UNIKASSEL VERSITÄT

Faculty of Organic Agricultural Sciences

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

Faculty of Agricultural Sciences
Faculty of Forestry Sciences

Mexico 2009 - Interdisciplinary Study Tour

Sustainable rural development in the light of globalisation

A study tour to Mexico
March 13th – March 28th 2009

Organised by:

German Institute for Tropical and Subtropical Agriculture - DITSL GmbH Witzenhausen

Centre for International Rural Development University of Kassel / Witzenhausen

Centre for Tropical and Subtropical Agriculture and Forestry (CeTSAF), Georg-August-University Göttingen

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Preface

Studies of organic agriculture at the University of Kassel in Witzenhausen and of agriculture and forestry at the University of Göttingen are - among other topics - concerned with tropical and subtropical areas. Both universities have built a wealth of expertise on tropical landuse systems and the sustainable management of natural resources. Many of the students interested herein will eventually conduct research in tropical countries - often in the frame of their M.Sc. or Ph.D. theses – and their academic curriculum must prepare them for the task. It is obvious that even the best lecture at a university located in a so called "developed" and temperate region cannot substitute hands-on experience while visiting the tropics. Therefore, field trips to tropical countries must be part of the curriculum. Unfortunately, such trips are costly and require long term planning and intricate knowledge of the region to be visited.

Since the year 2000, the Faculty of Organic Agricultural Sciences of the University of Kassel maintains continuous mutual student exchange activities with the Universidad Autónoma de Yucatan (UADY) in Merida. Prof. Bürkert has a longstanding research collaboration with the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), one of the 15 CGIAR Centres, and with the Universidad Autónoma Chapingo (UACh), a renowned agricultural university in Texcoco near Mexico City. Following a visit of students from UADY to Witzenhausen, Göttingen and Hohenheim in 2008, a trip of Witzenhausen and Göttingen students to Mexico was planned for 2009. Particularly through its varied geography, Mexico offers interesting examples for small to large scale tropical agriculture and for particular aspects of forestry. It shows the different development pathways that different parts of the sector can take within the overall development of the national economy, and, through the proximity to the USA and the NAFTA agreement offers insight into the effects of globalisation on landuse and the agricultural sector. Hence, a preliminary programme was drafted and the excursion and the accompanying seminar were announced in early 2008. After the participants were identified, a period of intensive preparation for the trip commenced. A seminar of 2 contact hours per week was held during winter semester 2008/09, where students presented different topics related to the forthcoming field trip. Funds were acquired, logistics were organised and in March 2009, 20 students and 4 lecturers set out for Mexico. Acquiring funds for such a trip is difficult and we are grateful for generous financial support by the German Academic Exchange Service DAAD, the University of Kassel through the International Academic Exchange Office and the Faculty of Organic Agricultural Sciences in Witzenhausen, the University of Göttingen through the Faculty of Agricultural Sciences, the Eiselen Foundation Ulm, the Universitätsbund Göttingen, the Freundeskreis Wilhelmshof e.V. in Witzenhausen, the Altner-Combecher Stiftung für Ökologie und Frieden, and the German Institute for Tropical and Subtropical Agriculture.

From March 13th until March 28th 2009 we followed through a very interesting and physically taxing schedule. Every aspect of the programme moved exceptionally smooth, which was facilitated through the excellent support received from our partners - to whom we express our sinbcere gratitude. We would also like to thank our colleagues from Witzenhausen and Göttingen for their great support in preparing this trip. Finally, all participating students deserve a big "Thank You". They worked hard to achieve the predetermined goals. But besides the work we also had a lot of fun together. It was a great opportunity to have had a chance to travel with all of you!

Andreas Bürkert
Achim Dohrenbusch
Christian Hülsebusch
Eva Schlecht

Introduction and itinerary

From March 13th to March 28th 2009, a group of 10 students from the University of Kassel (Witzenhausen) and 10 students from the University of Göttingen, accompanied by 4 lecturers went on a 2 weeks excursion entitled "Sustainable rural development in the light of globalisation" to Mexico. The group consisted of students at the BSc and MSc and Diploma level enrolled in study programmes on "Tropical and International Forestry" (Göttingen), "International Organic Agriculture" (Kassel), "Organic Agriculture" (Kassel), "International and Tropical Agriculture" (Göttingen), and "Forestry Science" (Göttingen). A detailed list of participants is provided on page 142. Having arrived in Mexico on March 13th, the group was joined by Mr. Angel Pita-Duque, a lecturer in agroecology at the Universidad Autonoma de Chapingo, who had shown much enthusiasm in making contacts and preparing and organising the trip in Mexico.

Figure 1: The excursion group at the Universidad Autonoma de Mexico UNAM

The first few excursion days were spent in and around Mexico City and Texcoco. The group met with students of agroecology of the Universidad Autonoma de Chapingo, who had organised a day trip to the "Chinampa floating garden systems" near Texcoco, which provided for both scientific and social exchange. The first days served the acclimatisation in and around Mexico City. Agricultural aspects such as urban dairying and periurban opuntia farming where part of the programme as well as cultural activities such as visits to the Virgen de Guadeloupe and to the Universidad Autonoma den Mexico. The group was set loose to explore Mexico City on their own using the modern and sophisticated Underground system. The excursion then went south into the dry Oaxaca region to visit agricultural systems and dryland reforestation projects. The way led on westward and past the world's largest tree "Arbol de Thule" went to uphill to San Cristobal de las Casas, where coffee farming, small scale agriculture and practical forestry where on the programme. From there, the group ventured down again into the tropical rainforest area with small scale farming and also the old Maya settlements of Palenque and Bonampak. From there, the path led towards the Yucatan peninsula with livestock operations of varied intensity, as well as integrated horticulture and fruiticulture systems.

Figure 2: Discussing Mexican student life and the ecology of Chinampa gardens with Chapingo students

A warm welcome was extended by the Universidad Autonoma de Yucatan in Merida, where they joined Mexican students and lecturers and were introduced to the research and training programme of UADY. The team split up in smaller groups and accompanied their Mexican counterparts on a guided tour around the university's campus and science facilities. UADY students the joined the team for a two day trip to the university's experimental station Hobonil Ranch further south on the peninsula. From Merida, the team went northwards along the coastline to Veracruz, where the aquaculture association of Veracruz had organised for a splendid programme on fish, crocodile and wildlife farming. From Veracruz, the way led via Puebla back to Texcoco where a visit of CIMMYT the Centro Internacional de Mejoramiento de Maíz y Trigo was on the agenda for the last excursion day. The itinerary is depicted in the following map and the excursion programme is detailed below.

Figure 3: The excursion itinerary

Excursion programme

Day	Activity	Overnight location
13.03 (Fr)	Evening: Arrival in Mexico City from Madrid with IB 6403 18:00 local time, transfer and check-in to guesthouse Posada Santa Bertha, Texcoco	Posada Santa Bertha, Texcoco (75 km)
14.03 (Sa)	Whole day: Mexico City, UNAM gate Iztapalapa: Tour of urban market, agriculture and dairy systems	Posada Santa Bertha, Texcoco (150 km)
15.03 (Su)	Morning: Texcoco: Universidad Autónoma Chapingo (UACh), meeting UACh resource persons, faculty staff and students, introduction to the programme; visit of library and laboratory facilities Afternoon: Mexico City: Visit to the Anthropological Museum in Mexico City, familiarisation with the agri-cultural heritage of Mexico: Aztec and Maya cultures Evening: "Virgen de Guadeloupe" (Catholic Centre of The Americas)	Posada Santa Bertha, Texcoco (150 km)
16.03 (Mo)	Whole day: Transfer to Oaxaca: Visit of a CIMMYT on farm research site	Oaxaca (guesthouse) (600 km)
17.03 (Tu)	Morning: From Oaxaca to Tuxtla Gutierrez Afternoon: Visit of an ecological coffee cooperative "FIECH - Federación Indígena Ecológica de Chiapas" with dry coffee processing „beneficio seco", transfer to San Cristobal de las Casas	Hotel Margarita San Cristobal (650 km)
18.03 (We)	Whole day: San Cristobal de las Casas: Visit of the coffee museum "Café Museo Café", visit of pine forests on the "Altos de Chiapas" & Mexican Synkretism in San Pedro de Chamula	Hotel Margarita San Cristobal (250 km)
19.03 (Th)	Whole day: From San Cristobal de las Casas to Palenque: Visit of an old Maya settlement site	Palenque (guesthouse) (200 km)
20.03 (Fr)	Whole day: From Palenque to Bonampak and back: Visit of Rainforest Systems	Palenque (guesthouse) (350 km)
21.03 (Sa)	Whole day: From Palenque to Merida. Check-In to Hotel, Excursion to Chichen Iza and visit of the Kukulcan Equinox festival	Merida, Hotel El Castellano (550 km)
22.03 (Su)	Whole day: Merida: Visit of organic agricultural cooperatives Sabileros Mayas Ecológicos and Naranjeros Mayas Ecológicos (Agroforestry systems, Aloe vera and citrus production); Visit of the Mayan Juice Factory in Oxkutzcab, transfer to to Tzucacab Hobonil	Hobonil Guesthouse (200 km)

23.03 (Mo)	Morning: Tzucacab: Visit of the ranch Hobonil of the veterinary and zootechnical faculty of UADY. Livestock experimental facilities, visits of small agroforestry farm systems Afternoon: Visit to Uxmal, tansfer to Merida	Merida, Hotel El Castellano (200 km)
24.03 (Tu)	Morning: Visit of the Veterinary and Zootechnical Faculty of UADY. Visit of an intensive pig raising unit, Visit of small and large scale livestock farms of different intensity, with beef production, sheep and swine farming and apiculture, transfer to Veracruz	Villas Dali ? Veracruz (800 km)
25.03 (We)	Morning: Veracruz: visit of small and semilarge scale aquaculture operations, Veracruz Aquarium and El Colibri Farm (tilapia, crocodile, deer and pheasant) Afternoon: Visit the Cempoala Archeological site	Villas Dali ? Veracruz (200 km)
26.03 (Th)	Whole Day: From Veracruz via Puebla to Texcoco: Remnants of Mexican Colonial Agriculture, Crop Residue Management	Posada Santa Bertha, Texcoco (75 km)
27.03 (Fr)	Morning: El Batan: Visit to CIMMYT, Introduction to CIMMYT's research agenda, visit to maize and wheat gene bank	Posada Santa Bertha, Texcoco (75 km)
28.03 (Sa)	Morning: Transfer to Mexico City Airport; Flight from Mexico City (IB 6400) at 11:55 via Madrid to Frankfurt	
29.03 (Su)	Noon: Arrival in Frankfurt	

(Total km travelled by bus: 5075, total overnight stays: 15)

Reporting during the excursion

Each student was assigned the task of taking notes and writing a protocol / report for at least one of the places visited, accounting the personal impressions gained and the major points of discussion raised. The following section of this document contains these individual reports in chronological order.

Mexico City, an agricultural space?

Arnd Zschocke

14.03.2009

After a long trip from Germany to Mexico the day before the group had enjoyed a good night's sleep and met at the bus in front of the hotel in Texcoco at 07:15. The Bus started into the busy traffic of commuters and soon was in the middle of street markets. Especially the open air meat and butcher shops we passed awoke the interest of the participants and gave a first impression on how food markets in Mexico work.

Urban dairy production

Our first destination was a dairy operation in the city. To get there we first had to meet up with our Mexican counterparts and leaders for that day. We met them and they led our bus to the dairy operation.

At around 09:00 we arrived:

- The "farm" exists since around 35 years and there are around 20 other similar operations in that area of the city.
- When we arrived 15 **Holstein Friesian** cows were standing in the feedlot and in the process of being milked by hand. The rest of the time they can move freely in the yard (around 400m²).
- Additionally there are around 10 Zebu cattle (Criollo) being fattened in a separate space for the meat market.
- **Farm outputs and inputs:**
  - Inputs:
    - The main feed for the cattle is organic wastes from the big wholesale market like cabbage leaves, ground bread etc. Which is balanced with alfalfa from Hidalgo province and some bough-in concentrate.
  - Outputs:
    - The manure is collected for free by farmers who spread it on Nopal (*Opuntia ficus-indica*) field which are a two hour drive away.
    - The urine is drained into the public sewage system
    - Calves are fattened and sold if they are not used to replace old milking cows
    - 11 cows are milked twice a day and give an average of 20 l of milk per day. After around 9 lactations the cows are replaced.
- **Marketing and Economics:**
  - The milk is marketed daily from the farm gate. Three resellers distribute it on motorbikes to private households in an radius of around 25km around the operation. Very few consumers also come to buy at farm gate.
  - The farm gate price is 4.5 pesos and the resale price is around 6 pesos.
  - The leftover milk is processed into fresh cheese.
  - This way the operation yields around 20,000 pesos (approx. 1000 €) a month.
  - 6 persons are working and 3 of them are full time.

- **Final thoughts**
  - The owner stated that his business had been bigger in the past, when his herd was double the size. He said that demand had decreased and prices had fallen, also because some more professional competitors who produce packaged and pasteurized milk have entered the market.
  - The general health of the cows did not appear to be very good and a lot of them had diarrhea. Also the hygienic standards of the milking (use of plastic buckets) and handling of the milk were quite low. A better management would improve quality but maybe also increase costs.

After around 30 min we left around 09:30h and drove to biggest wholesale market (Central de Abasto) for Mexico City.

Wholesale market

- The marked occupies around 320 ha and has different sections for the different products from meat, to fish to vegetables to fruit and others more.
- Most of the products are delivered and sold in the early morning or in the afternoon and big quantities are normally auctioned.
- We went through a small part of the vegetable section and were impressed by the logistical challenges that appear when feeding a 22 million city and how they are dealt with in Mexico City. Especially the waste management impressed when seeing the big mixed waste heaps and knowing that they would be cleaned and selected for further use (i.e. urban cattle) until the next day.
- After around half an hour of walking around the guards/police noticed our group and asked us for identification and then to leave the market.

We got back onto the bus and drove for a while to the outskirts of the city where we rested at the roadside at around 12:30 to get some food after the interesting morning. After an hour of lunchbreak we went to a Nopal field (*Opuntia ficus-indica*) which was the main crop, covering all the hillsides in that region.

Nopal production

For most of the group it was very interesting seeing this cactus being cultivated on such an extensive area.

Nopales (from the Nahuatl word nōpalli for the pads, or nostle, from the Nahuatl word nōchtli for the fruit) are a vegetable made from the young cladophyll (pad) segments of the prickly pear cactus, carefully peeled to remove the spines. Farmed nopales are most often of the species *Opuntia ficus-indica,* although the pads of almost all Opuntia species are edible.

Nopales are generally sold fresh, bottled, or canned, less often dried. They have a light, slightly tart flavor, and a crisp, mucilaginous texture. *(From Wikipedia the free encyclopedia)*

- The plant is propagated by planting half of a leave into fertile and manured soil in July and August.
- The plant is used for around 8 years until it becomes less productive and too woody.
- The leaves are harvested daily and thus constitute a steady income for the farmer.
- The plot we visited was cultivated by a wage laborer from the poor southern province of Oaxaca. Most of the Nopal plantations around Mexico city are owned by investors and real estate speculators.
- The soil was of volcanic origin and fertile but the limiting factor for production of

other crops is the low and seasonal rainfall coupled with the high temperatures and (potential) evapotranspiration.

- The plantations are heavily fertilized with manure.

Mexico City – Cultural Part

After around half an hour on the sunny Nopal plantation we boarded the bus back to Mexico City with the plan to visit the anthropological museum and afterwards the sanctuary of the Virgen de Guadalupe. Unfortunately because of the heavy traffic it was impossible for us to reach the museum on time and so we went to the *Universidad Nacional Autónoma de México* (**UNAM**) the famous public University which is UNESCO world heritage site and the place of important historic events for Mexico. The murals of Diego Rivera, covering whole buildings were very impressive.

After the walk through the university campus the group got some time to explore the City independently.

At 19:00h all met again in front of the Basilica of the Virgen de Guadalupe. This is a quite impressive modern religious building and the center of Mexican (some say even Latin American) Catholicism.

With this cultural experience and the sunset over Mexico City our first day of the excursion ended and was concluded by a 2 hour drive back to our hotel in Texcoco.

Visiting the Chinampas and getting in touch with students from the Chapingo Autonomous University

Philip Beckschäfer

15.03.2009

The day's program was organised by three students from the Universidad Autónoma Chapingo (UACh) in Texcoco. They had arranged a boats tour through the Chinampas of Xochimilco. During this trip not only the agricultural Chinampa system was discussed, but also the social and educational situation of the students was brought up.

For background information about the Chinampa system please consult the report "The Chinampas of the Valley of Mexico" by Jonas Hagman. It deals with important facts about what chinampas are, their history, biodiversity, productivity, and development.

