: meanings of diversity in the daily lives of immigrants

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In a globalized world where food travels thousands of miles and consumer demand dictates availability, it is necessary to understand whether people value diversity of the plants and animals they consume. Maintenance of agrobiodiversity will be a more sustainable process if it is economically profitable, and profitability depends on demand; if diversity has value to consumers, demand will

increase. Although agrobiodiversity is often depicted as important for biological benefits and food security, it also has the potential to directly affect people's daily lives as a result of the necessity of food, its social utility, and its cultural relevance. Previous researchers have examined differences in some of these areas between immigrant populations, such as in the area of comparative food plant knowledge. This qualitative research project addressed the meaning of produce diversity to individuals, and focused specifically on Latin American immigrants to the United States. The question to be addressed was: What is the importance and effect of differences in the availability of produce diversity in a person's daily life? Open-ended interviews were conducted with three individuals who had emigrated from Latin America during their adult life, were the primary preparers of food in the household, and had adequate means of living so as to avoid differences based on economically dictated availability. All three individuals lived in the Baltimore-Washington Metropolitan area.

Plantas medicinales y compuestos herbolarios en los mercados de Tehuacán y Ajalpan, Puebla, México

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Tehuacán y Ajalpan son dos municipios del sur del estado de Puebla, localizados en el Valle de Tehuacán, en cuyas cabeceras municipales se establecen sendos mercados semanales o 'tianguis' en donde se expenden numerosas plantas medicinales y compuestos herbolarios, que pueden incluir hasta una docena de especies. Objetivos: Registrar las plantas medicinales y conocer la composición de los compuestos herbolarios que se venden en los mercados de Tehuacán y Ajalpan. Métodos: Estos dos mercados se visitaron 20 veces entre junio de 2007 y mayo de 2009. En cada ocasión se realizaron entrevistas etnobotánicas con las y los comerciantes de plantas medicinales, que son al mismo tiempo médicos tradicionales; se compraron muestras secas o frescas de cada una de las especies y también se hicieron colectas en campo en compañía de alguno de los informantes en una de las comunidades que abastece con mayor número de plantas medicinales estos mercados. Resultados: Se registraron más de 100 especies de plantas medicinales, utilizadas para la atención de más de 80 padecimientos de nueve aparatos y sistemas orgánicos y para los llamados síndromes culturales. Se determinaron las especies que componen los casi 50 compuestos herbolarios vendidos en ambos mercados para el tratamiento de diferentes afecciones, así como sus formas de preparación y administración. Conclusión: Las plantas medicinales y los compuestos

herbolarios son muy demandados por la población que acude a los mercados de Ajalpan y Tehuacán. Las especies utilizadas son tanto plantas cultivadas como especies recolectadas, tanto en el Valle de Tehuacán como de regiones y estados vecinos.

Yerba Maté, a new crop for California?

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Yerbamate, or maté (*Ilex paraguariensis* A. St.-Hil.; Aquifoliaceae), is an evergreen tree to 18 m tall from Argentina, Brazil, Paraguay, and Uruguay that has a long history of use as a stimulating beverage. Maté is harvested from the wild and cultivated throughout its native range. California, with its diverse range of environmental conditions, could be suitable for growing maté as a new crop. Objectives: To compare environmental parameters within its native range in South America with those in California to predict the most suitable areas for successful introduction. Methods: A Geographic Information System (GIS) can be used for predicting wild or cultivated plant distributions based on environmental factors. ArcGIS software (ESRI) with robust spatial analytical tools will be used to match online raster and point climate data from origin area with comparable zones in California. Results: GIS software is able to predict the feasibility of introducing maté from South America into California, and to identify spe-

cific areas where cultivation would be most likely to succeed. Conclusion: GIS is a powerful tool for collecting, storing, analyzing, and displaying spatial information. Such applications include the potential for expanding the range of cultivation for economic plants.

Etnobotánica de la Subtribu Stanhopeinae (Orchidaceae) en México

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La subtribu Stanhopeinae está presente en México con 29 especies pertenecientes a los géneros *Acineta*, *Coryanthes*, *Gongora*, *Houlletia*, *Kegeliella*, *Lacaena* y *Stanhopea*. El conocimiento, uso y aprecio de las Orchidaceae en México comenzó antes de la llegada de los españoles, por ejemplo los aztecas cultivaban orquídeas en los jardines botánicos como símbolo de poder y riqueza; en los mercados prehispánicos se comercializaban las flores, frutos y raíces para uso culinario, medicinal y como adornos en ceremonias religiosas. Muchas de estas costumbres prevalecen hasta nuestros días,

la influencia del conocimiento etnobotánico prehispánico se refleja en la farmacopea tradicional de nuestro país, existen múltiples registros de la utilización de orquídeas en las zonas indígenas, principalmente en las zonas tropicales, donde son más diversas estas plantas. Con la llegada de los conquistadores las prácticas religiosas mesoamericanas se fusionaron con el catolicismo, por lo que es común observar como las orquídeas adornan santuarios, altares, cementerios, a manera de ofrendas florales que coinciden con las múltiples fiestas patronales de muchos pueblos mexicanos. A partir del siglo XVIII la belleza y fragancia de esta familia incito a las colectas masivas de ejemplares mexicanos los cuales alcanzaban precios muy altos en la aristocracia Europea, incluso las expediciones eran financiadas por invernaderos de Francia, Inglaterra y Austria, por lo que sus descripciones fueron realizadas en estas naciones. En México la afición por las colecciones de estas flores, comenzó en 1942 con la creación de la primera asociación de orquídeas y con ello el inicio de la producción y comercialización a nivel mundial, como flor de corte o de uso ornamental tanto de especies nativas o híbridos artificiales; esta actividad constituye un ejemplo de conservación, de no haberse cultivado por los aficionados y antepasados ya se hubieran extinguido; sin embargo el mercado mexicano dista mucho de la competencia internacional, ya que falta promover el cultivo adecuado de las orquídeas mexicanas, para que estas alcancen un alto precio en el ámbito global.

Enhancing STEM education through redesign of an entire degree curriculum: Ethnobiology

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The NSF-sponsored Ethnobiology Imperatives report (Salick et al. 2003) emphasized the directions that ethnobiological education should develop and pointed out that programs must have a sound interdisciplinary scientific basis, strong local focus, broad foundation, and include research experiences. The primary goals of this project were to develop and implement new ethnobiology learning objectives, curriculum modules and evaluation rubrics. New learning objectives were developed through literature surveys of research methods being used by current ethnobiologists, and interviews of employers to obtain information about needed skills, experiences and knowledge of graduates. Modules were developed to provide training in one or more courses following one of several educational models (Problem-based Learning, Citizen Science, Research Portfolios, Montessori, or Field-based Active Learning). Modules were implemented into ongoing courses in classroom, laboratory and field settings and evaluated using informed consent of the students with pre/post- surveys and tests. Teaching objectives and evaluation rubrics were also evaluated with examinations and

subsequently modified before posting on the Internet. All resulting content that has been tested has been posted on the Internet and is currently being evaluated by the Open Science Network. The curriculum redesign has resulted in a dynamic program that combines a strong interdisciplinary basis, has a strong local focus, has a broad foundation in diverse STEM disciplines, and includes multiple research experiences culminating in an integrated field school. It is hoped that this program will be transferable to other institutions for implementation at different educational levels.

Interchange patterns of native species of plants of the Tehuacan-Cuicatlán Valley

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A total of 1600 useful plant species were previously reported for the Tehuacan-Cuicatlán Valley. Part of such diversity is interchanged at local, regional, national and even international scales, and the demand in the market may cause impact on

vegetation, illegal traffic and other social problems. But also, interchanges may motivate developing management techniques. Objectives: Our study aimed at identifying native plants which are exchanged at different scales, socio-cultural factors influencing the demand of products, possible risks for conservation of resources and responses of management developed by people. Methods: Semistructured interviews were conducted to sellers and buyers interchanging forest resources in six regional markets and in five communities of the area. A data base was constructed with the information on interchanged plants, ecologic information on their distribution and abundance, and plant management practiced by people. With this information, an analysis of risks was performed. Results: Nearly 150 native plant species are interchanged, most of them are used as edible (39.8%), ornamental (26.1%), medicinal (24.8%), and fuel (6.5%). Plants of families Cactaceae and Fabaceae are the most used as food. Cactaceae and Crassulaceae are the main use as ornamental and these have more restrictions for marketing. Asteraceae is the family providing more medicinal resources, whereas Fabaceae is the one providing more fuel. Plant species more actively interchanged receive at least one management type by people. A group of six species of narrow distribution and scarce, without management or under incipient management are those under the highest risk. Conclusions: Mobiles of interchange differ at different scales. The local scale is mainly destined to satisfy needs of subsistence of peasant households, the regional scale is destined to obtain

monetary incomes, whereas the national and international scales are mainly directed to traffic of ornamental plants. People have management techniques for most plant resources exchanged at local or regional level. Illegal traffic of extracted plants is the main risk-determining activity.

The cocoplum (*Chrysobalanus icaco* L.), a species with multiple uses

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The cocoplum, is a native species of Tropical America. It has been use as an edible fruit, as ornamental, as a windbreaker fence, for the oils that contains, as well as for the different secondary metabolites. This species can adapt to different type of soils and its commonly found in orchards. Objectives: To propose its use as a potential resource in the region of Tabasco, Mexico Methods: A research regarding germination was conducted as well as phytochemistry analysis. A literature review was done to find out its geographical distribution as well as the environmental requirements for its cultivation mainly related to soil and climate to show its potential to be managed. Results: The distribution of this species is confined to coastal and riparian areas, associated to different ecosystems that include orchads. It has a hipogea criptocotilar type of germination that take around 60 days to germinate. There are three varie-

ties according to the color of the fruit. On coastal areas its fructification peak goes in autumn. Variations on the type of anthocyanins were detected on the exocarp. In Brazil the extract of this species has been marketed due to its pharmaceutical properties. Conclusion: This species can adapt to different ecosystems, it been use to maintain degraded sites of coastal and mangrove areas. Its important to do special tests in this region to production and find out if it can be use as a pharmaceutical product.

Estudio del uso potencial de Araceae en el estado de Veracruz, México

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La familia Araceae es un elemento muy conspicuo de los bosques húmedos tropicales del mundo. En México se han registrado 13 géneros y 109 especies, de las cuales 10 géneros y 54 especies se han reportado para el estado de Veracruz. En el presente estudio, se exploró el uso potencial de la familia Araceae en Veracruz mediante la revisión de bibliografía, revisión de bases de datos e información de material de herbario. En general la información existente es muy escasa, donde las principales categorías de uso documentadas son:

medicinal, ornamental y alimenticia. En la medicina tradicional las aráceas son utilizadas mayormente para el tratamiento de picaduras de víboras e insectos ponzoñosos, enfermedades de la piel, curar heridas y llagas, problemas estomacales, reumas y dolores musculares. Existen pocas especies reportadas como ornamentales, en contraste con el gran potencial ornamental que tienen muchas de las especies nativas. Nosotros identificamos un total de 34 especies que podrían ser utilizadas con este propósito por la belleza de su follaje, habito e inflorescencias. Las aráceas usadas como alimento son en parte especies tuberosas como *Xanthosoma* y *Zantedeschia*. Además se consumen las infrutescencias maduras de *Monstera* deliciosa y varias especies de *Syngonium*, así como las inflorescencias tiernas de *Spathiphyllum cochlearispathum*. Un recurso potencial promisorio podría ser el uso de las raíces aéreas de algunas especies de *Monstera* y *Philodendron* para cestería. Este uso es más popular en otros estados como en Oaxaca y Tabasco, donde esta adquiriendo importancia en relación al aprovechamiento de recursos forestales no maderables (RFNM). Sin embargo, el aprovechamiento sustentable de este último recurso requiere mayores estudios principalmente del efecto de la cosecha de las raíces para la supervivencia de los individuos utilizados. En conclusión se puede decir que el principal potencial de uso de la familia es el ornamental mediante el cultivo de las especies, aunque sería importante validar la sustentabilidad y el mercado de los otros usos de mayor importancia.

Plantas acuáticas emergentes; un cultivo energético potencial

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El empleo de materias primas alimenticias para la producción de biocombustibles es preocupante ante una insuficiente superficie agrícola global que compita o sustituya por completo a los hidrocarburos del petróleo y simultáneamente produzca alimentos para una población mundial creciente (FAO, 2008). Las plantas acuáticas emergentes (PAE) constituyen una opción como fuente de biodiesel, al poseer una elevada producción primaria y representar la posibilidad de aprovechar ecosistemas marginados. Objetivos: Analizar el contenido de lípidos totales y composición de ácidos grasos de hojas y semillas de *Pontederia sagittata*, *Typha domingensis* y *Sagittaria latifolia*. Métodos: Las hidrófitas emergentes se cosecharon de microembalses localizados en Villahermosa (17° 59'26" y 17° 59'17" N y 92° 58'16" y 92°58'37" O), Tabasco, México. Los lípidos totales (LT) fueron extraídos y cuantificados con éter de petróleo. Los ácidos grasos (AG) metilados fueron analizados en cromatógrafo de gases acoplado a un espectrómetro de masas (Varian GCMS).

Resultados El mayor contenido de LT se encontró en semillas y hojas de *S. latifolia* y semillas de *P. Sagittata* (p 0.05). El contenido de LT de las estructuras vegetales fluctuó, entre 1.80 a 9.28 % en peso seco. Entre los AG de relevancia para la producción de biodiésel según Knothe (2005) y Ramos et al., (2009) se encuentran los AG C 8:0, C10:0, C12:0, C14:0, C16:0, C18:0, C16:1, C18:1, C18:2, C18:3 y C22:1. El perfil de AG de la hoja de *S. latifolia* y la hoja y semilla de *P. sagittata* presentaron en promedio 95.1% a 96.5% de esta composición. Conclusión: El uso de *P. sagittata*, *T. domingensis* y *S. latifolia* como biocombustible es limitado ante su bajo contenido lípido. Sin embargo, su composición de AG ofrece la posibilidad de iniciar investigación aplicada con propósito agroindustrial, orientado al desarrollo de productos alternativos no convencionales.

Agrobiodiversidad de solanáceas comercializadas en la Sierra Sur de Oaxaca, México

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La Sierra Sur de Oaxaca es una región biocultural compleja donde una variada gama de recursos naturales son conocidos, usados y manejados por mujeres y hombres hablantes de por lo menos seis

variantes dialectales del zapoteco. El mercado de Miahuatlán representa un escenario idóneo para realizar estudios prospectivos de la Agrobiodiversidad regional. Métodos: Se indagó la comercialización de solanáceas en el mercado de Miahuatlán mediante la observación participante y la compra entrevista. La determinación taxonómica se basó en la herborización de ejemplares, el cultivo de algunas especies y el empleo de claves taxonómicas. Resultados: Las solanáceas presentes en el mercado más importante de la Sierra Sur de Oaxaca son: a) quince cultivariedades de chile (*Capsicum annum* var. *annum*; *C. annum* var. *frutescens* y *C. pubescens*) y dos chiles silvestres (*Capsicum annum* var. *glabriusculum*); b) tres cultivariedades de jitomate (*Solanum lycopersicum*) y el cuatomate (*Solanum pimpinellifolium*); c) dos cultivariedades de miltomate (*Physalis philadelphica*) y su pariente silvestre; d) dos cultivariedades de papa (*Solanum tuberosum*) y e) dos especies de hierba mora (*Solanum americanum* y *S. nigrescens*). Conclusión: Tres géneros, ocho especies, tres variedades y 24 cultivariedades de solanáceas constituyen una muestra de la agrobiodiversidad de la región y un patrimonio generado y conservado *in situ* por los zapotecos del sur de Oaxaca.

Analysis of plant traditional knowledge evolution using the biplot multivariate method

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The need to search trends in the traditional knowledge and to perform comparisons both at the inter- and intra cultural level, have motivated the usage of quantitative methods in ethnobotanic studies in the last years. Objectives: Use the biplot multivariate method to identify factors related with the conservation, loss or transformation of the useful-plant traditional knowledge. Methods: We took into account 240 useful plants registered in a 18th-century document (year 1778) from Ixtlahuacán, Colima, Mexico. We survey 106 individuals from ten communities of that territory, and we ask them about the usage and knowledge of the 240 plants. The results of the survey were analyzed using the biplot multivariate method. Results: The conservation of the knowledge and usage of the plants between the communities was different. Approximately, 17% of the studied plants conserved the same usage and knowledge that had in the 18th century. Neither the individual's level of education nor the origin of their parents is related with the conservation of the knowledge. Conclusion: The biplot method allowed us to obtain a joint representation of the different factors and individuals, and also facilitated the hypothesis generation and data analysis.

Las mujeres: actores principales en la conservación del conocimiento tradicional

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El papel protagónico de las mujeres en la conservación de las tradiciones culturales relacionadas con el uso de los recursos naturales ha tenido una importancia marginal en las investigaciones de carácter etnobotánico. Sin embargo, en diversas localidades del sureste de México las mujeres son las que conservan de manera activa el conocimiento de tradiciones culinarias, manejando de manera consciente los recursos vegetales relacionados con las mismas. En estas localidades se puede observar un alto índice de migración por parte de la población masculina, mientras la femenina permanece en sus lugares de residencia y establece redes de cooperación social que promueven la conservación de las tradiciones al tiempo que intervienen de manera complementaria en la obtención de recursos económicos para el hogar. Un ejemplo de este fenómeno se observa en los estados de Veracruz, Puebla y Oaxaca, en donde la elaboración de bebidas tradicionales, cuyos ingredientes principales son semillas de *Theobroma bicolor* o *T. cacao*, ha representado un elemento de cohesión entre mujeres de diferentes edades

en varias localidades. En esta región, las mujeres son las responsables de la obtención de los ingredientes, el procesamiento de los mismos, la elaboración de la bebida y la preservación y transmisión del conocimiento. Asimismo, es la población femenina la que se encarga del manejo de las especies vegetales utilizadas para la elaboración de la bebida y la que administra los recursos económicos relacionados con esta preparación. De acuerdo con referencias históricas, las mujeres han jugado un papel trascendente en la producción de bebidas similares en México desde el siglo XVI. Esto sugiere la existencia de una continuidad histórica y cultural del conocimiento albergado en las mujeres en los últimos 400 años. Esta investigación representa una manera de explorar el impacto que las poblaciones humanas han tenido sobre la diversidad vegetal en el trópico mexicano y, en particular, la importancia del papel de las mujeres en la conservación de los recursos culturales y naturales de esta zona.

Spatial correlation of the regions of grain domestication with frequencies of human alcohol dehydrogenase haplotypes imply separate and independently derived fermentation technologies

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Grain domestication was fundamental in the early evolution of human societies. This event most likely happened independently in more than one region. One technology to store the surplus grain made available by domestication was fermentation into a palatable beverage. These beverages represented both a source of energy and relatively safe drinking water, thus influencing directional selection in human populations for an improved ability to digest ethanol. Although humans possess genes for the metabolism of ethanol, a highly derived allele (ADH1B*47His) is responsible for an increased rate of ethanol metabolism and associated with protection from alcoholism. A geographic analysis of regions of grain domestication and ADH1B*47His allelic frequencies indicates a spatial correlation supporting the hypothesis that separate fermentation technologies were derived independently in more than one region. The combined analysis of biocultural diversity, technology of fermented beverages, and genomics offers alternative hypotheses to address patterns of human migration, human evolution, and crop domestication.