To reach Xochimilco, the place where our boat trip started, we took the bus from Texcoco and passed the former area of Lake Texcoco. The lake was drained in 1967 by constructing the *Drenaje Profundo* ("Deep Drainage System"), a network of several hundred kilometers of tunnels, at a depth of 30 to 250 meters. Wind erosion is a great problem on the drained ground; it brings a lot of dust to the city of Texcoco which diminishes the life quality there.

In the area of the Ex-Lake-Texcoco, agriculture is practised. Greenhouses are built up to produce vegetables. The problem in this is that black waters from Mexico-City run to the region and are used for irrigation. This water is rich in nutrients and therefore preferably used by farmers, because it works like a fertilizer, and hence increases the productivity. But vegetables produced under these conditions are often contaminated by heavy metals. Other sources of heavy metals affecting agriculture are heavy industries (mainly galvanisation) and traffic. Before the use of unleaded fuel was obligatory, harmful substances dripped out of the cars and were then transported by the rain to the sewage and ended up in agricultural areas.

When we reached Xochimilco we hired two of the brightly colored, flat-bottomed boats called *Trajineras* to travel along the Chinampa canal system and have a closer look at this wetland area, representing a living example of an ingenious agricultural practice that was invented long time ago. Spending time here is popular for both visitors and residents. The canals of Xochimilco provide a festival-like atmosphere with the sound of mariachi bands filling the air. Smaller canoes with vendors sell everything from corn-on-the-cob to blankets and to chilled beverages. On Saturdays, a popular market also attracts large crowds. Figure 1 shows some typical scenes from the touristy view of the Chinampas.

During its bloom, the Chinampa system extended over 22,000 acres of wetlands and provided food for ten thousands of people. The canals were built to navigate the Chinampas and to provide a transportation corridor which brought products to the Aztec Empire. Today, the existing canals of Xochimilco represent only a fraction of their former acreage. A portion of the canals have been set aside, dedicated to an ecological park, the Parque Natural Xochimilco. This area of Mexico represents the only remaining habitat for the Axolotl salamander, a critically endangered species. Also, a great number of birds is living there, including herons, egrets and ducks, to name just a few. Altogether, Xochimilco is home to over 150 native birds with approximately 70 species visiting the canals during the winter season.

Figure 1: Touristy scenes from the Chinampas

To get in touch with one of the local farmers, Prof. Bürkert arranged a short visit on the property of the Chinampero **Mr. Ambrosio Garcia** (Fig. 2). Mr. Garcia reported that one of the main problems for agriculture on site is the unsteadiness of precipitation which makes it difficult to find the right time to seed. Other problems are labour capacity (Farmers give up cultivating the earth for established jobs in Mexico-City) and the construction of an urban instead of agricultural infrastructure. The uncontrollable urban spread of Mexico-City and the purchase of communal land for house building is an issue. Many irregular housing settlements are situated in the area and the drainage from these houses and greenhouses are discharged into the canals. The use of fertilizers and chemical pesticides affects water quality and water level is decreasing dramatically by almost ½ foot each year due the uncontrolled exploitation of the water resources form the subsoil. Invasion of exotic and ornamental plants from other regions of the country and other countries are contributing to the decrease of the Chinampas production (e.g. 80% of the Ahuejotes tree "*Ahuejote xochimilca*" have mistletoe).

Mr. Garcia produces mainly vegetables (pumpkin, cilantro, cactus, onion, radish, etc.). In former times he also produced fish, but since water quality is bad due to absent circulation and deposition of waste and faeces, he ceased doing this. To fertilise his fields he buys cow manure, which can't be produced by him on his land. His products are sold on the local market and to tourists.

Figure 2: Mr. Ambrosio Garcia (Chinampero)

On the neighbouring land use units farmers built greenhouses (Fig. 3) to provide not adapted plants with suitable conditions. Inside the greenhouses the application of pesticides is necessary, because the conditions for insects and pests are much better here then outside.

Figure 3: Production of ornamental flowers in greenhouses at the Chinampas

<u>Conversation with students from Universidad Autónoma Chapingo (UACh)</u>

The students who organized our boat trip through the Chinampas (Fig. 4) gave us an overview about the learning conditions and the history of the UACh.

The UACh was founded as the National School of Agriculture in 1854, in Mexico City. Following the Mexican Revolution, it was moved to its present location, a hacienda expropriated by the Revolution in the municipality of Texcoco, about an hour northeast of the City. In 1978, its name was changed to the UACh, and the university added the development of rural areas of Mexico to its functions of teaching, research and extension services.

The UACh has a preparatory school, which offers a high school, as well as technical agronomy courses to around 3,000 students. At the bachelor's level, UACh offers 22 programs in agronomy, forestry, environment, engineering, food processing, social sciences, and statistics to an additional 3,000 students. Advanced studies in many of these fields are provided through 13 Master of Science programs and 6 doctoral programs.

The University holds students from all states of Mexico, through an admission process carried out every year. This process not only gives admission but awards full scholarships to all students selected. Students are divided into three categories, depending on their socioeconomic status. However, no fees are charged to any national student. Additionally, the university offers rooms and facilities to accommodate students on campus. Currently the professors and workers are on strike asking for land to build their houses and a salary increase of 60 %. The strike started on the 19th of February and since then the University is closed.

Figure 4: Students from Autonomous University Chapingo, University of Kassel and University of Göttingen during the visit of the Chinampas

From Texcoco to Oaxaca

Fabian Cruz Uribe

16.03.2009

SUMMARY

During the transfer from Texcoco to Oaxaca, the excursion recognized 2 different production systems, the first near to Puebla, and the second in the vicinity of Acatlán de Osorio. The first one consisted of small plots cultivated with crops like maize, or covered with forages for animals like alfalfa. Nevertheless the urban pressure threats the agricultural system, localized on fertile soils but confronted with water scarcity. The second system localized around Acatlán de Osorio was developed with intensive poultry production systems, especially layers and broiler. Here the environmental conditions, especially the temperature between 25-30° C, the low humidity and the altitude (1.100 m a.l.s.) and the proximity to the markets have let to this development.

Finally the excursion visited the small settlement of La Unión-Reforma in the municipality of San Bartolo de Soyaltepec. There, the community has worked since 1996 in a project of reforestation, as a strategy to stop the erosion, and to give a legacy for the next generations. This project has involved the whole population, and with their own efforts, they have reforested successfully aprox. 60 ha using species such as *Pinus oaxacana*, *Quercus rubra*, *Juniperus communis,* or *Jacaranda sp*.

DESCRIPTION

On 16.03.09, the excursion traveled from Texcoco to Oaxaca, under the guidance of ALEJANDRO RAMIREZ Agronomic Engineer, M.Sc. Rural Development. Three main places were the objectives during this day:

- Agriculture systems in Puebla.
- Poultry production around Acatlán de Osorio – Puebla.
- The case of the settlement La Unión-Reforma in San Bartolo de Soyaltepec-Oaxaca.

The first place visited was near Puebla City, localized at 2200 m a.l.s. The soil has a very high fertility because of its volcanic origin. Nevertheless the scarcity of rainfall (in the majority of Puebla State) makes the producers in this zone use irrigation with treated waste water. Several parcels of land are cultivated with Maize, especially genetically improved varieties, and some of them with traditional varieties. We also observed some plots with alfalfa (*Medicago sativa*), and different species of grasses cut to feed livestock. The use of disk plow is common, and it can cause loss of soil humidity by the inversion of soil, but use of conservation plowing was not observed. The guide pointed to the small size of plots, probably due to the heritance scheme from one generation to the next, causing continued division of the areas. Also, the Engineer RAMIREZ said that the threats to agriculture in this zone are related to the urban growth, and the requirements of land for building.

The second place visited was around Acatlán de Osorio-Puebla. A very dry zone, characterized by cacti and vegetation adapted to arid conditions. The type of soils and the scarcity of water do not allow the agriculture development, but instead lead to the establishment of poultry farms. Taking advantage of the altitude (1100 m a.l.s) and the climatic conditions (high temperature and low humidity), the poultry farmers made a big investment in the infrastructure by intensive farms dedicated to layers, and broiler production, generating employment for the inhabitants of the region, and making use of a big market in México City and surrounded municipalities.

The last place visited was La Unión-Reforma in the municipality of San Bartolo de Soyaltepec, a small settlement of 81 persons, composed by 36 families, with 14 families formed by 1 person. The main economic activity of the village is the wheat tortilla, prepared during the week, and sold on local markets of towns like Nochixtlán at weekends. The other main income is related to the remittance of money from people who work outside, in the big cities of Mexico or even in USA.

Due to erosion and scarcity of water soils cannot be used for agricultural activities. Nevertheless, the community decided in 1996, to build a tree nursery with their resources, and to start a program of reforestation. Several tree species were tested, and the community decided to use *Pinus oaxacana*, a native species with low mortality during the establishment phase. Now, the community of La Unión-Reforma has reforested 60 ha, with a density between 1000 and 1500 trees/ha, and has protected 1300 ha of native forest, from 4700 ha of communal property of the municipality San Bartolo.

The decision of reforestation was adopted by the habitants of La Unión-Reforma as a contribution against climate change, and as legacy for the next generations. All decisions are usually taken in general assemblies, and their organization has improved the local conditions through access to electricity, potable water pumped from a well, and the construction of roads.

Every Monday the community is working in the communal projects, including the reforestation project. Usually the men make the dimples for the trees, and the women transplant them, and others (1 or 2) persons work in the tree nursery, in activities like to fill plastic bag, to sow on seed bed (almácigos), preparation of compost or transplantation. The littles plants are kept in the tree nursery for 7-8 months, the nursery's capacity is 3000 plants.

Presently the community is also sowing others native species, like Jacaranda (*Jacaranda sp.*), Red Encino (*Quercus rubra*), or Enebro (*Juniperus communis*). The reforestation has been sucesfull, and the high level of supervivency (>88%) is accompanied with an evident increase of soil organic matter, the regrowth of grasses, scrubs, and the return of fauna inside the forest. The project has been supported by the community, and received minimum support from the government, and some national and foreign institutions have supported technical or economically their initiative.

From Oaxaca to San Cristóbal de las Casas

Sandra González Monge

17.03.2009

We started the day very early in the morning and we visited the biggest tree in the world: "El árbol del Tule" (The Tule tree). This famous tree received its name due to the city in which it is, *Santa María del Tule* and is located approximately 13 km. east of the city of Oaxaca. Its scientific name is *Taxodium mucronatum*, but it is known in Mexico by its náhuatl name "Ahuehuete". The Tule tree has the stoutest trunk of any tree in the world, with a circumference around 40 meters. It is also a very old tree with around 1500 years of life and is related to popular local histories.

After this stop, we continued with our trip and we were step by step discovering the changes on the landscape, as well as the vegetation. At the beginning, in the neighborhoods of the city of Oaxaca, we observed a somewhat dry climate, because the rainy season is in summer. The vegetation was compound in its majority by cactus and throughout the way it went transforming into tropical flora as we were approached the Pacific Ocean. Likewise, the climatic conditions also changed, becoming the atmosphere more humid and warm. It is important to take in mind that 50% of the territory of the Oaxaca state is mountainous, because the crossing of the "Sierra Madre Oriental" and the "Sierra Madre del Sur". At the same time, Oaxaca state owns a considerable extension of coast, which allows Oaxaca to have an extensive variety of climates and vegetation throughout its territory.

In the following kilometers, we passed through "La Ventosa" (The windy), located in the Istmo of Tehuantepec. This zone is very well-known by the strong winds that the most of the time take place and blow here. Therefore, it is the propitious place for the development of the operation of the Aeolian energy. Recently, the first Aeolian plant integrated to the Latin American network was inaugurated here. It has an installed capacity of 84,875 MW and consists of 105 aero-generators.

Towards the end of the trip, we crossed a good part of the Chiapas state, where we could observe a warm and humid climate at the beginning and with rich vegetation in mangos and other tropical fruits. It was interesting to know that in spite of the great yellow mango production that this zone has, its consumption is mainly domestic. The reason of this is because this kind of mango is very sensible to the handling and it would not arrive abroad in well conditions for the sale.

Closely to San Cristóbal, in a temperate climate region called "Los Altos de Chiapas" (Chiapas Highlands) within the "Sierra Madre de Chiapas", we visited a cooperative of farmers dedicated to the cultivation of organic coffee. Finally, after a length but enriching route, we arrived at our final destiny, one of the most beautiful cities of southeastern México: San Cristóbal de las Casas.

Organic Coffee Cooperative: „Union de Ejidos San Fernando y/o Union de Sociedades de Producción Rural San Fernando, R.I."

Jonas Hagmann

17.03.2009

Summary

The cooperative was founded in 1984 and in the year 1997 they started with organic coffee production. It consists of 790 farmers who own 2,169 ha of cafetal. The plantations lie on altitudes between 600 and 1,800 m above sea level. All farmers have either been certified organic (91%) or are in conversion. They hold certificates for Japan, Canada, the EU and the USA and are also controlled for fair trade standards (FLO). The fair trade company GEPA is their main German client. In Mexico the coffee is sold under the brand name "Bio Café".

Report

The cooperative was founded in 1984 and in the year 1997 they started with organic coffee production. Now all farmers have either been certified (91%) or are in conversion to organic production. They hold certificates for Japan, Canada, the EU and the USA. Formerly, certification and control were done by IMO but since this organization wanted to be paid in USD they shifted to the only national internationally accredited certification body Certimex, accepting Mexican Pesos (MXN). Furthermore, every single farmer is checked for fair trade criteria (FLO standards).

The cooperative consists of 790 farmers who own 2,169 ha of cafetal. The plantations lie at altitudes between 600 and 1,800 m above sea level and the harvest lasts from November until March. It is done exclusively by hand by family members and sometimes hired labourers. The cherries are processed by the farmers themselves (dry processing only), meaning they take off the pulp (exocarp). At the factory of the cooperative the parchment (endocarp) and the silverskin are being removed and the seeds are graded to different qualities and the best and biggest beans are exported. Arabica and Robusta varieties are cultivated but only Arabica is suitable for export. Robusta beans are used for domestic sales. For the domestic market, the beans are also roasted and if necessary ground. In Mexico, the coffee is sold under the brand name "Bio Café" (Figure 1) and abroad under the brand names of the importers, in Germany e.g. GEPA.

Thus, the cooperative produces 6,000 bags of organic coffee per year for export. The fair trade company GEPA is their main German client; they have been dealing directly with GEPA for two years and are very content with their relationship. Since GEPA requires Naturland organic standards, the cooperative is a registered member of this international, German based farmers´ association, that requires additional environmental (shade trees, whole farm conversion etc.) and social standards compared to the European organic regulation.

Figure 1: Coffee products under the brand name "Bio Café" are sold on the domestic market

Figure 2: The main office of the cooperative in the village San Fernando

All farmers make use of shadow trees such as bananas or other fruit producing species. They produce vermicompost from the coffee pulp and if available cow dung or even grow edible mushrooms on the leftovers from the dry coffee processing.

The cooperative has its own experimental plot where they test and multiply their improved seeds which are then distributed to the farmers. At this experimental plot the farmers are also shown how they can make use of organic plant protection methods. The coffee berry

borer *Hypothenemus hampei* Ferrari (Coleoptera: *Scolytidae*) is a big problem but can be controlled with the application of spores of the insect parasitic fungus *Beauveria bassiana* (Bals.-Criv.) Vuill. This is a well known species for organic plant protection against insects (BLE 2007). 600 grams of fungus spores per ha and year, applied between May and August are enough to control the beetle.

Apparently, neither the coffee wilt disease (tracheomycosis), induced by *Gibberella xylarioides* Heim and Saccas (anamorph: *Fusarium xylarioides* Steyaert) (Rutherford 2006), nor coffee rust (*Hemileia vastatrix* Berk. and Br. [Herrera et al. 2009]) are a problem. Hence, there is no copper application against coffee rust necessary.

The biggest problem is the variable rainfall. Either there is too little or too much or at the wrong time, putting a constraint on proper drying of the coffee beans by the farmers.

The next picture (figure 3) shows the sorting and grading unit of the cooperative. Their capacity is much higher than what the members can produce and even the demand from national and international buyers can't be satisfied. Thus, for the future it would be possible to even encourage more farmers to join the cooperative and to convert to organic coffee production.