Chiles and Zapotec. A glimpse of the interactions between chiles and a modern native people of San Sebastián Abasolo, Oaxaca, Mexico

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Chiles are one of the main culinary ingredients that nourish soul and body of pre-hispanic and contemporary cultures of Mexico. It is part of the traditional "milpa" in most of the native cultures adding a distinctive element since we can still find a correlation one to one of "a particular chile to a particular culture". Objectives: To describe the chiles (*Capsicum* spp.) used by zapotecs of the Central Valley of Oaxaca. Methods: An holistic ethnobotanical approach was used to make interviews and participative observation with the aid of video and photo to obtain information related to chiles and the everyday life of zapotec people of the Central Valley of Oaxaca. Results: Chiles were used mainly as a condiment and vegetable. The most important chile is ginnia, a local variety cultivated with irrigation. Other varieties were found in homegardens or were bought at the local market (Tlacolula or Oaxaca city) to be used to prepare food. It was documented other uses that are disappearing.

Studies on vegetal diversity in home gardens near to reserve zones in the state of Campeche, Mexico

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Home gardens could contain a diversity of cultivars, rare species and endangered species by changes of soil use, specially in the reserve areas. Objectives: To estimate the proportion of vegetal diversity corresponding to rare, native and introduced species in home gardens of the Calakmul biosphere reserve zone in Campeche. Methods: We selected 30 home gardens from 3 communities, 10 at each one, vegetal species use was obtained by interviews with the owners. Plants were identified *in situ* with the aid of a botanist, when this was not possible, plants were collected for herbarium identification, in all cases we take photographs of the plants. Results: We found more than 300 plants species, approximately $\frac{3}{4}$ parts were herbaceous and arboreals. The proportion of rare or endangered species was lower than 10%; on the contrary more than a half of herbaceous species were introduced, mainly ornamental species. Conclusions: A high proportion of the registered vegetal diversity correspond to introduced species. The rare or endangered species were in a lower proportion. The studied home gardens maintain a low proportion of the local vegetal diversity.

New Crop Introductions and Development: Goji Berry in Virginia

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New crop introductions and development have the potential to add income to local farmers, reduce the use of fossil fuels in transportation, enhance product freshness, properly certify organic production and ensure greater control over factors that affect food safety. As an indication of demand, Goji berries are consistently listed as the #1 best selling item in more than one grocery category on Amazon.com. Domestic demand and consumption already exist, however domestic production is seriously lagging. As a result, most Goji Berries sold in the US are imported from China where the use of DDT and other insecticides is widespread. Goji Berries (*Lycium chinense* Mill. or *Lycium barbarum* L.) are perennial members of the Solanaceae native to SE Asia where they have been used as medicinal plants for centuries. Goji Berries have one of the highest Oxygen Radical Absorbance Capacity (ORAC) ratings of any fruit known (Zhou, 2008). Sugars in Goji Berries reduce insulin resistance, a risk factor of diabetes in laboratory animals. Goji Berries are also high in vitamins and minerals and reportedly improve immune responses in humans. The purpose of this project is to develop suitable cultivars, propagation protocols and cultural recommendations for organic and conventional Goji Berry production in Virginia. Data from

Virginia show that they are easy to grow and are winter hardy to USDA Hardiness Zone 4 (-28.9°C to -34.4°C). Productivity in multiple seasons, invasiveness, herbivore and disease resistance as well as the impact of different cultural systems will be investigated. Fruit quality will be evaluated for antioxidant levels and nutritional quality.

Growth and production of cassabanana (*Sicana odorífera* Vell. (Naudin) fruits. Preliminar report

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The casabanana is a important specie for its fruits edible, cooked or syrup, its resistant to drought and its growth is in associaton with fruit trees where climbing. Its native possibly of southamerica, but naturalized in all America tropical. Its fruits are rich in calcium and phosphorum. Objectives: To quantify the fruits, the morphologic and productive characteristics of casabanana Methods: The fruits were collected of familiar orchard and market, the fruits were weighed and they measured, its seed were recorded by fruit and the fruit numbers by plant. The different phenológic phases of germination from plantlet, the moments of flowering and fructification were identified. Results :Two varieties by their color of mesocarpio were

identified, each plant produces around 15 fruits, measure in average 29.5 cm in length and 8.8 cm of diameter. They reach a weight of 1.161 kg and can have up to 508 seeds. They germinate in three days, they bloom in seven months and the fruits begin to harvest in ten months. It is associated with *Annona* spp., *Persea americana* and *Citrus sinensis* mainly. The price that reaches oscillates between 50-60 pesos by fruit. Conclusion: The casabanana production is an option of commercialization for small producers, since they can associate this plants with other trees in his familiar orchards

Psychoactive herbs commercialized in streets of Diadema (SP, Brazil): risk in its consumption, Brazil

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The popular trade of herbal drugs without quality assurance implies a health risk. Objective: This study was an interdisciplinary analysis of the herbal drugs (DVs) trade network with focus on psychoactive drug plant (DVPs) available on the Brazilian city of Diadema, and risks associated with its consumption. Methods: Methods of ethnopharmacology, such as informal interviews, semi-structured interviews and participant

observation were used for the completion of the fieldwork, during which four tradesmen were selected to register the collection, handling, packaging and types of DVs marketed. Results: We registered 63 DVs that referred to psychoactive activity (DVPs) and categorized as stimulants (67%), depressants (27%), depressants and stimulants (1%) and finally some could not be set (5%). These DVPs had their popular names, preparations and uses, used parts, contraindications, and doses recorded. Eighteen of the 63 DVPs were selected according to the study criteria, and their lots were purchased by the selected tradesmen to be examined by microbiology (61 lots) and Pharmacognosy (only 22 of those lots, related to only 8 DVPs). The results for these areas, together with query in the scientific literature concerning descriptions of adverse reactions, provided the grant for the final analysis of these DVPs in the context of pharmacovigilance. Deficiencies were observed mainly in the handling and packaging of DVs by the traders, favoring its contamination and degradation. The microbiological analysis found that 16% of DVPs analyzed showed populations of bacteria (aerobic and Enterobacteriaceae) exceeding 105 CFU/g and 31%, populations of fungi (molds and yeasts) exceeding 10³ CFU/g and the presence of risk indicator microbial species in 17 DVPs, specifically in 74% of the 61 lots, in addition to aflatoxin B1 or B2 producing fungi in four of them. The results of pharmacognosy showed that 73% had failed at least one of the parameters (contaminants, characterization and chromatographic profile), 50% of the 22 lots analyzed did not match the specifications of the

pharmacopoeia, 36% were contaminated by other plant organs than those permitted in the monographs and a lot contamination by insects was found. All 22 lots have been disapproved in the evaluation of the label (classification and validity) and virtually all packages were considered inadequate. In addition to data obtained from such analysis, descriptions of contraindications, adverse effects and drug interactions were found in the literature for 3 DVPs who had their identity confirmed by the Pharmacognosy (chamomile, ginkgo biloba and guarana). Conclusion: The results obtained here allow us to observe the priorities of sanitary adequacy of the DVs popular trade, as well as establishing a profile of quality of DVPs marketed according to the analyzed parameters. We conclude that these DVPs gather important factors that could cause damage to the consumers health, especially for some groups such as pregnant women and immunosuppressed individuals.

Ethnobotanical survey among "caboclos river-dwellers" living in Reserva Extrativista do Rio Unini, AM., Brazil

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Amazon forest is a region biologically and culturally promising as for the presence and use of plants for medicinal purposes. Objective: This study aims to

record the therapeutic use of plants found among healing experts inhabitants of the Extractive Reserve of Rio Unini communities, Amazonas. It has been observed and rescued the use of plant parts and products, such as resins, latex, gums and oils. Methods: To perform the field work (selection, interviews and observations with the specialists) it has been used an ethnographic approach. Cooperation with professionals in the fields of botany and chemistry was celebrated as a way to enrich the methods of collection, identification and depositing of the material used for medicinal purposes. In addition, collaboration with a physician has promoted the understanding and translation of the terms of the local therapeutics. Results: A total of 64 plants were utilized for 30 therapeutic purposes during six months fieldwork. These were grouped under categories of use, including: gastrointestinal disturbances, inflammatory processes, genitourinary disturbances, fever, mishaps with animals, dermatological problems, pain, anxiolytics, stimulants, tropical diseases and others. Those who administer these medicines are local residents specializing in household remedies and other groups of healers like rezadores—prayer-maker; curadores—healers; parteiras—midwives; desmintidores—masseurs and médiuns—mediums. Conclusion: The data obtained in this work will serve as a guide in the future selection of potential bioactive in phytochemical and pharmacological research, in an attempt to contribute to the development of new drugs in Brazil.

El papel económico y ecológico de las Chinampas de Xochimilco en el siglo XXI

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En Xochimilco subsiste la Chinampa, que es un sistema tradicional de manejo de recursos naturales cuyo mayor auge se dio en el siglo XVI (Rojas 1995). En ese tiempo la productividad de la Chinampas se basaba en el reciclamiento de nutrientes cuyo origen era diverso. Con lo que se producía en ella alimentaba a una buena proporción de la población de Tenochtitlan (Ezcurra 1991). En la actualidad existe una fuerte tendencia a la sustitución del sistema tradicional de Chi-

nampas por invernaderos de plástico, lo cual constituye un impacto negativo en el paisaje y la cultura chinampera de Xochimilco. En el presente estudio se hace una evaluación de manejo de recursos naturales, desde la perspectiva de la sustentabilidad, utilizando indicadores sociales, económicos y ecológicos. Se pretende contestar a las preguntas: ¿cuáles son los impactos socio-ecológicos a escala regional y parcela, del cambio de uso del suelo y del reemplazo del sistema chinampa por los invernaderos? El marco metodológico que permitió orientar la formulación de indicadores en las tres dimensiones y las dos escalas de trabajo fue el MESMIS (Lopez-Ridaura, Masera et al. 2002). Aunque los resultados indican que tanto el sistema Chinampa como el sistema Invernadero podrían cambiar y mejorar algunos aspectos que debilitan su perfil de sustentabilidad a nivel sistémico, las implicaciones de las Chinampa en la prestación de servicios ecosistémicos no podría ser reemplazado por los invernaderos ya que los terrenos bajo invernaderos pierden la cobertura forestal, promueven el relleno de canales, icono del ambiente lacustre y no contribuyen a la provisión de alimentos.

The silent extraction of voqui fuco (*Berberidopsis corallina*): the case of Huilliche basket weavers in southern Chile

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There has been much emphasis placed on the important socioeconomic value that non-timber forest products (NTFP) can contribute to rural livelihoods of people living in or adjacent to forests. Additionally, the use and management of NTFPs has been promoted by conservation and development agencies worldwide as a sound land management practice. This ethnographic study focuses on the socioeconomic use of voqui fuco (*Berberidopsis corallina*), an endemic and endangered woody vine collected by indigenous Huilliche artisans in the southern commune of San Juan de la Costa, Chile. Seven artisan families were selected for an in-depth ethnographic study. Primary data was collected through semi-structured questionnaires with artisans, community members, artisan buyers and regional NGOs. Participant-observation was conducted at artisan's homes, forest collection sites and within local markets. Results demonstrated that: 1) the commercialization of an NTFPs did not lead to a significant income increase, yet the NTFP had an important cultural value within a rural, indigenous community; 2) the decline in voqui basketry production was primarily due to rural-urban migration, forest conversion to timber plantations, limited resource access, and limited knowledge transfer between artisan families and; 3) this basketry activity simultaneously incurred cultural changes in the types of products produced, commercialization forms and gender of individuals partaking in the process. Future production of this traditional art form is greatly dependent on the ability to balance socioeconomic, political and ecological

factors that affect its production. Furthermore, there is a need for future studies focusing on the ecological impacts of harvesting on voqui populations on the Valdivian temperate rainforest.

The role of ethnobotany in policy and commerce

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It should be ethnobotanist who present information on traditional plant use to the people who make legal and commercial decisions; information that is in a format tailored for legal and commercial applications. As the global market demand increases for "new" foods, sustainably harvested goods, and sources of medicinal compounds, policies are being created to govern the final product and all of the steps in between from the field to the store shelf. Ethnobotanists are importantly and uniquely situated to provide basic information and knowledgeable direction that can promote the respectful, responsible, and sustainable use of traditional plant materials.

La producción de café dentro del sistema tradicional totonaco y su transformación

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Los cafetales bajo sombra se consideran agroecosistemas con enormes beneficios en términos de protección ambiental y conservación de la biodiversidad local y regional, especialmente cuando son manejados por grupos indígenas. Este trabajo fue desarrollado en la comunidad totonaca El Zapotal, Municipio de Zozocolco, Veracruz, México ubicado a una altitud de 310 msnm. Se llevaron a cabo entrevistas abiertas y dirigidas, colectas botánicas, observación participativa y registros de manejo y producción de los cafetales durante una permanencia de 15 meses en la comunidad. La presente contribución forma parte de una investigación más amplia y de ella se discuten dos aspectos de la producción del café en esta zona totonaca de baja altitud. En el primero, se aborda la manera en que los indígenas Totonacos incorporaron el cultivo del café a un diseño cíclico de producción tradicional de maíz, caña de azúcar y vainilla, cuyo resultado es de enormes beneficios en términos productivos y de conservación. Una estrategia altamente sustentable que abastece productos para la subsistencia familiar y para el mercado nacional e internacional. Se analizan también, los elementos centrales de la problemática social y económica actual para sostener dicho sistema. En el segundo aspecto, se analiza el papel que esta jugando el cultivo de maíz para venta de "hoja" para exportación, como una de las razones de la transformación y disminución de las áreas dedicadas al cultivo del café en la zona de estudio.

Simposia Abstracts

Los centros de diversificación biocultural y el uso sustentable de los recursos bióticos por las comunidades indígenas de México

Eckart Boege

El Convenio de Diversidad Biológica firmado por México en Río de Janeiro en 1992, la Agenda 21 en su capítulo 26 y subsiguientes Conferencias de Partes, instan a los Estados a reconocer y fortalecer a los pueblos indígenas y comunidades locales como poblaciones estratégicas para la conservación de la diversidad biológica y agrobiodiversidad a nivel mundial. En particular, en lo que se refiere a los centros de origen y diversificación de la diversidad natural y domesticada en los territorios actuales de los pueblos indígenas se proponen una serie de medidas específicas. Para indicar la importancia de la diversidad biológica, incluyendo la domesticada en los territorios de los pueblos indígenas, desarrollamos el concepto de centros de diversificación biocultural. Para crear tal regionalización sobrepusimos en un sistema de información geográfica los territorios con presencia mayoritaria de población indígena con las regiones de mayor importancia en diversidad biológica del país, mismas que fueron definidas entre varios paneles de expertos a instancias de Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO 1998, 2000 y 2004).

Estas regiones incluyen: las Regiones Terrestres Prioritarias, las Regiones Hidrológicas Prioritarias y las Áreas de Importancia para la Conservación de las Aves y los territorios indígenas en donde se han colectado especímenes de maíces nativos y de otros cultivos domesticados mesoamericanos. En los últimos 30 años se han desarrollado una serie de experiencias locales en los territorios de los pueblos indígenas que aportan a la nación un nuevo frente de conservación y desarrollo sustentable.

Crisis ambiental y dendrocultura. Papel de los árboles remarcables en la comunicación ambiental y en el turismo sostenible

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La crisis ambiental que azota al planeta, es abordable desde posiciones de cambio profundo, un cambio que modifique las raíces del modelo general imperante, basado en términos generales en una apropiación acelerada y intensa, que no da tiempo de recuperación sistémica de los recursos. Las vías para dicha superación topan con una primera dificultad que es el babelismo conceptual,

una diáspora de lenguajes distintos que lejos de aclarar aumentan la nebulosa de la complejidad gratuita, que pone trabas a l'avance hacia un futuro durable. Una aportación, en apariencia sencilla, es el reconocimiento del valor que pueden alcanzar los árboles remarcables, entendiendo como tales aquellos ejemplares, que han alcanzado remarcabilidad, en tamaño, volumen, edad, altura, que han llegado hasta nuestros días como un legado a menudo ancestral, alcanzando formas excepcionales, no solo por biología estricta, sino por su significado cultural, ético i/o religioso. En un contexto de crisis como el actual, el valor de los árboles remarcables, permite reflexionar, incluso recuperar su sacralidad, como un elemento notorio para elaborar una pedagogía a partir de dichos recursos tan excepcionales, así como orientar un turismo sostenible, que ve en estos elementos un factor socioecológico que supera los valores del turismo arqueológico-religioso convencional.

Agrodiversity from the below-ground perspective: lessons from Sierra de Santa Marta, Los Tuxtlas

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Many tropical areas suffer from human-induced soil degradation resulting in a reduction of agricultural productivity. An unsustainable land use intensification of naturally thin and nutrient poor soils has often been invoked as the prime explanation for farming areas on steep slopes. Cropping rates have increased, the amount of land managed by each farmer greatly reduced, and the diversity of productive systems and products grown, diminished. In this talk we use a case study at Sierra de Santa Marta (Los Tuxtlas, Veracruz, Mexico) to first, quantify the cumulative effects of land use on soil fertility and belowground biodiversity (CSM-BGBD project) and second, present preliminary results from the BioPop project. This project is aimed at using symbiotic relationships between below and aboveground

native biodiversities to improve productivity in traditional (Zoque-Popoluca) milpas. We found that the cumulative effect of land use (cropping years in the last 70 yrs) can explain between 8 and 22% of the variability in soil fertility indicators, and between 5 and 22% of belowground biodiversity (taxa richness of 10 functional groups). The capacity of soils to establish mycorrhizal symbiosis (with experimental maize plants) diminishes with decreasing diversity of cultivated plants in the milpa ($R^2=0.78$, $P<0.01$), while locally grown maize produces an increasing number of cobs when the soil contains more mycorrhizal propagules ($R^2=0.47$, $P<0.05$). We conclude that the effect of land use intensification on belowground biodiversity may be hampering the natural mechanisms that native crops have to cope with naturally thin and nutrient poor soils. The immense variety of locally developed crops in traditional milpas (i.e., sixteen maize and fourteen bean varieties) is probably benefiting from symbiotic relationships with an equally diverse array of soil microorganisms. The challenge is to understand such a network to develop locally tailored technologies that improve productivity and conserve an invaluable indigenous heritage.