Contact:

Calzada Vicente Guerrero s/n

San Fernando,
Chiapas, Mexico

Tel:
0052-01-961-6564-198

0052-01-961-6564-205

C. Veronica Lopez Castillejos

comercializacion_uesf@prodigy.net.mx

Figure 3: The processing unit of the cooperative next to the main office

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Visit of the Coffee Museum in San Cristobal de las Casas

Charlotte Hohls

18.03.2009

Table 1: Green coffee production figures in Mexico

	1971	1981	1991	2001	2007
Production (tons)	187495	262904	334330	302996	320000
Consumption quantity (tons)	83274	98322	137456	124908	167255 [2003]
Area Harvested (ha)	380597	497182	643264	747416	770000
Yield (kg/ha)	492.6	528.7	519.7	405.3	415.5

Source: FAOSTAT 2009

Plant

Varieties of the coffee species, family *Rubiaceae*, genus: *coffea* are grown in Mexico, mainly *Coffea arabica* L. with different cultivars and *Coffea canephora* as the cultivar Robusta. The plants live up to 50 years; the first harvest is possible after 3 to 4 years. One plant produces eight to ten years. Coffee plants have a height of 4-6 meters.

Origin of the plant

The origin of the plant is tropical Africa; in Africa there exist around 40 species. The coffee drinking habit spread from the Orient to Europe. Europeans reduced their dependence on oriental coffee import by bringing the plant to their colonies- the arrival in México took place in 1790 with the planting of coffee trees in Acayucan.

Who produces how?

The following 28 of 54 indigenous groups in Mexico are involved in coffee production.

Amuzgo, Cora, Chatino, Chinateco, Chintal, Chol, Huichal, Ixateco, Jacalteco, Mane, Mazteco, Mixe, Mixteco, Motozintleco, Nahua, Otomi, Popoluca, Parepecha, Tenek, Tepehua, Tlapaneco, Tojoslobal, Totonaca, Trige, Tzeltal, Tzotzil, Zapotco. Zoque.

Coffee production is mainly in the hands of indigenous producers. The processing takes place on family, local, regional, national level. In 1998, there were 259,115 producers with less than 5 ha of 282,319 coffee producers in Mexico - this means that two thirds of the cultivated area produced only one third of the coffee production.

The rustic production by indigenes in the mountainous regions is based on a traditional multi-cropping in the rainforest as the coffee tree prefers shade. The museum guide differentiates between the latter and commercial multi- crop; also between mono-crop in shade or sun grown. Sun grown coffee plantations have the highest output but are said to be unsustainable- socially and economically.

For further reading:

Soto-Pinto L., Perfecto I., Castillo-Hernandez J., Caballero-Nieto J. Shade effect on coffee production at the northern Tzeltal Zone of the state of Chiapas, Mexico (2000) Agriculture, Ecosystems and Environment, 80 (1-2), pp. 61-69.

Processing

Coffee processing takes place wet or dry. Dry processing is possible without high mechanization; the cherries are wholly sundried for several weeks or in a machine. This process is followed by hulling.

Wet processing starts with the fermentation of the coffee cherry, brushing of the exterior, washing off the silver skin with rotating brushes (hulling)- the result of the process is "cafe lavado", "washed coffee", or "oro verde", green gold, both synonyms for green coffee.

These steps as well as milling, roasting, and grinding may take place on family, village, ejido and national level. Big producers may include the steps decaffeinating and processing for instant coffee in the production process.

Consumption

Coffee consumption covers about half of the production is produced as cash crop while production and consumption both grow equally (see Table 1). Exports are measured in quintals (46 kg) which equal 100 lb. of Oro Verde. Still, the export unit used is a 60-kg sack or bag.

Short history of coffee production in Mexico

There are historical phases to be distinguished in terms of coffee production structure.

Introduction: Small- medium scaled traditional ranch style/ejido production is introduced. The question for colonial structure is left open in the museum guide.

Porfiriato (1877-1911): The country is ruled by Porfirio Diaz who enforces a market- liberal policy which is ended by the Mexican Revolution 1910-1920. Diaz invited German, English and North American Companies to invest in building up coffee plantations in an estate style- these doubled the country's production of coffee. In Chiapas this took place especially in Sostenuso; other Mexican states involved in this development were Morelas, Veracruz, San Luis Potosi, Michoacán, Oaxaca, and Colima.

The working organization is described in the following. Intermediaries would make contacts with Indigenes in their mountain villages. They would sit behind a counter with piles of coins and talk people into signing contracts and pay something in advance which gave them a lot of power over the people. These contracts were based on piece rate. The Indigenes would walk down 40 km to the Tierra Caliente from their villages lying in high altitude and live in barracks in the coffee plantation for the season. There was no workers union, the workers were mistreated and suffered a lot. In the museum exhibition the work of the Don Erasto in the governmental Tapachula Commission is documented, memorizing the death of the Indian worker Marin Perez who died on a coffee plantation in the 1930ies.

A socially stabilizing function is ascribed to the parties with workers and plantation owners which took place at the end of the harvesting season. There would be a room for bosses, friends and family, neighboring another room for the workers. Around 1927, confiscation of state owned farms took place by change of law which blocked out non-Mexicans from the coffee business in Mexico. The estates were now state owned ejidos.

Sources

Museum guide (1998) after: Bastia et al.: La hora de cafe. Dos siglos de cafe mexicano a muchas voces. Instituteo de Estudios para el Desarollo Rural Maya, AC. DGCP, MNCP, year not known.

www.fao.faostat.org

Further reading

http://www.ico.org/site_map.asp, http://dev.ico.org/show_doc_category.asp?id=2

Museo Na Bolom in San Cristobal de las Casas

Hendrik Brand

18.03.2009

The museum Na Bolom in San Cristobal de las Casas is an exhibition about the Maya culture, especially about the Lacandon people. This museum was created from the private collection of the Blom family. The Danish archaeologist and explorer, and his wife Gertrude Duby, a conservationist and photographer from Switzerland, settled in San Cristobal de las Casas in the 1950ies and bought the house were the museum is now. The museum belongs to a non profit foundation.

During his expeditions Frans Blom changed his last name in Bolom which sounds similar to the word for Jaguar in a Maya language. After that they decided to name the house Na Bolom which means "The House of the Jaguar".

The museum has many photographs about the expeditions and the Lacandon culture taken by Gertude Duby. There are many religious artefacts and archaeological treasures they discovered in the Lacandon jungle, Oaxaca and other parts of Mexico. In the museum there are a few rooms with each of them a theme.

There is a room about the Lacandon people with artefacts and gifts collected from expeditions in the Lacandon jungle. There is a description about their daily life, about their religions and also about Lacandon people at the present time.

The Lacandon people calling themselves Hach Winik which means "true people", they have a traditional dress, this dress is white and consist for women just of two parts. With the arrival of commercial products many stopped wearing this traditional dress, also necklaces; traditional they are made of natural materials such as seeds, nowadays many women and children are wearing plastic bead necklaces.

The Lacandon religion was carried on through oral tradition. They are holding ceremonies for good health, rain and for good harvest. These activities are exclusively done by men, especially in the God house, a house set up for religious activities. In this religion God pots are important and represent the different Lacandon Gods. In these pots the Gods receive their offerings, songs and prayers; they are made out of clay and decorated with white, black and red paints. Some Lacandon people are making pilgrimages to the archaeological site of Yaxchilán as their ancestors did.

There is another room about the expeditions, how these were carried out by Blom and his wife. There are many photographs and utensils that were used during the expeditions of Frans Blom and Gertrud Duby in the jungle.

The Moxviquil room holds many examples of ceramics and other ancient artefacts found at an archaeological site located two km from San Cristobal. There are also maps from the Lacandon jungle since Frans Blom was also a skilled cartographer.

Then there is the room of Gertrud Duby. After her death in December 1993, her room was maintained to display her distinctive suits, jewellery collection and personal objects.

The house has also a chapel. It holds many religious objects; a ceiling and altar, paintings and sculptures from the sixteenth to the nineteenth century. On the ceiling and altar there is still the original paint. This chapel is a clear example of neoclassical construction in San Cristobal.

A film in the museum explains the current live of the Lacandon people and cultural projects that are conducted in the area. The museum also holds the first library for the Maya. Nowadays the Lacandon area is influenced by road access, canalisation and industrialisation. Since 1977 there is a reforestation project in the area. Sustainable agriculture is also taught

by traditional Maya methods. For school children there is education about the forest to realise the value of it.

There is also a garden with many different plants and a small straw house. The building is not just used as a museum but has also a restaurant and hotel.

Visit of pine forests on the "Altos de Chiapas"

Nora Honsdorf
18.03.2009

In the late morning of March 18th we visited a pine forest in the highlands of Chiapas, close to the city of San Cristóbal de las Casas. There we took a closer look to the soil conditions and the stock of wood of the place.

The selected place lies about 2400 m above sea level, has an average precipitation of 1500-1800 mm and a mean annual temperature of approximately 15 °C.

Soil conditions:
The parent material of soil in this region is lime stone.
The soil profile we looked at was a very deep red colored soil. We concluded that the depth of the soil was due to accumulation of eroded material from the upper part of the mountain. The physical properties of the soil are very good with good conditions for root growth.
A 15 cm top layer of organic material showed that there are problems with decomposition of pine needles.
The pH of the A-horizon was estimated to 6,2 whereas we assumed that the pH-value of the B-horizon should be much lower. Interesting findings were charcoal pieces in the B-horizon. Those are traced back to forest fires and are now not being decomposed because of the antibacterial effect of the phenols they contain.
Problems of the soil are low pH in the lower part and low nutrient content.
The soil type is Ferralsol. Ferralsols develop under hot and humid conditions over a long period of time. Therefore the soil we have seen must have evolved long ago under different climatic conditions.

Pine forest:
The natural forest of the region we visited is pine-oak forest.
Our task this day was to estimate the stock of wood per hectare of the visited forest. We started with a five minute walk in a sample area with the following questions:

- How does the forest stand?
- How has the forest been established?
- When has the forest been established?
- Which volume of wood do you expect in the area?

We agreed that the forest is a natural one, with different varieties and trees in different growth stages/ages. An important pine variety of the region is *Pinus pseudostrobus*. The majority of the trees were estimated to be about 30 to 40 years of age.
Since the majority of the group had no experience in forestry it turned out quite difficult for most of the students to estimate the wood stock. Therefore we tried two methods to determine the wood volume, total count and Bitterlich´s angle count method.

Total count:
Initially we marked an area of 20 m by 20 m and then counted those trees with a diameter of ≥ 7 cm and measured their diameter at chest height (1.3 m). From this data we calculated the total basal area of wood. In total we counted seven trees and calculated a basal area of 1.08 m² per 400 m². This results in about 175 trees per hectare with a basal area of 27 m².
To calculate wood stock per hectare we multiplied the basal area by the average height of the trees, which we estimated at 28 m, and a correction factor of 0.5. The volume of wood per hectare is about 380 m².

$$Wood\ \frac{Volume}{ha} = Basal\ \frac{area}{ha} \times Average\ height \times Correction\ Factor$$

Bitterlich´s angle count method:
As a second method to estimate the wood stock per hectare we tried Bitterlich´s angle count method.
We used a 1 cm wide clothes-peg on a 50 cm long string to take a bearing of all the trees seeming wider than the clothes-peg turning 360° around ourselves. The number of the trees counted equates the basal area of wood per hectare. We counted 25 trees. That means a basal area of 25 m²/ ha. This result is close to the one we got with measuring all trees in the plot.

Visit of Palenque archaeological site

Matthias Klaiß

19.03.2009

Summary

Palenque is an ancient Maya town and an archaeological site in Chiapas, Mexico. It had its bloom from 630 – 740 AC under the sovereign Pakal, who is represented as sun and shield in the inscriptions. The Maya used the so called Milpa-System to cultivate the land in an unsustainable way. Around 900 AC the great Maya civilization disappeared suddenly, the reasons are not known; a few theories exist to explain their disappearance.

Report

Palenque is a Maya archaeological site near the Usumacinta River in the Mexican state of Chiapas, located about 130 km south of Ciudad del Carmen. It is about 150 meters above sea-level. The original name is forgotten, Palenque is a Spanish word. The site extends about 400 x 500 m², the overall site has an area of several km². The origin of Palenque is in the Maya Classical Period, was first settled around 100 BC and was in his bloom from 630 – 740 AC under the under the sovereign Pakal (615-683) , who is represented in the Hieroglyphs as sun and shield. Compared to Palenque, Bonampak was less important. On the site different temples were built, whose real names are not known. Under Pakal's reign a lot of buildings were constructed, for example the "Templo de las Inscriptiones". Under his son Kan B'alam II (684-702), represented by a jaguar and a snake, more temples, like Grupo-de-las-Cruces-Temple and more stelae with stories on them were built. The names used today are only fantasy names.

The Mayas had a deep spiritual relation to nature. The historical and mythological aspects of the Maya were written down in the book "Popol Vuh". They were agriculturalists and great fighters. Their main crop was maize and they lived mainly of cultivated plants and hunted animals. To cultivate the land they used the Milpa system, clearing the forest with fire, turn the soil with a hoe, planting the maize with a stick and cultivating intercropped squash and beans (beans fix around 40-50 kg N/ha). Such a field could be used for two years. This kind of cultivation is not regarded as sustainable. Before the conquest only few animal were domesticated. The turkey, guinea pigs and further south in the Andes camelids were the only livestock used. To fertilize the soil livestock is needed; the grazing animals collect nutrients on the pasture and if they are kept at night in a stable, approximately 50% of the nutrients can be accumulated on the field by bringing out the dung.

Around 900 AC the Mayas disappeared, the huge empire broke apart and the famous towns were forgotten. When the Spaniards arrived in the 16th century, Palenque was only scarcely populated and the forest grew over the city since centuries. The reasons for this abrupt downfall are not known, however, different theories about possible reasons exist:

1. Ecological catastrophe theory: the repeated killing and sacrificing of prisoners and the need to go to war to get new prisoners decreased the population in a way that not enough labour was left to do the intensive work of agriculture and keep the land open.
2. The growing population needed to be feed, new land had to be cleared, as the traditional system was not sustainable and able to produce enough food. The rainfall distribution became unequal, in addition the quality of the shallow soil was poor, the calcarious rock underneath led to leaching of nutrients. So a big competitive situation between the city states occurred and led to fighting.
3. The Mayans mixed slowly with the Tolteks.

The rain forest system of Bonampak

Rita Khathir

20.03.2009

Summary

Bonampak is well known as an ancient Maya archaeological site and it is located actually in the rain forest region of Selva Lacandona. As it is experienced in many other places, its rain forest is threaten to be destroyed, for example by the construction of highway, government planned development, mining industry, the war, the increase of population, the application of silvo-pastoral system, and the application of the milpa system for agriculture. In total about 60% of forest loss had been reported in Selva Lacandona.

Report

There is no literature talk about rain forest in Bonampak specifically. Since Bonampak area is situated to the east part of Selva Lacandona rain forest region, the approach used to gain the information about its rain forest is by using all literatures about Selva Lacandona rain forest.

In fact, Bonampak is known as an ancient Maya archaeological site in the Mexican state of Chiapas. The origin word of Bonampak is *Bòonam Pak'*, meaning painted wall in Modern Maya. It was found in 1946 when local Lacandon Indians described it to an American photographer named Giles Healey (http://ngm.nationalgeographic.com/geopedia/Maya). In 1992, Mexico reserved an adjacent of 44 km^2 of Bonampak Natural Monument.

The Selva Lacandona, the largest remaining segment of Mexico's forest, is located in the eastern edge highland of Chiapas between latitudes 16°05'-17°45'N and longitudes 90°25'-91°45'W. In the beginning, the total area of this rain forest was approximately 30,000 km^2, but the deforestation started from 1950 reduced the forest area by about 60% (6000 km^2). In general, the deforestation rate in Mexico is about 1% or 0.5 million hectares per year. Bonampak was found in this jungle area because it was left by Mayan people for the unknown reasons.

The climate is warm and humid, with the median annual temperature above 22°C and the coolest month averaging above 18°C. The median annual precipitation is over 2,500 mm, with a summer rainy season which experiences monsoons (Gómez-Pompa *et al.*, 1994 in (1)). Generally, winds from the Chiapas Highlands predominate. The Chiapas Highlands, from 400-2200 m, are mostly limestone with some sandstone and volcanic extrusions. The eastern half of the region is primarily alluvial plains at low elevations, with isolated hills and valleys as major features; in general its altitude ranges from 80 m to 500 m asl. Bonampak murals are situated at 300 m asl with the rainfall around 1,200 mm (Noted from the guide).

The plants that are well adapted to the drained condition of the region's calcareous mountains are covered the forest. Lianas are much more common by canopy in range of 25 to 45 m. Epiphytes occur throughout, and the shrub layer is dense and well developed. Additional canopy trees include *Trichospermum* sp., *Calophyllum brasiliense* var. *rekoi*, *Ocotea rubriflora*, *Ocotea* sp. (*Nectandra sinuata*), *Quercus oleoides* and *Talauma mexicana* (Miranda 1961; Breedlove 1981 in (1)). The highest tree had been seen in the excursion is estimated at 50 m.