Toward the Domestication of *Vanilla pompona* (Orchidaceae) from Wetlands of the Peruvian Amazon, Phase 1: Agricultural, Chemical, and Ecological Investigations

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Through ongoing botanical exploration by the Botanical Research Institute of Texas (BRIT), large, abundant populations of *Vanilla pompona* were discovered in the vast wetlands of the Peruvian Amazon. Field studies during 2004-2007 led to the first hints that wild plants of *Vanilla pompona* in the Peruvian Amazon possess important characteristics that are desired on the commercial market, such as fast growth and large fruits that are strongly fragrant and also tasteful. During 2008-2009 intensive ecological, agricultural, and chemical studies were carried out as a first step toward the domestication or reintroduction of *Vanilla pompona*. Objectives: The goal of the first phase of research carried out during 2008-2009 was to document the diversity and ecology of *Vanilla* orchids in wetlands of the Peruvian Amazon, and to determine the optimum conditions for the propagation, growth, flower pollination, fruit production, and extraction of essence of *Vanilla pompona*. Methods: Populations of *Vanilla pompona* and five other wild species of *Vanilla* orchids were documented and mapped in their aguajal wetland habitats of

Madre de Dios, Peru. Good botanical practice and quantitative vegetation ecology protocols were used to document the distribution, abundance, and density of *Vanilla* populations and their vegetation associations in 28 large, disjunct aguajal wetlands located in Madre de Dios, Peru. Vegetative cuttings were collected and transported to the BRIT nursery in Puerto Maldonado where they were planted in an experimental plantation setting. Flowers of wild plants were pollinated and fruits were harvested, cured, and subjected to extraction experiments and chemical analysis aimed at describing the aromatic profiles. Results: Populations of *Vanilla pompona* and five other wild *Vanilla* species, and their habitats, were documented and mapped from 28 aguajal wetlands of Madre de Dios, Peru. Approximately 3500 individuals of *Vanilla* were documented, mapped, and studied over a two-year period. *Vanilla pompona* is the most dominant species, with an average of 250 stems per hectare. A total of 1000 cuttings of *Vanilla* were propagated in ex-situ plantation settings in the region. A total of 400 fruits were harvested, cured, and subjected in part to chemical analysis from a total of 1300 flowers pollinated on 130 wild plants. Fruits possess a high fragrance content when cured and dried properly, with aromatic characteristics comparative to but unique from those of *Vanilla planifolia*. The quantitative results attained in our preliminary chemical analysis of the aromatic content of *Vanilla pompona* will be summarized. Conclusion: *Vanilla pompona* from the vast wetlands of the Peruvian Amazon is an important candidate for large-scale production of fragrant fruits, essences, and

flavors. Additional studies are needed. Conservation efforts are needed to protect the aguajal wetlands of the Peruvian Amazon, as an increasing number of them are now being mined for gold. This entire project started with one botanical discovery in the Peruvian Amazon.

Plant management and domestication in the Tehuacán Valley: Traditional perspectives for biodiversity conservation

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The Tehuacán Valley has been inhabited by humans for nearly 10,000 years, and throughout history peoples of the region have interacted with a great biological diversity represented for instance by nearly 2,800 plant species. Currently, seven indigenous ethnic groups know and use more than 1,600 plant species, establishing with 610 of them some form of cultivation and/or *in situ* management in both forest and agroforestry systems. Use of diversity and the variety of management strategies by local peoples are keystones for biodiversity conservation. For instance, agroforestry systems maintain in average nearly 60% plant species occurring in the forests these systems derive from,

and nearly 94% genetic diversity of some dominant arboreal species. Among managed species some trees and shrubs have been recognized by ecologists as nurse plants that are crucial for recruitment of seedlings of numerous native plant species. In addition, well managed agroforestry systems make possible a good recovery of populations of key species after disturbs, as well as biotic interactions allowing gene flow among populations in landscape matrixes. Use and management of diversity also influences resilience of socio-ecological systems, which is a crucial issue for sustainable use of natural resources and ecosystems. Current traditional knowledge and management synthesizes a long history of human experience dealing with uncertainty of plant resources availability, which may substantially contributes to shortening ways for conserving and restoring plant populations and ecosystems. Socio-economic and cultural processes are currently affecting efficacy of traditional management for assuring sustainable use of natural resources. Understanding these processes may be crucial for designing adequate policies and participatory actions for biodiversity conservation and resilience management.

Does local participation enhance the conservation of protected areas? A comparative study in southeastern Mexico.

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The effectiveness of public, community, and private models of protected areas as biological conservation strategies is under debate at the international level. In Mexico, conservation strategies and policy have mainly focused on biological and ecological problems and have not adequately included local populations in decision-making and management within protected areas and surrounding buffer zones. However, in southeast Mexico, indigenous communities own and have access to the vast majority of forest land regarded as biodiversity hotspots. Some of these communities are currently undertaking conservation initiatives through protection of forests for environmental services, ecotourism or forest management, bringing to question the role of local participation in conservation. The international research project Conservcom aims at analyzing different types of local community participation in

decision-making regarding conservation. The goal is to identify and understand the effects of different management strategies for protected areas. The project is conducted in six rural communities that manage or live within or around protected areas in southeastern Mexico: Sian Ka'an and Calakmul Biosphere Reserves in Quintana Roo and Campeche, respectively, a Community Conservation Area in La Chinantla, Oaxaca, and an area for payment for Environmental Services in Veracruz. Specifically, we provide the analytical basis for evaluating 1) types and levels of local participation in decision making and management of protected areas, 2) spatially explicit landscape and natural resource use and land use/land cover change, 3) vital capitals assessment (human, natural, physical, financial, and social) by using indicators such as educational level, foreign investment, membership in local networks, institutional support and type of land tenure, and 4) local knowledge, perceptions, and values about biodiversity and protection strategies. We expect to identify the opportunities and risks for biodiversity conservation for various strategies that differ in the type and degree of local participation in the decision-making and management processes, as a contribution to national policy making and current international debate regarding the relevance of public, community, and private models of protected areas. We discuss the advantages and difficulties of using an interdisciplinary methodology and an inter-institutional framework for developing effective methods, analyzing valid data, and arriving to useful conclusions.

Agrobiodiversidad, autosubsistencia y especialización: lecciones aprendidas de la producción de café

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De acuerdo a la teoría del metabolismo social, hoy existen en el mundo dos modos radicalmente diferentes de apropiación de los recursos y servicios de la naturaleza: el metabolismo orgánico, agrario o campesino, y el agroindustrial. El primero surge a partir de la revolución neolítica (hace unos 10,000 años), utiliza solamente energía solar y está basado en una estrategia de uso múltiple. El segundo surge como consecuencia de la revolución industrial, tiene una antigüedad de algo más de un siglo, está basado en el uso de combustibles fósiles y lleva como rasgo principal la especialización productiva. El mundo de hoy es un complejo mosaico de situaciones entre estos dos prototipos, que es el resultado del encuentro de estos dos metabolismos: uno "tradicional" que resiste transformarse, y el otro "moderno", que amenaza con transformar. En su primera parte, la ponencia se dedica a explicar brevemente los procesos anteriores. Por el contrario, la segunda parte se dedica a ilustrar los supuestos teóricos mediante la revisión de los sistemas de producción de café a nivel mundial, en Latinoamérica y en México. La ponencia termina analizando con detalle un estudio de caso paradigmático de la Sierra

Norte de Puebla, haciendo énfasis en la agrobiodiversidad, la autosuficiencia alimentaria y el empoderamiento local.

The wild forms of chile pepper (*Capsicum* spp) of Mexico: domestication, uses, distribution and opportunities for conservation

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The study of wild forms of crop species in their Centers of Origin is essential to understand their evolution, domestication, utilization and conservation. This talk is focused on the origin, domestication and use of chile peppers (*Capsicum* spp) in Mexico and other countries. Advances on the study of wild forms of *Capsicum* from Mexico are presented, with emphasis on their distribution, diversity, utilization and conservation. We also inform about the largest and unique seed collection of wild *Capsicum* in addition to a Geographic Information System (GIS) developed to study the wild chiles of Mexico. The collection is the result of a collaborative Project between Universidad Autónoma de Aguascalientes (UAA) and University of California Davis, with funding from UC-Mexus, Garcia-Robles Fulbright and UAA. To date, more than 400 accessions of wild *Capsicum* have been collected in different ecoregions from 13 Mexican states. The wild *Capsicum* collection holds a great biological

richness, with excellent potential for ethnobotanical, ecogeographic, and ecophysiological studies, as well as for crop improvement. The analysis with 17 molecular markers (microsatellites/SSR's) suggest the existence of three well differentiated groups of wild *Capsicum* accessions according to their genetic similarities. Each genetic group corresponds well to its specific area of origin or ecoregion (NW deserts, Pacific coast and Queretaro; NE lowlands and N Gulf of Mexico; Gulf of Mexico's tropical dry lowlands, and SE region). Collection sites—between 0 and 2000 masl, combined with literature reported sites were used to develop a GIS in order to study the wild chiles of Mexico. This wild *Capsicum* GIS has been used, among other things, for bioclimatic analysis and ecoregion's identification and/or characterization, and for the detection of areas in Mexico with high probability of gene flow between wild and domesticated forms of *Capsicum*.