There are an estimated 4000 species of vascular plants in the Selva Lacandona (Medellín 1991 in (1)). Ongoing research in the Lacandon region by the Universidad Nacional Autónoma de México (UNAM) has resulted in many new collections. Studies are urgently needed to recognize threatened species, which may include the cycads *Ceratozamia matudae, Dioon merolae* and *Zamia splendens*.

The Lacandon forest contains important reserves of timber, such as *Calophyllum brasiliense* var. *rekoi*, *Cedrela odorata*, *Cordia* spp., *Dialium guianense*, *Lonchocarpus castilloi*, *Swietenia macrophylla*, *Tabebuia guayacan, Talisia oliviformis* and *Trema micranthum*. Other species of economic importance are *Manilkara zapota* - the "Sapodilla" tree from which chicle gum is extracted; *Castilla elastica* var. *elastica* - its latex was the source of rubber ("caoutchouc") for the indigenous people of Mexico; *Cymbopetalum penduliflorum* the flowers are used among the Maya Amerindians for flavouring and medicine (Wagner 1964 in (1)); and species that bear edible fruits, such as (among trees) *Manilkara zapota*, *Pimenta dioica* (allspice), *Poulsenia armata*, *Pouteria mammosum* and many others (Miranda 1961). Peters and Pardo-Tejeda (1982 in (1)) have evaluated the promising economic potential of *Brosimum alicastrum* ("ramón") (by using fruits, seeds, leaves, wood, latex, bark).

Several species of palms (e.g. *Geonoma oxycarpa*, *Scheelea liebmannii*) are used by the local inhabitants for roofing. Additionally, seeds, seedlings and leaves of some small palms called "xate" (e.g. *Chamaedorea tepejilote*, *C. oblongata*, *C. elegans*) are being commercialized to U.S.A. (Marshall, 1989 in (1)).

The Selva Lacandona is important for its large watersheds and soil conservation, and encompasses a significant portion of Mexican biodiversity. About 20-25% of the Mexican species of many groups are present in the Montes Azules BR, which is only 0.16% of the Mexican territory. Among the best represented groups are birds - 345 species, over 33% of the Mexican species, including harpy eagle, black-and-white hawk-eagle (*Spizastur melanoleucus*), macaws and parrots; mammals - 112 species, c. 25%; and diurnal butterflies - 800 species, 44% (Medellín 1991, 1994 in (1)). The forest has also the viable populations of animals such as jaguars, ocelots, howler and spider monkeys, Baird's tapirs, white-lipped peccaries, kinkajous and caimans (cf. Vega-Rivera 1990 in (1)).

The region is variously inhabited by five Amerindian groups (Lacandons, Tojolobals, Chols, Tzeltals, and Tzotzils), including descendants of the pre-Columbian Maya civilization that flourished for nearly ten centuries, practicing a highly diverse, long-term system of food production that showed sustained use of the tropical forest ecosystem. Among the few Mayan groups that continue using elements of this knowledge are the c. 300-450 Lacandons (Nations 1984, 1985 in (1)), whose techniques of farming (a milpa style mimicking the forest's dynamics) allow the forest to regenerate without significant loss. Aspects of the Lacandon Maya subsistence and forest-management systems are being examined and applied by some institutions to demonstrate that the practices that serve them and served the Classic Maya (250-950 AD) are helpful for the modern development of sustained-yield use of tropical forest ecosystems (Gómez-Pompa 1987; Nations 1988 in (1)).

Important quantities of valuable woods had been obtained c. 1850-1948; most of the good trees accessible by river were gone by 1949, when the Mexican government prohibited export of unprocessed trunks (Medellín 1991 in (1)). Logging roads began to open up the region in 1965. The increased rate of timber extraction is far from sustainable.

Arizpe et al. (1998) found that the Lacandon and La Union people assumed the war (35.4%) as the greatest dangerous activity in the world, following by poverty (15.6%), illness (13.5%), pollution (5.2%), divine punishment (4.2%), environmental degradation (2.1%), do not know (14.6%), and others (2.1%). The other things refer to lack of technology, natural disaster, the Mexican Government’s ban on tree felling, and natural danger of the forest. The community also reported changes on the environment, such as rainfall (84%), heat (74%), wind (55%), floods (22%), and animal (96%).

Accelerating rates of loss of the Lacandon forest threaten its flora and fauna and the survival of its indigenous peoples. Some activities assumed to be the cause of this deforestation are:

1. The construction of highways through the country;
2. The mining industries;
3. The specific case of war, where about 70,000 Guatemalans converted the forest to be the village (guerrilla activity) (Wilkerson, 1985 in (1));
4. The government-planned hydroelectric project at the Usumacinta River, and extending of agricultural activities over 2000 km² farther into the Marqués de Comillas zone (Wilkerson, 1985 in (1));
5. The high increase of population;
6. The application of silvo-pastoral systems; and
7. The application of the milpa system for agriculture in an un-sustainable way.

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Chichén Itzá archeological site

Sabrina Leupolt

20.03.2009

Chichén Itzá

Chichén Itzá is the most famous Mayan site of Yucatán. It is located 120km far from Merida at an altitude of 10 m above sea level. Today Chizén Itzá is visited by many tourists who see the old buildings, myths, traditions and mindsets of the Maya.

Our excursion group also visited Chichén Itzá and, after the main tourist stream had vanished, got a private introduction by a nice archeologist. By combining archaeological knowledge and the guidebooks, I try to give you a historical insight of Chichén Itzá.

History

The foundation of Chichén Itzá by immigrated Maya tribes from the south is dated around 450 AC. There is the hypothesis that Chichén Itzá was not left by the Maya at 900 AC when the classical Maya epoch ended. The opinion is that in 1000 AC the Tolteks immigrated from Tollán to Chichén Itzá. Old Náhua-chronics tell that the legend prince Ce Ácatl Topiltzín lead the Toltek immigrants. Ce Ácatl Topiltzín called himself, like other Toltek monarchs too, Quetzalcóatl or Kukulkán. The meaning of Kukulkán is feathered snake. By the fusion of the Maya and the Tolteks there was a renaissance of the Maya culture for the following two centuries. Under the authority of Kukulkán, Chichén Itzá grew to a very influential town of Yucatán. In the 14th century a Mayan monarch displaced his capital to Mayapán and thus building activity stopped and Chichén Itzá mutated to a mere religious center, and the comedown of the city begun. Chichén Itzá lost its importance. At the time of conquest by the Spanish in 1533 the city was barely populated but further on a visited place of pilgrimage.

Buildings of Chichén Itzá

Chichén Itzá is a big Maya city. The archeological zone extends over an area of about 8 $km^{2.}$ Only some buildings are excavated. In the Maya epoch the buildings were used for administrative and ceremonial matters. Sacrifices of humans for the gods or other religious ceremonies took place in the temples. An observable change is the floor of the big central place where you can find the pyramid. The original ground of the central place was actually two meters under the current situation. Furthermore Chichén Itzá was circled by a city wall. Some famous buildings are explained below.

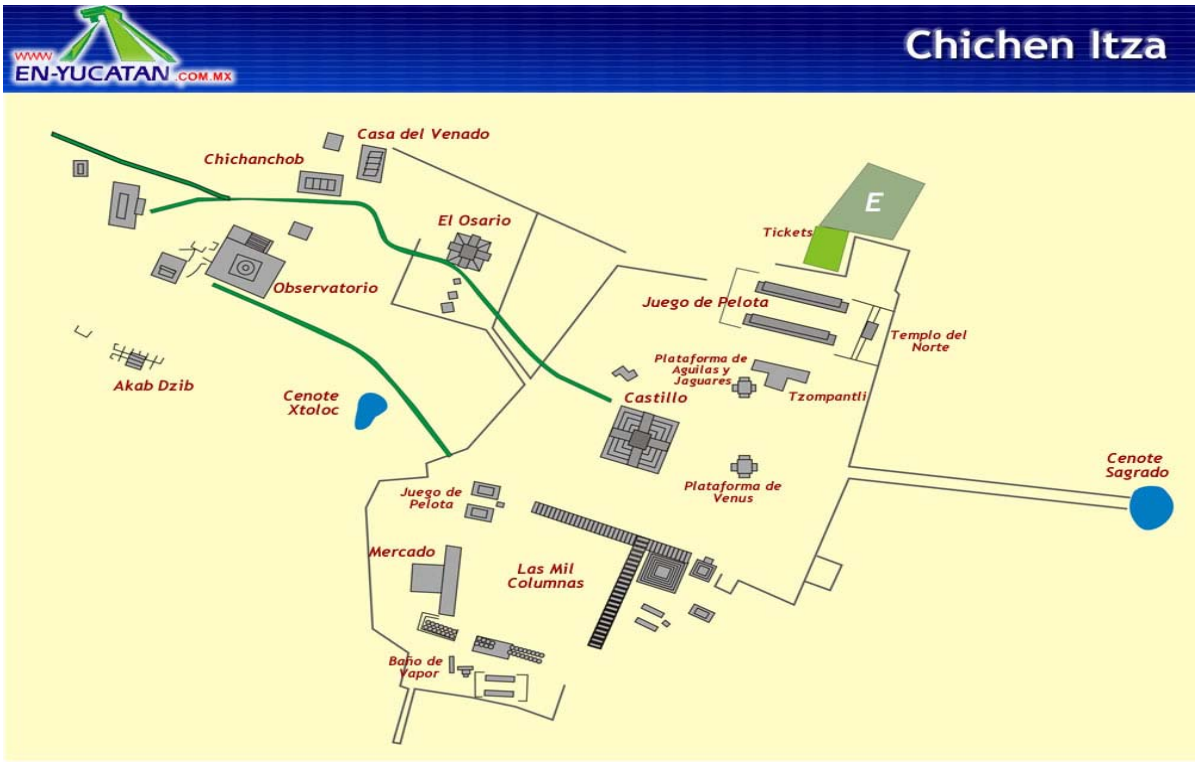

Figure 1: Map of Chicèn Itzà

Pyramid of Kukulkán

Astronomical and astrological phenomena gave the Tolteks the inspiration to build the Pyramid of Kukulkán. The pyramid is 24m high, four-sided and possesses nine terraces and four steps which symbolize the nine heavens and the four cardinal points. At all sides there is one step, in each case with 91 stairs. Four steps multiplied by 91 stairs result in 364 stairs. Added with the stair of the main entrance the pyramid has 365 stairs as much as the days of the year. In the 1970s Mexican archeologists discovered a phenomenon, the ingenious astronomical abilities of the Maya. The phenomenon takes place every year on March 21 and on September 21/22 when the solstice occurs. On this both afternoons the shafts of sunlight cast a cloud over the front stairs, broken trough the nine terraces, so finally getting the impression that a snake slowly crawls the temple up or down. Thus the stony head of the snake downstairs awakes to life for some hours. This spectacle attracts thousand of visitors from all over the world.

Figure 2: Pyramid of Kukulkán (left) and Cenote Sagrado (right)

Cenote Sagrado

El Cenote des los Sacrificios, the holy fountain, was an arena of sacrificing humans. The fountain is circular and stony bowl down to the water hole is 24 m deep. The perimeter is about 60 m. The freshwater was not for drinking, the inhabitants of Chichén Itzá had other cisterns for drinking water. The Cenote was a ceremonial place. In time of aridity humans and valuable objects were put in the fountain for sacrificing to the gods, especially the rain god. The sacrifices were cleaned in a steam bath located near the Cenote. In the last century Edward Thompson, an US consul, bought the whole area and wanted to find gold, because he heard the story of sacrificing virgins having gold. But the Maya did not have any gold, only mussels and jade (a stone). Thus Thompson only found bones of humans, ceramics, pots, clothes and swords. All of these historical, valuable things are in the museum now.

Juego de Pelota

The ball game Pelota was less a sportive than a ritual event. The game was played on typical archaeological playing fields. The field is about 150 m long and 35 m broad, and the long sides of the field are delimited by walls of 8 m high. In the middle of the wall on upper border there is placed a stony ring, the goal for the ball. The ball, made of rubber, was a symbol of the sun. For the priests the game Pelota was an oracle "heaven and underworld". The two teams, each consisting of seven men, were not allowed to play the ball with their hands and feet but only with their knee, elbow and hip. When the player passed the ball to someone else, the priest could interpret the destiny out of the fly. Having scored a goal, the winners were allowed to take the clothes and the decorations of the audience, the losers lost their head. There are two small temples near to the Pelota field, Edificio Sur and Temple Norte. Both temples were hallowed the gods of the sun and the moon as some researcher affirmed.

The history of the game Pelota is sculptured as a relief in the stony wall. The Maya folk could not write and read so figures and colors told the story of Pelota.

Figure 3: Drawing of Pelota play (left) and Chichén Itzá Pelota playground (right)

Impressive Chichén Itzá – some more insights

In the last century the archeologists Stephensen and Katherwood painted detail drawings of Chichén Itzá with ink.

It is interesting that an original wooden beam of the main door of the pyramid is still conserved.

A lot of the buildings are not accessible to tourists today. For example you are not allowed to climb the pyramid because many tourists populate Chichén Itzá every day. Per day 4000 tourists and on good days 7000 - 11000 tourists were counted.

The Observatory has a round form and this is an exception because only few buildings of this form existed at that time. In the Observatory when you go upstairs the spiral stairs, which is of course not allowed, on the top there is a small window. Through the small window the Maya priest observed the stars and the heaven.

Ahead to the temple "Los Mil Columnas" (thousand columns) there is a statue of Chac Mool who watches over the temple.

Something about the construction of the buildings: The stones are not perfectly formed. The buildings were constructed also with small stones. In addition everything was plastered with stucco and painted on.

Finally Chichén Itzá shows many wonderful conserved historical buildings of the Maya epoch. Today a Light and Sound Show make the history of Chichén Itzá accessible to the tourists every night.

Oxkutzcab

Heike Pannwitt

22.03.2009

On 22th of March we discovered the region around Oxkutzcab, Yucatán.

The south of Yucatán is known for its plantation of citrus as well as honey production. Because of the general problem of water shortage these plantations become irrigated by flood or drop irrigation. All in all in this area there is a rainfall of 800 mm per year which falls mainly during the raining season from June until October. A problem of this area is leaching. Most of the soil is limestone with a pH around 7.

Fruit and vegetable market in Oxkutzcab

The first stop of the day was at the fruit and vegetable market in Oxkutzcab. Here we had a ½ hour to take some impressions of this lively place. The market was separated in the building there was a selling of meat e.g. from chicken in one open room and clothes like shoes, trousers and T-shirts in the middle part of the building. But the main esculent which was sold in this market was fruits and vegetables from the region. They offered chili avanero, sweet potatoes, mangoes, salad, radish, tomatoes, oranges, onions, carrots, bananas, apples, garlic, coriander, papayas, avocados, melons, pumpkin, maize, citrus, mamey. The market was organized that customers who just buy small amounts like one or two pieces of the fruits or vegetables have to buy it inside of the building while bigger customers are buying boxes in front of the building (Fig. 1).

Figure 1: Front of the fruit and vegetable market in Oxkutzcab

Agroforestry system with Pitahaya in Xohuayan

In an area with red soil which goes around 100 m deep and consist of 0,5% organic carbon we visited a farm where they cultivated Pitahya in 3 different Agroforestry systems:

1. Pitahaya with tomatoes (Fig. 3)
2. Pitahaya with Chili avanero which will be exported to Canada and Europe
3. Pitahaya with cucumber which will be used for home consumption

A Pitahaya plant will become 2 m high which takes 6 years. The plant are cultivated on trees and irrigated by furrow irrigation (Fig. 2). Pitahaya is in flower in May so that the fruits are ripe in August/September.

They harvest the fruits by hand and put them into plastic boxes as we saw at the market in Oxkutzcab (Fig. 1). The plastic boxes are as well the way of measuring the fruits for dealing with them and transport them. The transport chain consists of carrying the boxes from the farm to the market by bike and/or truck. If the Papayas will be exported to Japan they go by flight because the fruits just last for 8 days. This farm did not cultivate Papayas that long. The good price and the big market encouraged them to change from Milpa to a market-orientated Ejido. They cultivate about 85% Pitahaya and 15% secondary crops. Around 100 people are working together and invest in the 49 plots of Pitahaya. The biggest investment is the purchase of sweet water. After that they have to buy mineral fertilizer to balance the small amount of phosphorus of the soil once a year by 84060. Because of the increase price of the phosphorus the farmer is considering about changing to Guano. Problems they have are pathogen fungi, the white fly and thrips as well as fruit fly and bird damage. Against the insects they spray a systemic insecticide once. Because of high pressure of pest an organic cultivation is not possible in this area.

Figure 2: Cultivation of Pitahaya in an Agroforestry system irrigated by furrow irrigation

Figure 3: Cultivation of Pitahaya in an Agroforestry system with tomatoes as secondary crop

Animal Husbandry System

On our way to the mamey farm we had a stopover to discover a farm where they had mother cows for meat production.

This farmer owned 25 animals in total:

- 2 x 3 weeks old
- 8 x 6 month old
- 6 x adult for mast
- 7 mother breeding animals
- 2 mating bulls of the breed Zebu and Indo

Figure 4: Example of mother cow husbandry in Yukatan

They sell the animals after around 2 years with 450kg. For nutrition the farmer buys maize and chicken mineral from Merida as well as citrus left over from a juice factory. The fresh chicken will be dried and treated to powder. The farmer feeds his cows during the dry season twice per day. In the morning he mixes 3 kg maize x 3 kg chicken mineral per cow and in the afternoon they get 10 kg none dried citrus. The cows are also always having an access to fresh water and a salt bloc which the farmer buys in the veterinary shop. On the 20 ha big ranch which is divided in 1ha big plots, 10 ha are cultivated with irrigated crops and citrus and the other 10 ha are cultivated with Taiwan grass for the cows. Seasonal the animals get 200 kg Taiwan grass per day. During the raining season there exists a rotation of the herd. All 2-3 day they rotate from one to another plot. After the raining season the herd is placed in a stand of 400 m^2 with 2 feeding trough to avoid feeding competition (Fig. 4).

Health problems consist through bats as well as ticks. To prevent the tick problem they use 2 or 3 times a year an acaricide by spraying it on the cows.

Mamey production and pulp factory

After having lunch and getting to know the students from the Universidad Autonoma de Yucatan that accompanied us during the day we started getting to know Mr. Margania. He showed us the mamey production from the tree nursery up to the pulp factory in Akil, Yucatan.

Mr. Margania started 36 years ago with 1 ha and 4 plots to grow mamey trees in 11 different varieties which fall off 2 varieties called N1 and N2. Today the area has a size of 80 ha and

the aim is to grow up to an area of 100 ha. At the moment he produces for the local and national fresh product market where they use the fruit for ice cream and fresh pulp.

Since the early beginning of the orchard they make experiment of different tree densities. They planted on one hectare:

- 200 plant mamey
- 100 plant mamey x 100 citrus
- 100 plant mamey x 300 citrus
- 100 plant mamey x 100 avocado
- 100 plant mamey x 300 avocado

Also they tried to prune the young tress of his tree nursery in the right way. One way is that he cuts the crown every 2 years or he just does it by looking at the branches by heart. The harvest time of the mamey depends on the 2 varieties which mean that the variety N1 will be harvest in March - April and the variety N2 will be harvest in April - June.

The mamey orchard produces the fertilizer by their integrated compost works, which is necessary to become an organic certified farm. This compost works is located in a poured-in-place shelter. 3 steps are necessary to it compost:

1. Crashed fruit
2. Compost
3. Compost mixed with red Californian earthworm = vermicompost

The soakage which occurs during the compost process is used for the irrigation of the tree nursery.

The problems they have while composting are the fruit flies which they try to reduce with the insecticide Malathion. As amount of the compost is not yet sufficient, 2 kg/tree of a synthetic fertilizer is used to nourish with Potassium as well zinc and iron is sprayed.

To avoid alternation of the trees they will be pruned and different nutrients are applied which is explored by the university.

While starting the plantation they use secondary crops as maize, cucumber, melon, chili and avocado for maximum utilization.

For general work on the orchard and picking they are 30 employees that number doesn't include the number when the pulp factory is working in the near future. The factory is the next long term aim of the owner which is financed by bank credits, the local government and by own money. In future the harvested fruits should either be exported México City or used for pulp production. For the market they pack the fresh picked fruits in boxes in which they will be transported to México City till the next day. The packing will be done in the new factory. The trucks which carry the fruits from the other orchards can drive in front of the factory and the fruit will be selected and weighed over a conveyor belt and packed into boxes which should have a weigh of 25-20 kg each.

For pulp production the fruits will be washed, peeled, pitted, refrigerated to -15 °C and sold. The factory has a capacity of converting 20t pulp per 8h for that they need 35t fruits. As well there exist 300 other subcontractor that have around 1-20 ha mamey plantation.

Behind the factory there is the idea to sell the pulp to Europe as well but the problem is that they cannot meet the HACCP-standard so far.

Hobonil UADY University farm

Julian Plagemann

23.03.2009

Cattle & Horses

At this day the first point of our program was the University farm. There was cattle breeding, horses, a program to rescue an old Mexican pig breed and they had a few sheep. The cattle were kept together with the horses but they had one extra stable for more horses, which were only kept for ecotourism. The cattle breeds were *Bos indicus* crossed with European cattle (Swiss and Holstein breeds) to increase the efficiency. Six different types of ticks are a problem for health, so they have to spray them every 3 weeks with a tick treatment to avoid diseases like anemia, babesiosis or anaplasmosis. Without treatment they would become skinny in a short while. They brand their cattle because the skin in Mexico does not really have a market value. The males' meat is sold for streets consume and the females are used for reproduction and milking. The milk is generally not sold, but it depends on the milk price as they said. At all, the farm is a University program without a real market focus. The first semester students of the Biology faculty who study animal production have classes here in physiology and anatomy, to get to known the animals.

Pigs

The pigs are typical Mexican Pigs, a hairless tropical adapted old breed. They are undemanding and cheap in production. They don't need any tick treatments and don't get any antibiotics (in contrast to the cattle). They almost don't add any additives, because the only problem they sometimes have is diarrhea. The pigs are fed with kitchen waste and agriculturally produced trees (*Leucaena*) and mixed herbs. They don't eat too much and are able to handle fodder scarcity well. In comparison to the US pigs they have less fat but they do have intramuscular fat for good taste. After two months the pigs get separated from their mothers. But the separation depends on the size because they don't have a registry. Fifty days after the separation the mothers become pregnant again. The objective is to preserve the species; therefore they cross them back to old characteristics.

Sheep

They have two races, the Blackbelly and another one, which are the most adapted ones. During the day they are on pasture and they are also fed with some legume plants. Because of their sensitivity to parasites they are treated every 3 months and in rain season every two months. They have rarely ticks but often problems with clostridia and gas brand. They get inoculations. Rabies is a problem they get from the high amount of bats living in the area. There was an area for milking but the milk is not good marketable even if it is a good alternative for allergic children.

Organic *Aloe vera* production farm

The farm is certified organic producer and is cooperating with the University of Kassel in form of exchanges for practices etc. The owner is a global player with farms in Uruguay and Africa and other ones in Mexico. On this farm he manly produced Aloe Vera, wood, fruits and honey. There also was plant nursery. Because of the many different activation fields and test plantations it was more a farm to try out different production systems to establish them on the other farms of the owner.

Aloe vera

The cropped *Aloe vera* leaves were washed milled and finally cooked to a powder or a liquid. As a special product for export they also fermented the elixir by most effective micro organisms which they obtain from Japan. The fermentation process takes about one year. It serves as an Energy Source and as Medicine for wounds (especially in older persons) for example. It is added to a broad branch of organic produced goods.

Jatropha

There was one hectare cultivated with *Jatropha* to get enough seeds to cultivate additional 25 hectares in expectation to produce biofuel. The seeds have an oil concentration of 40% and they expect a crop of 1-2 tons of oil. On another colony the owner already has a mill. He makes different intercropping tests.

Neem

The Neem field was cultivated for its Azadirachtin content which is utilized as an insecticide. The final goal is to use the seeds for Biofuel production too.

Coffee & Kakao (Intercropped)

Cahoba

They were growing a field of seedlings of this indigenous Mexican tree. The germination is slow and uneven. It gets felled after 20 years of growth with a diameter of about 70 cm. The wood is used for furniture.

Honey

Behind the fields there were further 20 ha of seemingly unused shrub land. The different flowering time of the shrubs is used by 30 bee hives to produce honey. The hives were established by a student of Witzenhausen a couple of years ago. They established 2 different tropical bees, Africans and Italian bees because they are less aggressive. These types also have a good resistance against *varroa* mites. To avoid problems ones a year they add 250 ml of 65% concentrated acid per hive to kill the mites by the evaporation. They can't add sugar because they are organic producers. They harvest in November and from February to June. The owner produces about 180-200 t of honey on his 20 enterprises in Chiapas and Yucatan.

Livestock Systems in Yucatan, México

Edinson Rivera Aedo

23.03.2009

Introduction

In the Yucatan Region we could appreciate the different livestock systems that exist there, which have some variations in the breeding and feeding process. Despite these differences there are similar characteristics like the species which are used in the livestock system. Thus, in the Yucatan region the rancher breeds pure *Bos indicus* and *Bos taurus* as well as crosses in the case of cattle production. However, there is also sheep production, where the rancher keeps breeds like Blackbelly, Belly Belly, Pelibuey, and Dorper.

Likewise, Universidad Autónoma of Yucatan has a livestock unit with pig, cattle and horse production, to help their students in the learning process. The pig production serves the conservation of the "Cerdo Pelón", a pig species native of the Yucatan region.

Feeding

Through the excursion in the Yucatan region, we had the possibility to visit some livestock production systems. Thus, we talked with some ranchers and their families that were all involved in the management process.

We also could appreciate the difference in the feeding strategies depending on the season. Thus, in the summer season (March until September, sometimes until December), the cattle go out of the stable to feed themselves with the grass that exist in the zone until the next day, when they come back to the stable for water and to rest until the night to go out again, because in the day the temperature are too high, and there is not grassland in all areas, therefore in the stable they receive additional feed, which is a "Mix" composes from a part of chicken manure and a part of citric husk that is usually bought in the juice industries, and sometime that "mix" have maize. Further, to ensuring a permanent growth of the grass, some ranchers have separated the hectares with fences creating paddocks. So, when the cattle go out to the grassland, they eat all the grass that is in each paddock. The cattle stay around three days in each area before they are moved to another one, i.e. there is a rotation system.

In the winter season, the cattle are most of the time on the grassland and they come back only for water if they don't have access to a source of water. Furthermore, to avoid the under-nutrition of the calves, the ranchers have a place designed specially for them, ensuring them a good nutrition.

In the case of sheep production, the ranchers use to feed them with a "mix" from a part of citric husk and fodder, according a combination given by Universidad Autonoma, avoiding the intoxication by acidosis of the sheep (80% orange husk, 10% concentrates, and 10% grass). The fodder is cut each 45 days, after that it is mixed with soybean, orange husk and it is ensiled for about 120 days. However, the sheep also go out to the grassland to feed themselves both in summer and winter.

Breeding

For the cattle, the most common practice is the natural breeding in the case of small ranchers, because in the case of middle or big rancher it is used the artificial insemination, with the aim of get a good mixed breed which should be more adapted to the temperature and at the same time, it should be more productive. However, to get the same results the small ranchers have in their stable different species of cattle and different species of breeding animal, especially with the European, trying to get the best productivity.

The whole livestock system in the Yucatan region is oriented to the meat market, therefore is really important have under control all diseases associated with the cattle, pig or sheep production. The most common problem is the tick plague. Then, the ranchers give to the cattle twice or three times medicaments again ticks, the application of those medicaments could be done over the skin or through an injection, however, the last one is a combination with other medicaments again parasites that are inside cattle's stomachs.

Nevertheless, the medicaments against parasites are used in the calves twice in a year from 7 or 8 months old. If the rancher don't use the medicament on their livestock the consequences are undernutrition, low meat production, and at the end death of the cattle. An additional problem is the rabies because of the bats that are living near to the stables.

In the case of the sheep, they are breed only within the same breed, e.g. Bluebelly or Blackbelly, and so on. They have three parturitions each two years. Likewise, they are treated against ticks and parasites through application of medicaments by injection or over the skin each two or three months.

The Market

As it was mentioned before, the whole livestock production in Yucatan is oriented to the meat market. Thus, the ranchers sell the cattle when they reach approximately 450 Kg, it means when they have around two years. Some of the calves are bought when they get 180 kg in order to be a breeding animal in other stable or to be slaughter for meat production ($21 per kg, around 1,3€). There is also milk production but it is only used for feeding the calves, a cow produce approximately 15 liter per day.

The manure of the cattle is gave for free to anybody who needs it, because for the rancher there is a sanitary problem associated, and if they sell the manure probably nobody will buy it, according to their opinion. The use of this manure is mainly on the farm production for vegetables or for fruit production.

The Bald Pig (El Cerdo Pelón)

The Universidad Autonoma is trying to preserve the native Yucatan pig breed, the bald pig (cerdo pelón) that doesn't have any problem with ticks, however, they face the same problem that other species, parasites, and nevertheless they are not under any treatment against those parasites. Some of their characteristics are a lower weight in comparison with the American specie, and that they use to have 8 piglets, but it is normal that two or three die because of weather conditions or diarrhea. The piglets that survive are separate from the mother when they are two months old. The feed for this pig is only grass but sometime there is a pig portion of *Leucaena*.

Visit of an ejido orange-juice-factory

Nina Rakow

23.03.2009

Cattle

In the afternoon we tried to visit a cattle-farmer, but as he just returned from the United States where he lived for nine years and has not been working in farming he did not know many things about livestock farming and also his animals were not in a good shape - one could see the hip bones and the rough hair that is a sign for mineral deficiency. He had 12 animals in the place where we were and another 12 in another place. 14 of the animals were mother cows which he kept. And he had two breeding bulls. So he named himself a smallholder. He had another income that from oranges and lime. As we got to know during the whole excursion, the price for lime is better than the one for oranges.

The animals are fed with braches from oak- and ramon (*Brosimum alicastrum* Swartz) -trees which the farmer bought and also with grass and sweet potato. The cattle holder only uses the cows for meat production but not for milking. He vaccinates the animals twice a year. The ones working with the cattle are him and his brother. That was everything we could find out because the farmer was in a hurry and could not tell us more.

Afterwards we visited an orange-juice-factory that is named:

Union de ejidos citricultures; Planta Procesadora de citricos; Mayan juice

…but when we arrived the processing had already stopped. Our guide, Jorge Chan, explained to us the processing steps for the oranges, mandarins, grapefruits and lemons that are processed in the factory. They are producing two main products in the factory: essential oil and concentrated citrus juice that is then further processed in another factory. The juice is more a secondary product because the essential oil is more valuable. Because the essential oil is so valuable, it is very important to control the quality of the fruit. The fruit has to have an appropriate state and must not be contaminated with any chemicals or manure. The factory exists since 29 years and since 2003 they are also producing essential oil out of the citrus fruits. The fruits arrive in the factory in a small lorry. The mandarins are protected with boxes. The other fruits come just directly on the lorry. One lorry contains five to ten tons of fruits. This size shows that the farmers of the citrus plantation are small-scale farmers.

Our guide explained that the farmers as well as the producers are part of the ejido which means that they are producing their products as a cooperative. They have 12 owners of the factory. They also have special farmers that belong to this ejido from whom they buy the fruits for a good price (ca. 950 Pesos per t). As the oranges of this region often do not look good at the shelf, the juice factory is the best way to sell oranges for a farmer because on the local market he only gets a very low price and for other markets the outer appearance is too bad.

In total all farmers that sell their fruits to this factory have an area of 15.000 ha. When the fruits arrive they are first weighed, then the fruits are inspected. Fruits that do not have the right quality are sent back to the lorry.

The factory has a capacity of 16 silos to store about 380 tons of fruits. This store has been built in 1999 out of wood. Nowadays they would not build it out of wood anymore but of stainless steel to prevent fungi.

In case of oranges they can process the amount they can store in about 20 hours. That means in one hour 18-20 tons of oranges can be processed. From one ton they obtain 5-6 kg essential oil and 18 gallons (1 gallon= 3.8 l) juice. In case of lemon the amount

processed in one hour amounts to 11 tons, but here the oil extraction is more important. From one ton of lime they obtain also 5 to 6 kg essential oil but only 13 gallons juice.

If the store is full, they do not buy more fruits from the farmers because they also do not have more space to store the juice. They can only take it to Merida but there they have to pay for the storage.

The first step of the procession is to wash the oranges with double-brushes and water coming from the top. In this step also bad fruits are taken off. The second step is the extraction of oils out of the shell of the fruits. For this the high osmotic pressure in the cells has to be broken by pressure from all sides. This process also happens under water. Its outcome is a suspension of water and essential oils that are then filtered to separate the solids. The mixture of oil and water is then centrifuged to obtain a suspension that contains 80 % of essential oil. The leftover water is recycled into the washing process again.