El café cultivado bajo la sombra de los árboles, un recurso de gran valor para la biodiversidad de México

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Se presenta la importancia de la cafecultura en la conservación de la biodiversidad, el bienestar social y cultural de la población rural de México. Se analizan las lecciones del proyecto Biocafé (2003-

2008) se describen los sistemas múltiples de producción, los servicios ambientales y las luchas sociales de los productores. El trabajo sugiere la estrategia de investigación participativa para incidir en la conservación de los bosques de niebla, la producción de café de bajo impacto ambiental, las alternativas de desarrollo local y el consumo responsable. En Veracruz queda un 8 por ciento de la vegetación natural, por ello es fundamental estudiar los bosques de niebla, en Biocafé se registraron en los cafetales y los fragmentos de bosque 2,197 especies pertenecientes a 190 familias, 42 órdenes, y 7 clases. El 84 por ciento de la especies de los bosques de niebla aún permanecen en los cafetales, principalmente en las fincas rústicas. Es urgente el pago por servicios ambientales para los productores de café por su aportación de suelo fértil, agua, estabilidad climática, biodiversidad, secuestro de carbono, y producción múltiple, sin el reconocimiento económico, las fincas de café se reducirán y con ello, el aislamiento de los pocos fragmentos de bosque de niebla. En México las luchas campesinas continúan siendo por la tierra, el apoyo a la producción y el precio justo de sus productos. Las políticas públicas no han sido eficientes para estabilizar la producción, el mercado internacional aprovecha la inestabilidad del precio para castigar el grano mexicano. Es necesario un acuerdo para el apoyo a la cafecultura, así como, la participación solidaria de los consumidores, de lo contrario -productores y consumidores- viviremos una grave crisis ecológica y dejaremos de tomar café de calidad.

An alternative environmental history of the Maya forest

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What is the role of humans in the development of Maya forest? Is the transformation of this ecosystem from the earliest times to the present related to human activities? By reevaluating the current paleoenvironmental, ethnobiological, and archaeological data an alternative view of the origins of the Maya forest emerges. Humans were in the New World form 12,000 years ago, a dry and cold period. By the Archaic period 8,000–4,000 years ago, climatic conditions were warm and wet. This would have been the time that the ancestral Maya established an intimate relationship with an expanding tropical forest, modifying the landscape to meet their subsistence needs. The succeeding period of climatic chaos during the Preclassic period, 4,000–1,750 years ago, provoked the adaptation to settled agrarian life. This new adaptation was based on a resource management strategy that grew out of early landscape modification practices. Eventually, this resulted in a highly managed landscape, the Maya Forest Garden and Milpa cycle. This highly productive and sustainable system of resource management formed the foundation for the development of the Maya civilization, from 3,000 to 1,000 years ago, and was intensified during the latter millennia of a stable climatic regime as

population grew and the civilization developed. These strategies of living in the forest evolved into the milpa cycle—the axis of the Maya Forest garden system that created the extraordinary economic value recognized in the Maya Forest today.

Development of strategies for *in situ* conservation of agrobiodiversity in Yucatan

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Traditional cultures have selected, produced and conserved agricultural diversity while managing their natural resources. The result of these practices is agrobiodiversity, the sum of agricultural diversity and its associated knowledge. This knowledge has been a factor of survival for ancient societies in the Maya area. Nowadays human activities are threatening this diversity. Different strategies have been developed trying to maintain biodiversity but little has been done for *in situ* conservation of agrobiodiversity. We present a project which includes five communities working in the development of strategies for conservation *in situ* of agrobiodiversity. Activities being conducted are

the diagnosis of diversity, capacity building and an outreach program to maintain society informed. Some important factors needed for the success of this project are: participatory planning and evaluation, commitment of actors involved, institutional support and collaboration. A quality system to evaluate Agroforestry Systems for Conservation will be developed between local producers and academia. Two strategies that are already working are: the selection of local systems that are maintaining high diversity of trees, crops and animals and the establishment of community homegardens in the junior high school with selected species. Results from the participatory planning and the outreach program are presented.

Amazonian anthropogenic landscapes: the view from the 'New Ecologies'

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Historical, symbolic and political ecology offer complementary and inter-related perspectives for better understanding the complexity, multidimensionality and fluidity of human-environment relations. The value of this approach is examined with reference to a case-study among the Sonene Eje Eja, a small group of pre-Andean Amazonian peoples whose relationships with the riverine landscapes of the Heath (Sonene) river (Peru-

Bolivia) have overlapping material (ecological), symbolic and political dimensions. I suggest that the hermeneutic value of the concept of 'anthropogenic landscape' rests precisely in its ability to demonstrate the interplay between the material and the symbolic, revealing the workings of ecology, history and power in the making of place and self. Understanding Amazonian environments as historical, political and symbolic artifacts in turn provides us with new ways of thinking about the future of a humanized Amazonia.

Diversity of the Mexican maize agroecosystem and transgenic maize

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Broad gradients of relief, climate, soil and biota interact in short geographical distances in Mexico, resulting in multiple discrete and very different ecological niches. Many of these niches have been settled by 62 ethnic groups that have used the natural resources of the ecosystem for subsistence, and have domesticated a number of crops. Maize, their main food crop, was introduced to most human settlements by harnessing the natural diversity of the species (including teosinte, maize's most likely ancestor) and developing 59 or more maize landraces with vast intraracial diversity. Some landraces are adapted to high elevations, some tolerate or escape

severe drought, and some thrive in hyperacidic soils or hyperalkaline soils. Some have a large geographic domain, some are very early. Some are specific for special preparations like tlayuda-tortilla or totopo in Oaxaca, for drinks, pinole, etc. The 62 ethnic groups have developed more than 600 food preparations from mostly nixtamalized maize, plus more than 300 types of tamales. Maize is central to food security but also critical to cultural diversity. The Mexican maize agroecosystem covers over 8.5 million hectares, in which one or more native landrace will adapt to any extreme condition. At present, 75 percent of the maize agroecosystem is planted with native landraces; the rest is the domain of modern, introduced varieties. Mexico has a growing dependency on the regional grain market, currently equal to 32 percent apparent consumption. This most unwanted condition explains the proclivity of the Mexican government to seek commercial planting of transgenic maize in the maize agroecosystem. By following such erroneous route to self sufficiency, the critical value of biodiversity of maize is ignored. The consequences of conducting a mega experiment with transgenic maize on native landraces are analyzed.

SPECIAL SYMPOSIUM

Plant domestication as an ongoing process: Implications and applications for conservation and resilience

**David E. Williams and
Marleni Ramirez (Conveners)**

Bioversity International, Rome, Italy and Cali, Colombia

Through a series of case studies, this symposium aims to highlight the ancient, dynamic and ongoing processes of plant domestication, and how they continue to give rise to novel crop varieties and farming practices. For the purposes of the symposium, the concept of domestication is considered in the broad sense, to encompass a variety of disciplinary approaches that can shed light on the potential applications of those processes to enhance the contemporary management of agrobiodiversity. The factors contributing to the domestication and diversification of crop plants will be examined through the analysis of archaeological, agromorphological, ethnohistorical, ethnographic and genetic evidence. The presentations will address crop diversity at the genepool level, including domesticates, their local varieties and closely related wild and weedy species. Case studies from Latin America will provide insights on the role of culture, inter- and intra-continental diffusion, introgressive hybridization, extreme weather events and mutation on the adoption, re-adaptation and

diversification of crop species through local selection practices. Moreover, the guest speakers will illustrate how a better understanding of these farmer-driven processes can be incorporated into more effective strategies for the conservation and use of genetic resources, and provide contemporary farmers, breeders and consumers with increased options for responding to social, economic and climatic change. Following the symposium presentations, a roundtable discussion will be held to identify and prioritize some key research gaps, and recommend approaches that help maintain farmers' involvement as a viable and effective evolutionary force for our crops, and enhance the on-farm conservation of crop diversity. These approaches can also be usefully applied by scientists, development agencies and policy-makers to improve the livelihoods, nutrition, and food security of rural farming communities. Building upon the public awareness opportunities associated with the 2010 International Year of Biodiversity, the symposium will serve to highlight the importance of on-farm management of agricultural biodiversity and its fundamental role in securing the future wellbeing of humankind.

The cultural aspects of early crop adoption in western South America

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The discussion about the origins of agriculture has broadened in perspective over the past ten years. New data and syntheses of neotropical agriculture are helping direct our discussions about timing, place, as well as on the reasons for the initiation of farming both of local crops as well as species acquired through trade. Historical ecology has helped reorient approaches to a more anthropocentric view of long-term human plant interactions. In a recent volume, Piperno and Pearsall conclude that before 2000 BC plant transmission was largely 'cultural' in Central and South America. After that date, issues of population pressure, food requirements and yield came into operation. We therefore should ask why did crop plants move and become part of the subsistence base in these neotropical environments before 2000 BC? This presentation proposes that in western South America the crops that were adopted early on had special meanings and identities due to their associations with places, events, and family histories, especially for women. Crop plants that were brought into communities also became part of the groups' cosmologies, cultural meanings and identity constructions as well as restructuring their diets and annual work cycles. Tracking the presence of individual crops through time across western South America can give us clues to the past cultural dynamics, engagement and decisions that were taking place. In specific I will focus on the issue of the adoption and maintenance of crops with special reference to beans on the coast and tubers in the highlands of western South America, the home land for some but not all of these important crops.