Afterwards the suspension is put into a high speed centrifuge to receive essential oil of 99%. The leftover water is again recycled into the first processing step. The essential oil then goes into a barrel out of steel with a plastic layer where the oil is protected against oxidation through nitrogen. Then the wax-content in the essential oil is separated through freezing at 16-18°C because at that temperature the oil does not freeze but the wax does. So it can be separated by a flow separation to pure oil. This is sold for skin cream, as flavour agents and medical substitutes.

To produce the juice, the fruits are separated by size. The factory contains seven squeezing units in which fruits of approximately the same size are squeezed completely automatically. A squeezing unit consists of a system of knives that cut, open and squeeze out the oranges. The shell is disposed as animal fodder. The juice is then let through a stainless steel tube and pressed through a filter with a diameter of 0.9 inch (1 inch = 2.5 cm). By this filter the seeds and thick shell particles are filtered out. Then the juice goes to a second filter with a diameter of 0.016 inch to receive fresh juice that is then evaporated by low pressure evaporation and let in two vertical extraction units.

The evaporation consists of several steps. The first is the heating and pasteurization at 90-95ºC for three seconds to kill bacteria and inactivate enzymes to get the juice more stable. Through this the water is evaporated but the juice stays. Through further evaporation a concentration of 6.5 l of juice to 1 l water is obtained. For the conservation the sugar content has to be increased to avoid bacteria. Then the juice is subjected to a flash, where the temperature decreases very quickly to 10ºC. The cold juice is then filled into stainless steel basins to cool down to 0ºC. The juice is than filled in barrels that contain 52 gallons. To provide contamination of the juice there are two plastic layers in every barrel that separate the barrel from the juice. Each barrel has a label which says when, where and at which factory the juice has been produced. In this factory they store about 30 barrels at a temperature of 18ºC. Like this it is possible to conserve the juice unspoiled for 18 month. The whole process is done without chemicals.

They have several customers for their products such as gepa and Hipp (http://mayanjuice.com.mx).

Visit of the Veterinary and Zootechnical Faculty of the Universidad Autónoma de Yucatán (UADY)

Moritz Reckling

24.03.2009

Summary

The Universidad Autónoma de Yucatán (UADY) is an autonomous public university in the State of Yucatán working with an applied science approach. It has the four major departments, Agro-Ecology, Veterinary Zoology, Marine Biology and General Biology. With the visit we had the chance interacting with students and discussing the availability of scientific literature and the study fees compared to other countries and universities in Latin America and abroad. Besides, we visited the unique beekeeping unit of UADY.

Report

The Universidad Autónoma de Yucatán (UADY) is an autonomous public university in the State of Yucatán, with its central campuses located in the state capital of Mérida (Figure 1). It is the largest higher educational institution in the state. UADY has four major departments focusing on an applied science approach:

- Agroecology
- Veterinary Zoology
- Marine Biology
- Biology

Courses are offered at the undergraduate level with the licenciatura as the final degree (can be compared to the diploma in the German system), postgraduate courses finalizing with the maestrías (Master´s degree) and a PhD program. In the current B.Sc. courses which have a duration of five years, the majority studies veterinary zoology (322 students), followed by biology (202), marine biology (94) and the new course agro-ecology (44). In the M.Sc. courses which take three years, tropical animal production has most students (65), followed by nature conservation with ten students, and 27 students are in the PhD program.

The institution was established in 1922 as the Universidad Nacional del Sureste and its lineage may be traced back to a Spanish Empire Royal Decree promulgated in 1611, that allowed for the creation of the Colegio de San Francisco Javier in Mérida (Reseña Histórica de la UADY).

Our group had the honor to be welcomed by the director of the faculty and we had the chance to interact with students of different disciplines.

Figure 1: Main building of the Universidad Autónoma de Yucatán in Merida (Source: http://panrimo.com/wp-content/uploads/2008/07/uady-bldg.jpg).

The University has different facilities to allow practical research. Besides the herbarium, laboratories, green house and a research station, the university has a unique beekeeping unit which we visited. The unit contains around 10 beehives of different varieties of the local Yucatan bee species *Melipona*. This variety has a pre-Hispanic origin and its honey was already used by the Mayas to sweeten their food and in natural traditional medicine. The Mayas believed that the *Melipona* bees were protected by their traditional gods and the Spanish did not bring new bee varieties to Mexico because the *Melipona* bee was already very well established and resistant to the *varroa* mite. 17 different Yucatan species can be differentiated and they were the only bees domesticated by the Mayas, others served for wild collection in the forests. Although, *Melipona* and *Melifera* (European variety) originate from the same genus, they have very different characteristics. *Melipona* is much smaller, it does not sting but the defense strategy is to built thick wax layers in the bee hive, it has smaller individual storage units, resistant to *varroa* mite, high water content in the honey but still having good storage abilities. *Melifera* bees are more productive and one hive contains 50,000 bees compared to 4,000 of the *Melipona* bee. Nevertheless, prices for *Melipona* honey are much higher with around 55 €/l compared to 3 €/l for honey from *Melifera* bees. The beekeeping unit is used for demonstration and research to discover additional information on this unique species.

While interacting with the students we discussed different topics e.g. the poor availability of scientific literature due to no free access to scientific journals through the library and no possibilities to order books from other Mexican universities. Although theses are in general written in Spanish, students are reliant on current international research findings and therefore English literature in scientific journals. We compared the access to scientific literature of different universities in our group. One student from the Technical University of Veracruz (Mexico) confirmed that they face the same constraints like at UADY. Another student from 'La Salle' University (Mexico, private) explained that they have as good access

to scientific literature as the student of the University of Talca (Chile). Both compared it to the standard of the University of Göttingen (Germany). Furthermore, we compared the fees people from our group and students from UADY pay for the different universities. Table 1 indicates the total fee per year for different countries, universities and courses.

Table 1: Comparison of annual fees of different Universities, courses and countries

Country	University	Course (M.Sc.)	Total fee per year (€)
Mexico	UADY	Agroecology (B.Sc.)	130
Mexico	Veracruz Institute of Technology	Agribusiness (B.Sc.)	140
Mexico	La Salle	Food Chemistry	4,545
Chile	Talca	Business Engineering	3,000
Germany	Göttingen	Agribusiness	1,400
Germany	Kassel	Organic Agriculture	440
Norway	University of Life Sciences	Agroecology	80
England	Not specified	Not specified	3,300 (estimated avg.)
Canada	Alberta	Ethnology (B.Sc.)	3,437

The table indicates a high variation of fees even within continents and countries. In Mexico, fees vary according to the ownership. Federal Universities (like Chapingo, UNAM, Politécnico and UAM) charge fees from 1 to 400 Mexican pesos per semester, state Universities charge from 500 to 5,000 Mexican pesos per semester. Then there are some Institutes and Universities partly founded by the federation and private founding, they charge more than 10,000 pesos per semester. Furthermore, private Universities charge from 10,000 up to 90,000 Mexican pesos per semester depending on the University (if it is renowned). Besides fees depend for all Universities on the subject studied e.g. sciences, engineering, medicine, architecture and graphic design are some of the most expensive subjects to study and the number of courses. However, most students are reliant on scholarships provided by the Universities or other federal or private institutions that cover the fees and in some cases maintenance for living. Scholarships are somehow a precondition for nearly all students when they apply to study abroad which are often founded from the receiving University or other international programs like the German Academic Exchange Service (DAAD).

Reforestation activities in lime stone mining in Yucatan
('Reforestatión De Canteras MAPSA Comprometidos con la Naturaleza')

Moritz Reckling

24.03.2009

Summary

A lime stone company in Yucatan with well managed reforestation activities was visited. Recultivation of the mined area is carried out to comply with the national mining regulations and having timber production as a future income generating activity. Furthermore the reforestation measures will be opened to tourist and research groups to bring an additional income during growth periods.

Report

Lime stone mining is a common practice in Yucatan due to the high occurrence of lime stone in the area. Many companies leave the area fallow after mining and do not apply any recultivation measures, although this is against the national mining regulations. The company visited, however, tries to comply with these regulations on the one hand and uses this opportunity to invest in timber production through intensive reforestation of the mined areas.

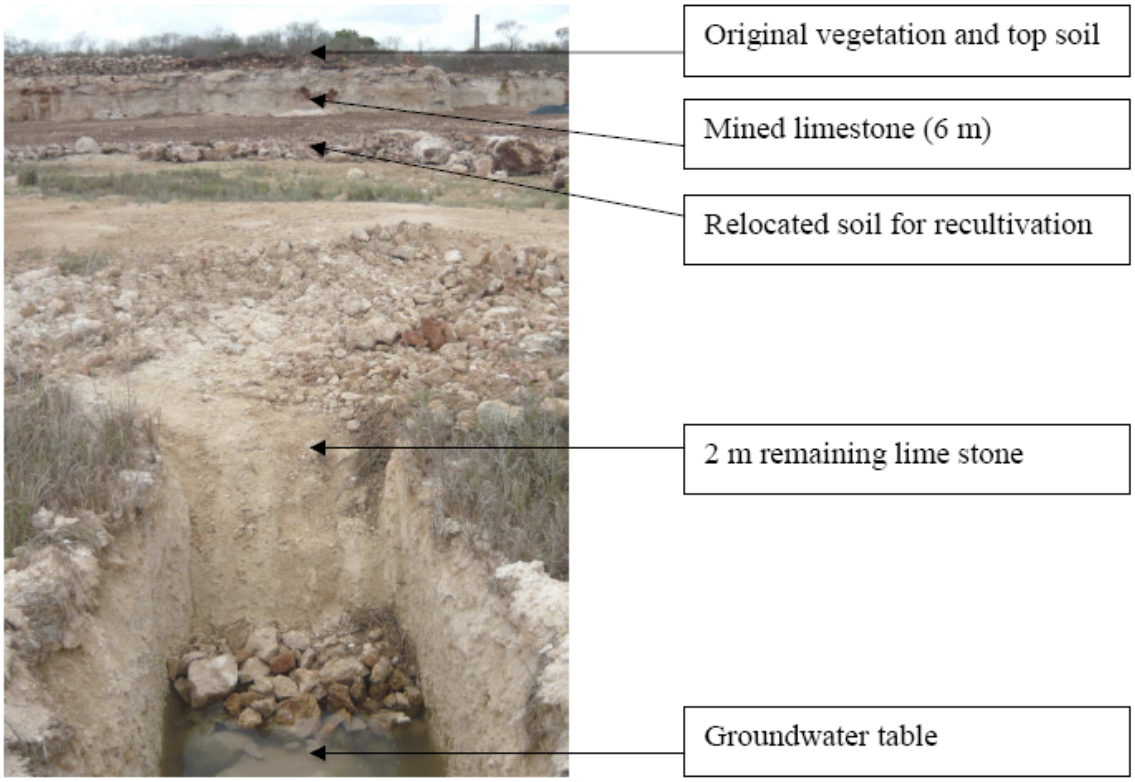

Figure 1: Profile of limestone and soil layers before and after mining

Due to the aim of landuse after mining, the top soil layer (around 2 cm) is removed before mining and stored. After mining around 6 m of lime stone has been removed and processed, and the top soil is spread again on the area to enable recultivation. The ground water table is originally very close to the surface in the area with 7 m before and 2 m after mining. The shallow water level does not allow deeper mining. Figure 1 shows the profile of the limestone and soil layers before and after mining.

The company has a 30 years long experience with reforestation. They started with planting fruit trees which where stolen by people due to the large unsupervised and non fenced area.

Fodder trees where less attractive to be stolen and generated a good income. Today all kinds of timber trees are planted, e.g. caoba (*Swietenia macrophylla* KING), teak (*Tectona spp.*), ceiba (*Ceiba pentandra* (L.) GAERTN), chiit (*Thrinax radiata* LODD. EX J.A. & J.H. SCHULT, local palms used for thatching local houses), eucalyptus (*Eucalyptus spp.)*, leucaena (*Leucaena leucocephala* LAM; DE WIT) and many others. So far 55 ha have been recultivated with trees and the recultivation area grows continuously.

Figure 2: Recultivated mining ground with different fast growing tree species

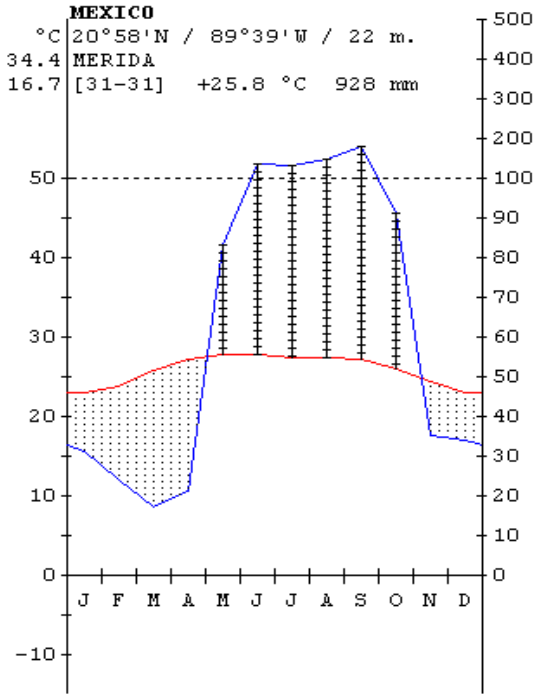

Figure 3: Climate diagram Merida

As the climate diagram (Figure 3) indicates, the climate is semi-arid to sub-humid in the region with a total annual precipitation of 930 mm. The potential evapotranspiration exceeds precipitation in the months November to April which is responsible for long drought periods. In those months all trees are irrigated by modern drip irrigation systems adding another 950 mm annually with a constant supply of 3 times in a week for 3 hours.

Agroforestry is scarcely carried out for producing animal fodder crops (maize and mucuna) and only when the timber trees are still in a young stage.

There are only few disease problems but some occur for example in the case of the caoba tree. Here the early growth stage of 3-5 m is most sensitive and therefore early irrigation applied to foster the growth rate. In addition, natural plant protection measures are applied recently, replacing former chemical inputs.

To increase soil fertility, a liquid fertilizer is applied. This fertilizer is produced from an on farm vermicompost. Local organic material is transformed to nutrient rich fertilizer by red compost worms and constant irrigation.

Blue coloured cotton residues from a cotton processing plant are used to be added on very nutrient poor areas to increase soil fertility and the water holding capacity. The definite origin and chemical components of the residues were unclear but it seemed to be high contaminated trash which could be harmful for humans, animals and maybe the environment. However, recycling and proper waste management is uncommon in the area and it might be a possible solution to grow timber trees on it instead of burning it or polluting sea or river waters. The production of food or fodder crops on this material should, however, be avoided due to health risks.

The economic turnover of the reforestation activities are of course not the main income of the mining company but a long term investment, which will bring high incomes in the coming ten to 30 years. The reforestation activities however, still plays a minor role compared to the mining activities. To get an impression on the size of the forestry department compared to the mining department the number of workers employed can give an indication. For mining activities 100 workers are employed and for the reforestation only three (plus 30 workers who are engaged in the top soil removal and deposition). The main extra costs are basically for removing, storing and returning the topsoil which costs around 9,000 USD a year. Further costs are electricity for irrigation, labour costs and seed and seedling materials. It could be supposed that when the building industries faces problems and less lime stoned is demanded; the forestry department of the company can be of much higher value. In addition to the timber sales a kind of reforestation tourism is planned to have another income generating activity. When asked on our opinion on that idea we suggested including more demonstration material indicating the different growth and development steps of the reforestation process. Besides, we suggested complying with environmental and social certification schemes such as the Forest Stewardship Council (FSC) and e.g. Naturland forest certification. Such certification schemes could provide better marketing options on the international market and would assure visitors that the production is environmentally and socially friendly managed which could increase there attention and interest significantly.

Tilapia and crocodile farming near Veracruz

Alison Roberts

25.03.2009

We had a really early start this morning, waking up a 4:30AM in Villahermosa and boarding the bus at 5:00AM. Along the way we stopped at a....

Pineapple plantation

- pineapple is adapted to dry conditions, needs a lot of sunlight
- the leaves have a waxy surface, are formed in such a way so that rainfall is directed to the roots
- pineapple is not ideal for intercropping, therefore the inter- and intra-cropping distance between plants is very small as we saw in the field – there were roughly 2,000 pineapples per hectare planted there
- one fruit is produced per plant per year, fruit need about five months to ripen
- after the harvest the mother plant produces "suckers", which are planted directly in the soil to produce new plants for the next harvest
- pineapple is full of vitamins and enzymes, considered a "brain food" and is used in weight loss

After a very long bus ride we arrived at Veracruz around 12:00 PM and made our way to...

"El colibri" farm

The farm has three main areas: tilapia, crocodiles and pheasants

Luis was our guide for the tilapia part of the farm. He studied aquaculture in Veracruz and now manages a second tilapia farm which we saw in the afternoon.