Estudios sobre la domesticación de chiles en México

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El estudio de los procesos que conllevan a la domesticación de plantas es una disciplina híbrida que abarca métodos tanto de las ciencias naturales como de las sociales. Sin embargo, el frenesí actual por la biotecnología ha hecho que muchos estudios recientes se basen solamente en el análisis de datos moleculares, haciendo inferencias sobre el origen de un cultivo, mientras ignoran el contexto cultural en que las poblaciones silvestres fueron manejadas por seres humanos responsables por los cambios genéticos de interés. En el presente estudio, se analizan las complejas conexiones entre datos generados por las ciencias sociales y naturales para entender el dinámico proceso de domesticación de los chiles en Mesoamérica. La hipótesis que hoy día en México podemos observar poblaciones de chiles silvestres que fueron manejadas en el pasado, y que siguen siendo manejadas actualmente por poblaciones humanas. A pesar de ello, podemos utilizar a los chiles silvestres como el pariente más cercano (o su "proxy") para analizar, mediante técnicas moleculares, la diversidad genética de estas poblaciones silvestres y compararlas con poblaciones de chiles domesticados. Se presentarán datos moleculares, incluyendo secuencias de ADN extraídas de 80 muestras individuales de chiles

silvestres y domesticados provenientes de diez estados, y microsatélites de poblaciones silvestres y cultivadas, para analizar los patrones observados y sus posibles interpretaciones desde las perspectivas de la botánica sistemática y la genética de poblaciones. También se presentarán datos etnográficos de los Zapotecos de los Valles Centrales de Oaxaca, y de los Náhuatl de la huasteca veracruzana, que mostrarán la gama de factores culturales que influyen en el manejo de las poblaciones silvestres y domesticadas de chile en estas comunidades tradicionales. Luego, se integrarán los diversos tipos de datos obtenidos para dar una perspectiva global sobre la domesticación de chiles en México. Valiéndose de estos conocimientos, se están implementando un proyecto de desarrollo para el cultivo y comercialización del chile 'pocle' por las comunidades Náhuatl, Tepehua, Otomí y mestiza en el municipio de Zontecomatlán, Veracruz, para darle un valor agregado a la producción tradicional del chile chipotle de esta zona, uno de los municipios de alta marginalidad del país.

Landscapes of maize in Mexico: Farmer mediated crop evolution and *in situ* conservation of genetic resources

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Crop landrace diversity and its *in situ* conservation is a by-product of farmers' participation in, and control over, crop evolution. Currently, commercial seed of maize is planted in not more than one-fourth of Mexico's eight million hectares; the rest is farmer saved seed that include traditional landraces, but also creolized commercial cultivars. As we experience climate change, one question of great interest to conservationist and farmers alike is: to what degree will landraces be able to respond to climate change? We know that Mexican maize landraces experience evolutionary forces, such as gene flow, hybridization, selection, mutation, and genetic drift. And multiple factors organize both neutral and adaptive genetic diversity. Lowland versus highland landraces are differentially affected by intro-gression from, and displacement by, improved varieties. A greater diversity of maize races is found in the south of Mexico compared to the north, due, in part, to the greater number of indigenous populations in the south. Studies employing neutral molecular markers indicate that genetic diversity seems to be higher within populations than between populations, with an excess of homozygotes. Nevertheless, despite weak neutral population structure, landrace populations have been shown to vary in performance and adaptive traits under field conditions, suggesting that some adaptive markers should be strongly correlated. To better understand how this diversity will respond to climate change, we need to strengthen two foci of future

research. First, we need more studies of adaptive traits under a range of environmental conditions, as well as of the molecular variation that controls these traits (QTLs, candidate genes). Second, we must explore the actual processes governing farmer mediated crop evolution. Our understanding of these issues will help us determine how landraces will contend with climate change. Globally, farmers' involvement in crop evolution has declined in the last century, with scientists becoming the main driving force. Nonetheless, remaining landraces conserved *in situ* are the product of past and contemporary patterns of natural and farmer mediated selection and gene flow, with scant involvement of scientists. We should strive to maintain farmers' involvement in crop evolution as a viable and effective evolutionary force for our crops.

Extreme climatic events and seed flows: Effects of a hurricane on agricultural biodiversity and crop evolution in central Yucatan, Mexico

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The immediate economic and environmental after-effects of drought, hurricanes, floods and other extreme climatic events are chronicled intensively by media sources, but few researchers have examined how natural disasters affect do-

mestication processes and shape the evolution of crop gene pools as traditional farmers respond to and recover from disasters. I present a case study of the effects on crop diversity of a category III hurricane that struck central Yucatan state, Mexico, in September 2002. A major land use in this region is small-scale maize farming (milpa) by Mayan households utilizing primarily landraces rather than improved varieties. Central Yucatan milpa farmers suffered major harvest losses of maize, bean, and squash crops, and in many cases total losses of seed stocks necessary for replanting. Harvest and seed stock losses varied significantly between maize, beans, and squash and, within each crop, by variety as well. Time to maturation emerged as the most salient varietal characteristic influencing the post-hurricane retention or loss of seed stocks, with precocious bean and squash landraces and intermediate maize landraces faring best. Farmers primarily sought to recuperate their own maize varieties on-farm (often with greatly reduced population sizes), while looking off-farm (in many cases outside the community) to recover bean and squash populations. In general, the hurricane appeared to alter maize, bean, and squash seed flows in ways that made them more genetically open systems. Immediate post-hurricane interventions by the Yucatan state government were unable to provide sufficient seed supplies for replanting, leading most farm households to rely on traditional social coping mechanisms for securing seed stocks. This study from Yucatan suggests that disaster relief programs should emphasize supporting farmers'

traditional seed exchange networks (both locally and regionally) for provisioning seed stocks, with this approach being the most likely to support the maintenance and continued evolution of diverse crop gene pools.

Ongoing evolution of the potato in its Andean center of origin: Exploring the evidence

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Germplasm enhancement and crop improvement by breeders and on-farm genetic resource management by farmers are arguably the main contemporary drivers of ongoing crop evolution. This paper will focus on the latter phenomenon which, as well as supporting local food systems, providing eco-system resilience in the face of environmental change and offering a 'back-up' for *ex situ* collections, is one of the cornerstones of contemporary *in situ* conservation of crop diversity. The potato is a clonally multiplied crop, but can sexually reproduce through botanical seed. Even though high levels of landrace diversity can hardly be explained without the historically conscious use of sexual seed, there are very few reports of its use as a traditional practice among potato farmers. 'Spontaneous' introgression and incorporation of hybrid seed tubers into a farmer-

managed cultivar pool may represent another hypothetical, yet little-documented, pathway. The exposure of the potato to high levels of UV radiation in its native mountain environment, or the use of pesticides, may hypothetically result in mutations and the creation of novel genetic diversity. So-called 'sports' (near-identical potato cultivars with a different skin color) may be the result of mutations or chimera. Social factors also influence the management by farmers of high levels of intraspecific diversity. Food preferences and other cultural habits, farmer experimentation and curiosity to incorporate new genotypes, tuber seed selection and exchange practices, and the spatial management of numerous scattered fields along an altitudinal gradient and in close proximity to crop wild relatives are among the numerous anthropogenic factors influencing species and cultivar compositions at the household level. Furthermore, biotic and abiotic stress, in combination with changing market demand, influence the temporal abundance of genotypes and thereby the relative likelihood of these being involved in evolutionary change. Drawing on a literature review, this presentation compares potato genetic diversity and integrity over a 30-year timeframe in Huancavelica, Peru, explores the semi-wild *Araq* group as an intermediate domesticate, examines rates of natural hybridization and establishment of cultivated and wild species, and incorporates information from the breeding program of the International Potato Center (CIP) about the crossability of species in the sect. *Petota*.

The role of crop diversity for food security in a changing climate: lessons from early and present-day farmers of Ethiopia

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Biodiversity International, Maccaresse, Rome, Italy³

Ethiopian farmers domesticated a diversity of indigenous crops, such as the oil-seed crop Noug (*Guizotia abyssinica*) and the cereal T'ef (*Eragrostis tef*). Both have much smaller seeds than closely related oilseeds and cereals that were domesticated elsewhere. We hypothesize that early Ethiopian farmers prioritized reliable production of seeds under low tillage and periodically untended environments over an increase in seed size, likely resulting in increased selection for more branching and higher percentage seed set, but not larger seeds. This might have facilitated consistent production of seeds even under challenging environmental conditions, a characteristic that is likely to be increasingly valuable as farmers and breeders confront climate change. Indigenous crops generally harbor high levels of intra-specific diversity, are well adapted to local conditions and often show remarkable resilience to environmental change. Furthermore, such crops

often possess unique characteristics that are in demand on the global marketplace - T'ef is sought-after as a basis for gluten-free foods and Noug has become a popular birdseed on North-American markets. We argue that strategies that aim to increase food security in Ethiopia through the introduction of high yielding exotics should be complemented by efforts to improve locally important indigenous crops. Although the breeding infrastructure for such species is often severely underdeveloped, breeding can be facilitated by linkages to closely related major crops - such as sunflower in the case of Noug. Strategies that aim to increase diversity in agricultural production systems have many benefits including the maintenance of cultural practices and traditional knowledge, balanced nutrition, increased resilience to climate extremes, and exploitation of a broader array of environments for food production. It is agronomically, ecologically, nutritionally as well as economically risky and unsustainable to rely almost exclusively on a handful of major crops to provide food for the world's nearly 7 billion people. Diversification is not only a sound strategy employed repeatedly by nature and championed by many economists, but it also has the potential to provide the necessary resilience that our food systems, particularly in the developing world, so desperately need.