1) Tilapia

- first we visited the fingerling production lab where 3,000-4,000 eggs are extracted from the females every week. To collect the eggs they lower the water level, net the fish, open the gill and flip them downwards – eggs are collected in a basin below
- from there the eggs are brought to the blue containers in the hatching yards; fertilized eggs hatch in 3-7 days, depending on the temperature
- after 7 days the tilapia are graded according to 5 different weight sizes – larger fish go to different tanks
- many fingerlings are produced over the month and which are sold all over the country – either they are shipped by plane or picked up directly by producers – Luis told us that producers should be prepared (i.e. bring ice) when they do this because the fingerlings will die in the heat otherwise
- to transport the fingerlings, the farm fills a plastic bag full of them, lowers the temperature and over-saturates the contents with oxygen (200% saturation) – can live up to 24-36 hours like this
- a bag of ~35,000 fingerlings costs around 2,000 pesos (50 cents a fish) → profitable business
- there is a large difference in the fingerling's sizes, the farm has recorded 0.1g-13g in the same batch

- once the fish reach 20g they don't grow as fast, once they reach 100g they turn grey – this is not a defect, just a genetic mutation
- grey fish are more popular in the market
- it is possible to produce genetically male fish (with the use of hormones in the feed during the first week) but the farm does not do this because of costs involved
- there are several different tanks according the fish's size
- the fish are fed a mixture of min. 50% corn and 32% protein
- 120 liters of water is pumped per second, waste water goes through the wetlands area behind the farm and is pumped back, some tanks have higher levels of ammonium and nitrates
- the farm does not use antibiotics or hormones, only every 5-6 months if there's a breakout

2) Crocodiles

- there are roughly 400 crocodiles on the farm
- they are fed the leftovers from the meat production plants
- they mate in May and there are roughly 15-30 eggs per nest
- retrieving eggs is tricky: one man takes the eggs while 6 others stay on guard with sticks. Luis said there hadn't been any serious accidents... yet!
- once eggs are retrieved, the nest must be destroyed
- the main market is for their skins, then their meat (there isn't much meat, though: max. 2kg)
- most crocodiles live 3-4 years, average length is 1.5 meters
- one variety of crocodile on the farm is the crocdillo muruletti, comes from the Golf of Mexico
- females are separated from the males due to the heigh rates of cannibalism
- crocodile meat costs P$250 per kilogram
- crocodile "house" -they stay in the dark house for 3.5 years, darkness minimizes stress levels

3) Wild Boar – Picali

- native breed, destined for the game farm

4) Pheasants

- females are sent to the restaurants, males are primarily for shooting, game farms, etc.
- they are fed chicken feed
- eggs hatch after 20-23 days

After about a 45 minute bus ride through the suburbs of Veracruz we arrived at...

Luis' Tilapia Farm

- less water is pumped at this farm: 20L per second yet he produces three times more
- Luis manages the farm well: for example, the light bill went down from P$ 900,000 to P$ 350,000; 6 tanks were in effect when the farm was purchased, now there are 29 tanks
- profitable business: 82 tons in 10 months, P$ 3.5 million
- Operational costs:
  - paddle wheels for the tanks: P$ 500 per month
  - pump: P$ 20,000 per month
  - feed: 1.6 kg per fish P$ 8.20 per kg
  - labour: 10 people working at P$ 10 per hour
- the farm is the 5th or 6th biggest tilapia operation in Mexico, and the biggest in the state
- Luis' job is to help prevent farmers from losing fish and not invest in faulty equipment
- pests on the farm are birds (air gun used to scare them off), dogs (esp. in the smaller tanks)
- feed is imported from Chile, consists of a fish feed meal made from anchovies
- because prices of fish meal have increased tremendously, soya is becoming an alternative yet because fish are carnivorous, they prefer the fish meal instead of soya
- maggot feed is only used for ornamental fish, is too expensive for the farm.

From there we stopped to take pictures and eat ice cream at Hernan Cortez's first house in La Antigua, an area outside of Veracruz. From there we went to listen to the "Grandfather" of Aquaculture in Veracruz and see his farm (at night), which was called...

Granja Acuicola RAYANA

- farm is 30 years old; produces tilapia, prawns and fingerlings
- Juan from the Colegio de Posgrados gave us an introduction to this institution, which used to be with the University of Chapingo
- They focus on tropical agroecosystems, and apply a 'holistic' method that involves an ecological, technical and social approach to agriculture
- The grandfather's story: he bought a parcel of land which wasn't being used and had to be a ejidatario (ejido owner) and developed three ponds on this land. Then, with a credit from the bank, he built 8 more ponds and asked for surrounding land to be donated
- the Grandfather is determined that freshwater aquaculture should be improved and expanded
- he told us that there is actually a shortage of tilapia in the are and that Mexico even imports tilapia from China! But he says that Mexicans are willing to pay more for fresh, unfrozen fish
- challenges to Mexican aquaculture include a lack of good infrastructure in Mexico, and ways to implement and enforce new aquaculture rules and laws, both local and international
- Nonetheless the Grandfather believes that quality will prevail and thus he helps his fellow aquaculture farmers by providing them with capacity building courses free of charge

Question-time with the Grandfather:

- No, an organic market for aquaculture does not exist in Mexico
- When asked about the environmental pollution in the municipality, he responded by telling us that he thinks his water is improved by aquaculture
- Sure there are enterprisers only interested in making money, but he is determined that if one loves one's farm, one will deliver a quality product, which wins every time
- What about distribution? ~25 farms produce 50% of the tilapia in the area, there are thousands of other smaller farms that make up the other 50%
- Because current demand for tilapia exceeds supply, fish are imported from China and competition exists but if they can afford it, Mexicans prefer to eat fresh, local tilapia
- He does not produce more prawns (although they are much more profitable) because he lacks space and the price of land around his farm is too high for him to expand

From Veracruz via Puebla to Texcoco

Daniel Stout

26.03.2009

13:30 h: (Bus leaves Veracruz).

14:00 – 14:20 h: **Some clarifications regarding earlier sites:**

1) The visit to the Lacandona farmer (near Bonampak) on Friday 20th March:

On his site was found a bottle of the herbicide 'Roundup'*. The farmer rushed over to explain that it was not used as a herbicide, but as a poison against mammalian species (such as mice) damaging his cassava crops; he claimed he had previously used gramazone (paraquat) without success. This explanation seemed untrue, and in any case the use of 'roundup' would be illegal due to the site being part of a Biosphere Reserve. It was suggested that the farmer was probably too busy with his job guiding tourists to be able to manage his harvests without the use of herbicides.

*'Round-up' is not used in Europe due to its property of being easily transported into groundwater, and toxic to aquatic organisms.

2) The visit to the tilapia farm(s) in Veracruz on Wednesday 25th March:

As there were no specific fish antibiotics available, more general antibiotics (such as those used on, for example, dogs or horses) were used in the operations. Such antibiotics can remain in the body for about six months, and since the fish are harvested after about eight months, it is possible there are remains of antibiotics upon harvesting.

3) Cropping of drug plants in Chiapas:

In Chiapas there does exist a problem with drug plant production, which is also related to the conflict over water with Guatemala. Due to political instability, and a large number of Europeans in the area (who are seen as potential users of marijuana), drug plant production takes a considerable share of the total cropping area. However, the production of cattle and maize are most likely still the main crops.

The production & transport of drug plants is the ostensible reason for the frequent placement of military checkpoints along the roads in Chiapas. But there are many who believe that parts of the regional and/or national government actually collaborate in the trade.

Returning to observations during today's journey

14:30 h: Fields of sugar cane can be seen here, some of which have been fairly recently burned; it is common practice to burn at some point before the harvest, then to burn again after harvesting – the latter practice stimulates the plant to resprout, meaning it can be harvested again in some months. The cycle can be repeated until the plant has become too weak to produce a desirable crop.

14:45 h: In ecological terms, we are now in a dry zone area again (Eastern slope of the Sierra Madre Oriental), with circa 600 mm annual rainfall. The climate zones may change over very short distances. As we are still not high enough to be at the height of cloud formation, the coastal rains from the Atlantic Ocean are not reaching this area. In such areas, agriculture of crops like sugar cane or fruit crops like mango is only possible when irrigation is available. The natural vegetation in such areas mostly consists of drought-tolerant, and even succulent plants.

15:50 h: Currently we have reached a relatively high altitude – it is signified by the return of oak and pine species as the dominant vegetation, and it also means a greater amount of rain

than in the location passed through one hour ago. Here we also see what appear to be the quintessential Holstein black and white dairy cattle, and we also see much locally-produced cheese being sold on the road. It seems the area is quite productive.

Regarding the climate here, the rainfall typically comes from the Caribbean Sea (part of the Atlantic Ocean), hitting the mountains before cooling and falling. The rain here will be regular throughout the year and will easily exceed 1000 mm, with a figure of approximately 1500 mm being more likely. There is a 'dry season', but it is not so pronounced. This high rainfall total and frequency is reflected in the landscape, which is distinctly green.

16:00 h: As discussed in earlier days, there is currently a crisis in orange fruit production due to world overproduction and competition, leading to extremely low prices (at least here in Mexico). Currently we have seen that 20 kilograms of oranges are being sold for approximately one euro.

17:30 h: Once again we have descended into a drier area, where the rainfall is estimated to be circa 600-800mm. As we have also seen towards the beginning of the excursion in the Valley of Mexico, there are large irrigated fields here; in the Valley of Mexico the fields seemed mostly to be of wheat, followed by maize, whereas here the irrigated fields seem to be mostly wheat and alfalfa.

[ca] 20:00 h: Arrival in Texcoco (Mexico City), approximately two hours after darkness has fallen.

Visit to CIMMYT I – the organization and its mission

Verena Tigges

27.03.2009

Summary

Visit of CIMMYT – El Centro Internacional de Mejoramiento de Maíz y Trigo - Headquarter in Texcoco. On the agenda was the introduction by a German PhD student from Hohenheim explaining her personal way to CIMMYT. After a guided round tour through the building and a summary on CIMMYT's history, several researchers presented their actual work. As the crowning finale, we visited the CIMMYT Maize and Wheat Gene Bank, containing all actually known maize and wheat varieties.

Figure 1: CIMMYT Headquarters in El Batan (Source: cril.cimmyt.org)

CIMMYT – the organization and its history

The international maize and wheat improvement center is a non-profit research and training institution that that works on the sustainable improvement of maize and wheat productivity and quality. It is a part of the CGIAR (Consultative Group of International Agricultural Research) and funded by several countries and organizations such as the Bill and Melinda Gates Foundation, the European Commission and the World Bank. The organization employs about 100 specialized research staff and 500 support staff operating in 14 countries of the world. Their research activities are organized in the Global Maize Program, Global Wheat Program, Genetic Resources Program, Socioeconomic Program and the Conservation Agriculture Program.

At our tour through the in CIMMYT headquarter we passed many information boards explaining the situation of poverty and hunger in the world and CIMMYT's efforts and achievements in the fight against malnutrition. Our guide showed us the offices of numerous scientists, laboratories, and the big library open for every interested person. And she presented us to the personality of Norman Borlaug, the so-called "Institutional Hero" who was the father of the Green Revolution and heart of the creation of CIMMYT.

After his doctorate in forestry science Borlaug became geneticist and plant pathologist in the Cooperative Wheat Research and Production Program in Mexico where he developed high-yielding, short-straw, disease-resistant wheat. For this work he acquired the Nobel Prize in 1970. But his real merit is not only his work as scientist but also his dedication to implement his results in the fight against hunger and poverty as well as his humanitarian and political engagement. With his life work he mainly contributed to CIMMYT's philosophy and approach to science at present.

Figure 2: In the office of Norman Borlaug – facing an Idol?

CIMMYT's approach to research

"No matter how excellent the research done in one specific discipline, its application in isolation will have little positive effect on crop production. What is needed are venturesome scientists who can work across disciplines to produce appropriate technologies and who have the courage to make this case with political leaders to bring advances to fruition" Norman Borlaug

Due to this philosophy, an important aspect of CIMMYTS research approach is the interdisciplinarity of their work and the recruitment of scientist with different backgrounds. Dr. Kevin Pixley, associate director of the global maize program, presented us with CIMMYT's

Global Maize Program to demonstrate CIMMYT's aims, function and the way of interdisciplinary collaboration of CIMMYT's researchers.

Aim of every scientist's work is to improve food security and the harvest index in developing countries cultivating maize. All maize research works can be divided into two fields: stress tolerance and nutritional value.

An important part of CIMMYT's work today is to create breeds that perform well under the on-farm situation in tropical and subtropical countries where small plots worked by hand without irrigation, fertilization or fungicides. To provide different adaptations of the new varieties, CIMMYT has research sites located under different climate conditions in Mexico (El Batan, Obregon and Toluca) and 14 other countries. Most important for maize breeding are Columbia, Nepal, Zimbabwe and Nigeria. Problems that farmers face with breeds developed under ideal conditions are N- and drought stress, insect problems and deficient genetic resistance. Other difficulties using conventional seeds are the grain handling and storage. In farmer participatory trials ("Mother Baby Trials") breeds that meet farmer's needs are selected. Another part of global maize programs research is the analysis of the nutritional habits of maize consumers and their needs of vitamins and nutrients, e.g. vitamin A. DNA-analysis serves to evaluate the nutrient content in the grain. The application of this method saves a lot of time and money compared to the conventional analysis of the grain. Hence the enhancement of maize DNA analysis plays an important role on CIMMYT's research agenda. Nutritionists will study the conversion and nutritional process as well as the bio-availability of the nutrients to predict nutritional losses. Associated sociologists (of the Socioeconomics Program) assure the relevance of their work: they are charged with the presentation of the new breed to farmers, and study and provide the way of implementation and the promotion of a new breed as well as the communication of nutritional values and needs.

Personal insights into CIMMYT

Vanessa Prigge, PhD student from Hohenheim, presented her PhD project to us and gave us her personal insight into the research organization. She works on the development of doubled haploids in tropical maize. Double haploid maize lines are important in the process to create hybrid varieties. The technology she works on could be used to achive a rapid development of completely homozygous inbred lines. This technique consists of four main steps: First an induction cross is made, using the inducer genotype. In step two, she identifies the kernels with the haploid kernel. Then she doubles the chromosomes artificially using a colchicine treatment to create the generation D0. Through a selfing of these plants she develops her D1 invert line. With the acceleration of inbred lines that can be achieved with this technique, she hopes to contribute to the reduction of costs of the nursery and maintenance maize breeding work.

Vanessa Prigge did her first internship in a CGIAR Center at IRRI (International Rice Research Center) at the Philippines during her M.Sc. studies. There she enjoyed especially the international and open atmosphere. The experience she made during this internship encouraged her to apply for her PhD study at CIMMYT in cooperation with University of Hohenheim. According to Vanessa Prigge, an internship or PhD at CIMMYT can be highly recommended - the scientific atmosphere, the various research facilities and the support of experienced and notable scientists are very helpful and motivating for your work. For all those who might be interested in such an internship or work: Dr. Kevin Pixley mentioned that CIMMYT job announcements can be found at the cimmyt.org homepage.

Conatct: Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT)

Km 45 Carretera Mexico-Veracruz

El Batan, Texcoco, Edo. de Mexico, D.F.

Tel. +52-5804-2004; Fax. +52-5804-7558

Visit to CIMMYT II - The Genetic Resource Program

Sergio René Araujo-Enciso

27.03.2009

CIMMYT, as a non-profit organization, is committed to the development of sustainable agriculture. In order to achieve it, several programs are managed.

The Genetic Resource Program was created in order to ensure CIMMMYT to have a collection of maize and wheat genetic resources available for people all around the globe. As for that it was created the "Wellhausen-Anderson Plant Genetic Resources Center", which we visited during our excursion. It was named after Edwin J. Wellhausen, who took part on the conservation of Mexican maize species; and Glenn Anderson, who worked actively on the green revolution. The actual facilities of the center were opened in 1996.

In the Plant Genetic Resource Center are stored more than 20,000 samples of maize and *teosinte* (a plant relative to maize); and more than 160,000 samples of *Triticeae*, including wheat. The broad range of genetic material is stored under two different conditions for different purposes each one. The first is the active collection, which is stored at -3°C in order to ensure the viability of the seeds for 25 to 40 years. The second is the Base Collection, which is stored at -18°C, and maintains seed viability for about 50 years. In order to store the seeds, it is followed a strict process that allows to identify its variety, genetic material and viability. Such process includes among many other steps, health procedures, seed cleaning and drying, and viability tests. The seeds are packaged in different ways. For the Base Collection 1 kg of maize or 100 grams of wheat are put into laminated aluminum foil packets. For the Active Collection, 2-3 kg of maize can be stored in a plastic container; and 250 grams of wheat in a laminated foil packet.