Farmer choices and environmental adaptation of *Phaseolus* species in Oaxaca, Mexico

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In this era of increasing concern over human population growth, climate change, and increased resource scarcity, it is becoming ever more important to conserve crop genetic resources. For *in situ* conservation, it is crucial to understand the ways that farmers perceive and manage diversity. The smallholder farmers of highland Oaxaca regularly interplant a great diversity of bean landraces of three species: common bean (*P. vulgaris*), runner bean (*P. coccineus*), and year bean [*P. dumosus* (= *P. polyanthus*)]. In this study, we tested the hypothesis that the presence of these three bean species is a risk-mitigating strategy on the part of the farmers by conducting interviews and making germplasm collections from fields in the village of Santa María Jaltianguis in the Sierra Juárez of Oaxaca. Collections of *Phaseolus* landraces were made in ten distinctly managed fields during December, 2008. The amount of genetic diversity and the actual genetic relationships present in the 287 samples collected from the farmers' fields were then assessed at ten nuclear microsatellite loci well distributed over the entire *Phaseolus* genome

and at three polymorphic chloroplast microsatellites (cpSSRs). Three genetically distinct populations were identified within the germplasm collections from Santa Maria Jaltianguis using STRUCTURE, principal coordinate analysis, and neighbor joining tree construction. Based on pod and seed characteristics, the first two populations were identified as *P. vulgaris* eco-geographic races Mesoamerica and Jalisco and the third population was comprised of samples of *P. coccineus* and *P. dumosus*. Each of the fields represented in the collections was comprised primarily of a single *Phaseolus* species or eco-geographic race. Race Mesoamerica beans, which were grown in monoculture and were intended for sale in the market, were managed in isolation from the Race Jalisco beans, which were grown in polyculture with maize and squash for home consumption. These results indicate that farmers are able to perceive real genetic differences between their seeds and adapt their field management strategies accordingly.

El cultivo de las chías (*Chenopodium berlandieri* *ssp. nutalliae* y *Amaranthus* *hypochondriacus*) en Opopeo, Michoacán.

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Juan Manuel García Andrade²**

Jardín Botánico. Instituto de Biología. Universidad
Autónoma de México.¹ Departamento de Biología.
Instituto Nacional de Investigaciones Nucleares.²

La comunidad de Opopeo se encuentra localizada en el estado de Michoacán, México. Las chías se siembran tanto en terrenos planos como en "mogote". Este último sistema de lleva a cabo en los pedregales o malpaíses los cuales son de origen volcánico. En estos lugares se siembran multicultivos que incluyen tres diferentes clases de chías, maíz y chilacayote. Objetivos: Se estudio la importancia actual de los pseudocereales presentes en la comunidad y se trato de entender las posibles causas, desde el punto de vista del agricultor, de la casi desaparición de estos cultivos. Métodos: Se registraron todas las prácticas agrícolas involucradas en el cultivo, se hicieron colectas botánicas y de semilla, se aplicaron 30 entrevistas semiestructuradas a agricultores. Resultados: El cultivo de las chías se ha visto reducido en los últimos años en la región de estudio y actualmente Opopeo es la comunidad que sigue conservando estos recursos. las prácticas agrícolas involucradas en los pedregales muestran un gran conocimiento por parte de los agricultores especializados en estas áreas. Conclusiones: Las respuestas dadas por los agricultores ante la pregunta de porqué ya no se siembran los mogotes fueron múltiples y de una gran complejidad. En la erosión genética de estos cultivos intervienen factores históricos y sociopolíticos que influyen fuertemente en la toma de decisiones del agricultor.

Ongoing evolution of oca under human influence – Implications for conservation

Eve Emshwiller

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In vegetatively-propagated crops, humans affect crop evolution as primary agents of micro-evolutionary factors such as selection and dispersal (gene-flow). Agricultural practices even affect the extent to which sexual reproduction and recombination of alleles occur. People act as dispersal agents for crops through networks for the exchange of planting material, sometimes called "seed flows," whereby farmers may potentially distribute clones of the crop long distances. Ongoing research on clonal distributions of the Andean tuber crop "oca," *Oxalis tuberosa* Molina, provides a model for understanding how clonal distributions in traditional agriculture are patterned by farmers' social networks and other factors. Samples of cultivated oca were collected from dispersed localities throughout the Peruvian Andes, in collaboration with the International Potato Center (CIP) and the Peruvian National Institute for Agricultural Innovation (INIA). Data from morphology and DNA fingerprints (AFLP) were used to distinguish clones of the crop, assess the structure of distributions of clonal genotypes, and test hypotheses about factors that pattern those distributions, i.e., by assessing where there are areas of more or less "seed flow." Results revealed that many clonal varieties of oca have very restricted distributions, having been collected from areas encompassing only 2 to 4 of the localities sampled. Both in-situ and ex-situ conservation efforts need to consider the narrow distributions of these varieties. Despite the lack of previous baseline data, our observations also suggest that cultivation of oca is rapidly decreasing in many areas, leading to increasing concern about the loss of diversity in this crop.

Workshops

Cultural workshop: Traditional sauce preparation

Meeting participants:

\$25 USD*

\$20 USD**

External and national meeting participants (Mexico):

\$150 pesos*

\$120 pesos**

*This fees include a molcajete, which is a the traditional Mexican version of the mortar and pestle tool and the ingredients for the sauce preparation.

**This fees only include the ingredients for the sauce preparation.

Date and time: 10:15-12:30 hrs,
Thursday 10th of June

Number of participants: Min. 10

Description: Traditional sauce preparation has been conserved due to the fact that chili peppers are a cultural, magical, religious and nutritional element in the native cultures of Mexico. Women representing three cultures of Mesoamerica will guide us through a journey of flavors and teach us how to prepare traditional

sauces. A brief description of the chili peppers' history will be offered and a recipe book with the sauce recipes in Spanish, English, Nahuatl, Zapoteco and Mayan will be provided. Come and interact with the people that have maintained such an important cultural legacy in a relaxed and unique atmosphere!

Language: Spanish with English translation

Place: Hotel Crowne Plaza, Xalapa

Schedule: 10:15–10:30 hrs.

Presentation of the women and their cultures.

10:30–10:45 hrs.

Brief description of the chili peppers that will be used.

10:45–11:15 hrs.

Sauce preparation.

11:15–12:30 hrs.

Questions and experience sharing.

Contact information:

Mayra Villar Buzo and Esli Suárez Zurita

Tel: 842 17 00 Ext. 12644 and 12649

E-mail: villarmayra@yahoo.com

and esliszurita@gmail.com

Workshop: Teaching strategies to promote active learning in ethnobotany

SEB Student Committee and the
Open Science Network

Free of charge

Date and time: 15:45-18:15 hrs,
Tuesday 8th of June

Description: This workshop will present various views of education within ethnobotany. Theme areas will include new tools used in teaching, use of multimedia, information systems, teaching strategies and more.

Language: English

Place: Hotel Crowne Plaza, Xalapa

Contact information:

Laura Weiss

E-mail: weissl@hawaii.edu

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Universidad Veracruzana



Centro de Investigaciones Tropicales
Universidad Veracruzana

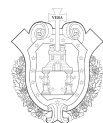


Universidad Veracruzana
Dirección General del Área Académica
de Ciencias Biológicas Agropecuarias



INSTITUTO DE
ECOLOGIA, A.C.

Chile, Biodiversity & Culture Event



VERACRUZ
GOBIERNO DEL ESTADO



FUNPROVER

Host Institutions

The SEB's 2010 Annual meeting to be held in Xalapa, Veracruz will be co-sponsored by two hallmark research institutions in the state of Veracruz with national and international recognition. Both institutions have major strengths in botanical, ecological, natural resource management and biodiversity research with significant roles in the promotion of conservation and sustainable development in Mexico. In addition, Bioversity International will sponsor and provide support in organizing the Special Symposium.

Centro de Investigaciones Tropicales (CITRO), Universidad Veracruzana

Contact Information

Casco de la ex hacienda Lucas Martín, Privada de Araucarias s/n, Col. Periodistas. C.P. 91019, Xalapa, Veracruz, México.

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<http://www.citrouv.edu.mx/>

<http://www.uv.mx/citro/intro.html>

The main mission of CITRO is to integrate research on natural resources and human-environment relationships. Since its creation, CITRO has focused on establishing a new academic paradigm, becoming an interdisciplinary institution involved in scientific research, technology development, environmental education and extension, with the objective of improving environmental, social and economic conditions of communities in the Mexican tropics. CITRO began its operations in 2003 as a result of a cooperative agreement between the Universidad Veracruzana (UV)

and the University of California, Riverside (UCR) and was formally constituted in 2004 as a major strategic project for UV. In its five years since establishment, CITRO has made major research and development contributions in subjects ranging from ethnobotanical and botanical studies, diversification of agricultural and coffee agroecosystems, alternative production systems, application of geomatics for natural resource conservation and management, environmental education, as well as studies on water resources and watershed management. In this period, CITRO has also developed a nationally recognized graduate program for the UV.

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<http://www.inecol.edu.mx>

INECOL is one of CONACYT, the Mexican Science and Technology National Council, federal research institutes. It is nationally and internationally recognized and has a trajectory of more than 30 years. Its mission is to produce scientific knowledge, develop technology, generate public opinion and prepare professionals on the subjects of ecology, biodiversity and natural resource management. The aim is to contribute to the conservation of the natural heritage

and to social and economic development. With more than a hundred researchers and a graduate program, research is conducted on a multitude of topics including several aspects that relates plants and peoples. The INECOL has also been involved in the organization of several national and international symposia and conferences.

Bioversity International

Contact information

Via dei Tre Denari, 472a 00057

Maccarese (Rome) Italy

Tel.: (39) 066118.1 - Fax: (39) 0661979661

<http://www.bioversityinternational.org>

Bioversity International, Bioversity for short, is the operating name of the International Plant Genetic Resources Institute (IPGRI) and the International Network for Improvement of Banana and Plantain (INIBAP). Bioversity is the world's largest international research organization dedicated solely to the conservation and use of agricultural biodiversity. It is non-profit and independently operated. Bioversity is committed to research that can help foster sustainable development; research that can help people living in poverty secure dignified and sustainable livelihoods through food and agricultural production, research that can help raise nutrition levels in areas where hunger is widespread, research that can help keep communities and the environment healthy. Our area of expertise is biodiversity, but it is benefiting people, especially the people of the developing world, that is at the centre of our work.

Notes