Upon request is possible to obtain seeds from the Plant Genetic Resource Center. Usually the seeds are shipped in small amounts. Between 50 and 100 seeds are shipped for both, maize and wheat. The seed quality is checked before shipping to the final destination. Furthermore plant sanitary requirements concerning international and national laws are followed. As a considerable amount of seeds are shipped, it is necessary to regenerate the seeds in order to ensure their availability. When a seed is under regeneration and some third party asks for such material, it might take some time to get it.

As the main task of the plant Genetic Resource Centre is to keep the genetic resources, they work together with governments, international organizations and research centers around the globe to obtain more genetic resources. Such activities are carried out under the scope of different international laws that are related to the management of the plant genetic resources. Nonetheless the non-profit nature of the genetic resources collection, recently many countries have decided to stop cooperation with the center and are no longer sharing their genetic resources. Anther limitation for obtaining genetic resources is the patents hold by big companies.

An important component of the Genetic Resource Program is the Applied Biotechnology Center (ABC). The objective of the ABC is to develop tools and technologies that improve the efficiency in the utilization of the genetic resources. The two main projects of the ABC are the conservation and characterization of maize and wheat genetic resources, and the development and test of methodologies for genetic improvement. Furthermore, they also contribute to other major programs at CIMMYT such as the Global Maize Program and Global Wheat Program.

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Schedule of the preparatory seminar / presentations

Thirteen student presentations on political, social, economic, bio-physical, agronomic and ecological aspects of Mexico along the thread of the country's history were held during the preparatory seminar. Each topic had 20 - 30 min. presentation plus 10 min. discussion. The presentation schedule is given below.

No.	Title	Presenter
Wednesday, Oct. 22nd 2008, 17:30 - 20:00 / Seminar room S1, Steinstrasse 19, WITZENHAUSEN		
	Introduction to programme and host country Mexico, assignment of seminar topics, Schedule of further meetings, Credits	Hülsebusch, Bürkert, Schlecht, Dohrenbusch
Saturday, Nov. 29th 2008, 10:00 - 14:00 & Lecture Hall 06, Albrecht Thaer Weg 3, GOETTINGEN		
01	Physical geography, climate zoning, vegetation zones and agro-ecosystems	Nora Honsdorf Charlotte Hohls
02	Forestry in Mexico & certification of forest enterprises	Miriam Guth
03	Timber market and Non timber forest products (NTFP) in Mexico	Hendrik Brand
04	The Mexican livestock sector	Rita Khathir
Saturday, Dec. 6th 2008, 10:00 - 14:00 / Seminar room S1, Steinstrasse 19, WITZENHAUSEN		
05	The Aztecs and the Mayas – two contrasting powers in Mesoamerica	Sandra Gonzalez Monge Edinson Rivera Aedo
06	From political independence to the revolution with Emilio Zapata & Benito Juarez	Matthias Klaiß Verena Tigges
07	Political and Economical Overview of Mexico	Sergio Rene Araujo Enciso Fabian Cruz Uribe
Saturday, Jan. 24th 2009, 10:00 - 14:00 / Lecture Hall 06, Albrecht Thaer Weg 3, GOETTINGEN		
08	The first post-modern revolution – the insurrection of the 'Zapatistas' in Chiapas	Daniel Stout
09	Catholicism in Mexico	Nina Rakow Alison Roberts
10	'Plan Puebla' - Panama and other efforts to modernize Mexican agriculture	Arnd Zschocke
11	The 'Ejido' system and the perpetual question of land property rights	Julian Plagemann Heike Pannwitt
Saturday, Jan. 31st 2009, 10:00 - 14:00 / Seminar room S1, Steinstrasse 19, WITZENHAUSEN		
12	The massacre of Tlatelolco and the 1968 movement	Sabrina Leupolt
13	The 'Chinampas' of the Valley of Mexico	Jonas Hagmann
14	Organic Agriculture in Mexico	Moritz Reckling
	Organisational matters	Huelsebusch, Buerkert, Schlecht, Dohrenbusch

Physical geography, climate zoning, vegetation zones and agro-ecosystems

Nora Honsdorf & Charlotte Hohls

Physical Geography

Mexico is part of the Americas, situated between 32° and 14° N latitude. Its east-west extension reaches from 17°19′ W at Tijuana in Baja California to 86°46′ W longitude at the peninsula of Yucatan. The total area of the Mexican state covers 1,972,550 km² of which approximately 6000 km² are islands in the Pacific Ocean, Gulf of Mexico, Caribbean Sea, and Gulf of California. Mexico shares borders with three countries, the United States of America, Guatemala and Belize.

Eighty percent of Mexico's landmass belongs to the continent of North America. The Isthmus of Tehuantepec is scenically the border region between North and Central America. Mexico´s landscapes can roughly be divided in four parts, the mountain ranges (Sierras), the table land (Altiplanis or Mesetas), coastal plains and the intramontane basin of Rio-Balsas. This will be described in more detail in the following. Northern and Central Mexico are defined by two prominent mountain ranges, the Sierra Madre Oriental and the Sierra Madre Occidental, and the altiplano (high plane) that lies between those mountain ranges. The altiplano stretches from the United States border in the north to the Cordillera Neovolcánica in the south. The Mexican altiplano is divided into a northern and a southern section by a low east-west range between Monterrey and Torreón. The northern part of the high plane, Mesa del Norte, has an average elevation of 1,100 m. This region is characterized by aridity. The southern part of the high plane, Mesa Central, is higher than its northern counterpart, it averages 2000 m in elevation. Within the altiplano lie numerous valleys in which Mexico´s most important cities are located. In a more narrow sense the Mesa Central is the semiarid to semi-humid region of the central Mexican region between approximately the 22° N latitude and the depression of Rio Balsas. As Meseta Neovolcánica, the transmexican vulcano range, the Cordillera Neovolcánica belongs to the Mesa Central. This is where Mexico City is situated. The range runs from the Pacific Ocean to the Gulf of Mexico, has a length of 900 kilometers and a width of 130 kilometers. From the volcanic high plane with altitudes between 1800 and 2300 m, arise volcanoes of more the 5000 m altitude, for example the famous Popocatépetl and Iz-taccíhiatl near Mexico City. With 5,747 m Pico de Orizaba is the highest mountain of Mexico. The Cordillera Neovolcánica is regarded as the geological dividing line between North and Central America.

There are several important mountain ranges in Mexico. As mentioned above the Sierra Madre Oriental and Occidental border the Mexican altiplano. The Sierra Madre Occidental begins approximately 50 kilometers from the US-border and runs 1,250 kilometers southwards where it merges with the Cordillera Neovolcánica. At the northern end the Sierra Madre Oc-cidental lies about 300 kilometers inland from the west coast but approaches to within 50 ki-lometers at the southern end. The range averages 2,250 m in elevation with peaks up to 3000 m. The Sierra Madre Oriental starts at the Texas-Mexico border and stretches 1350 kilometers southwards until reaching the eastern part of the Cordillera Neovolcánica. It has approximately the same altitudes as the Sierra Madre Occidental. In southern Mexico there are two more mountain ranges, the Sierra Madre del Sur and the Sierra Madre de Chiapas. The first one which can be divided in a coastal mountain range and the mountain range of Oaxaca reaches altitudes of up to 3700 m. The Isthmus of Tehuantepec separates the Sierra Madre del Sur from the Sierra Madre de Chiapas. The latter one reaches altitudes of about 3000 m. The Mesa Central of Chiapas has average altitudes between 2000 and 2500 m. One other significant mountain range is on the peninsula of Baja California (Lower California). It has a length of 1,430 kilometers. Peaks measure between 250 and 2,200 m. At the bottom of Sierra Madre Occidental and Oriental

coastal lowlands can be found. The lowlands of the Golf Coast stretch up to the peninsula of Yucatan.

Yucatán is the peninsula in the very southeast of Mexico, which is composed of a plate of karstified limestone. It has a length of 450 kilometers and a width of 350 kilometers. The peninsula separates the Gulf of Mexico from the Caribbean Sea. With 300 m altitude the Sierrita is the highest point on the peninsula. In Yucatan there is no above ground drainage, all drain-age takes places in underground rivers in the karstified limestone. Through Cenotes, which are some type of doline, the water is accessible.

Climate

Mexico does not have thermic seasons but hygric seasons with a change between rainy season and dry season. Moreover Mexico has parts in tropical and subtropical climate zones.

South and Central Mexico belong to the tropical climate zone. Tropical Mexico is characterized by a diurnal climate. This means that variation in temperature is greater between day and night than the variation within the whole year. The variation in course of one year increases from South with 5 °C to up to 20 °C in the North of the country. A variation within the year of 10 – 12 °C is the limit in the thermic definition of the tropics. This is reached in the region around tropic of Cancer, which is the range in defining tropics by insolation.

Northern Mexico belongs to the subtropics because it lies north of tropic of Cancer and temperature variation is greater within one year than within one day.

The annual rhythm is determined by rainy season and dry season. Mexico has its rainy season in the summer months. Usually the winters are dry. An exception is the peninsula Baja California, which has its rainy season in winter. Moreover there are some regions in the South that do not have a dry season at all.

Mexico has part in all hygric climate zones of the tropics, from very humid in the southeast with 12 humid months to arid with less than two humid months in the desert and semi-desert climate in northern Mexico. Most parts of the country are semihumid to semiarid. Definitions of the different zones are as follows:

- Humid: 11 – 12 humid months, everhumid tropical wet climate
- Subhumid: 9 – 10 humid months, tropical wet climate, short interruption of rainy season
- Semihumid: 7 – 8 humid months, wet climate with longer interruption of rainy season
- Semiarid: 4 – 6 humid months, dry climate with short rainy season
- Subarid: 2 – 4 humid months, dry climate with very short rainy season
- Arid: 0 – 2 humid months, semi-desert and desert climate

Thermic climate levels: Due to the great differences in altitude that exist in Mexico, the country has part in all thermic levels of the tropics. The lower parts of the country belong to the warm tropics (tierra caliente: hot land and tierra semicaliente: warm land) with mean annual temperatures within 25 and 19 °C. At the 19 °C isothermal line starts the temperate level (tierra templada) which is the transition zone between warm and cold tropics and represents the average frost line. It is found in altitudes between 1300 and 1800 m. It has mean temperatures between 19 and 15 °C. The cold tropics (tierra fresco, tierra fría) have average temperatures between 9 and 15°C and start in altitudes between 2000 and 2400 m above sea level. In 3200 m begins the tierra helada with average temperatures between 9 and 5 °C which is followed up by the tierra subnevada with temperatures between 5 – 1°C in 4000 m altitude and the tierra nevada 4800 m altitude which represents the snowline.

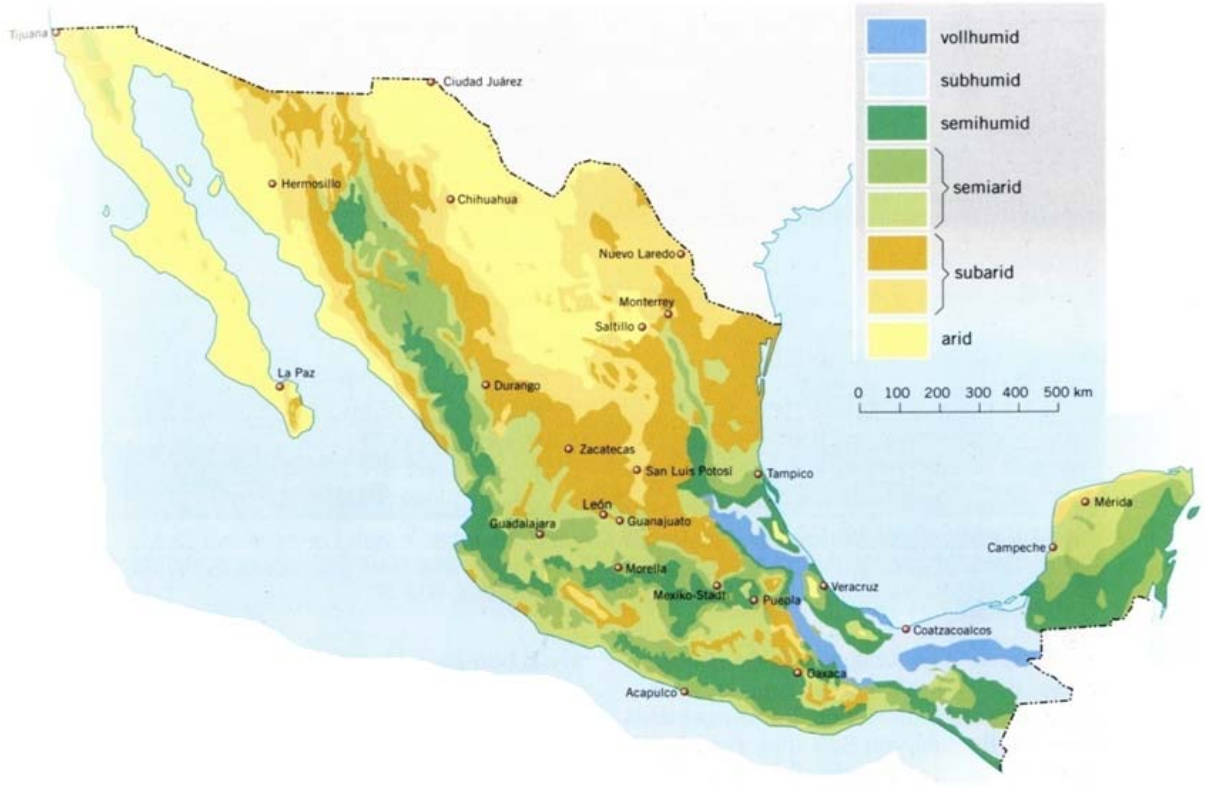

Figure 1: Climate zones of Mexico

Vegetation Zones

The mentioned border between cold and warm tropics is the most important height border concerning agro ecosystems and vegetation zones. (Sommerhoff 1999). The common classification of vegetation zones is based upon climax vegetation due to climate, varying in hygric and thermal condition (Schröder 1998). The horizontal distribution of vegetation zones depends on height of precipitation and the duration of wet respectively dry season. The vertical distribution is characterized by temperature height steps. A systematic is provided by Lauer/Frankenberg (1987) in Sommerhoff (1999).

Floral realms are another concept of classifying the earth`s vegetation (Schröder 1998). In Mexico, two floral realms are toothed into one another which is another specialty of the country's vegetation. Holarctic plant genera (e.g. pinus, quercus, picea, juniperus) dominate the highlands and the mountains whilst neotropic plant genera (yucca, psidium) are widespread in the lowlands. This feature of Mexico`s flora is made possible by the bridge position between North and South America and the meridian direction of the Cordilleras: no massif stood in the way of plant migration, so the holarctic genera migrated southwards along the mountains- probably during the cold periods of Pleistocene (Sommerhoff 1999).

The multiple variations of plant formation are categorized into eight vegetation units (Sommerhoff 1999) which cover vegetation zones of the tropics following hygric criteria.

Agro-Ecosystems

Some general remarks about Mexican agro-ecosystems can be made. Mountain areas are endangered by erosion and are, in most cases, only suitable for extensive subsistence agriculture. Arid zones have potential for irrigated agriculture - reserve areas. The yields there are even higher than in humid zones, where soil condition is the limiting factor. Semi humid areas of central Mexico are ecologically favourable for agriculture (Sommerhoff 1999).

An agroecological system can be defined by the following elements (Rickerl, Francis 2004):

- Physiochemical factors – soils, climate, moisture, radiation, day length;
- Biological elements – crops, animals, pests
- Changing and appropriate technologies available to the farmer
- Sociocultural background – education, policy, experience
- Economic viability – market, costs, management
- Ecological soundness – preservation of biodiversity and ecosystem functions

Heterogenous tenure structure led to by different systems of land use and have its roots in history. Three historical categories of Mexican agriculture have shaped today's agro-ecosystems:

Indians had diverse subsistancial systems with low mechanisation. The systems were characterized by handwork- there was no ploughing known. They did not have no livestock except for turkeys and hairless dogs, crops were maize, beans, avocado, tomato, chilli, agave, tobacco, cocoa, vanilla, pineapple, papaya, guava, sapodilla and rubber tree. The land was common land and identification point for the community. They fit their strategies to the environment, not the other way around. Fruit rotations included mixed culture, often with pumpkin, maize, beans. Up until twelve species were planted per hectare.

No livestock waste was used. In the tropical areas people practiced a complex integration between agriculture, horticulture, cropping in the secondary forest and collection economy in the primeval forest. Another agro-ecosystem were the chinampas; another the "Milpa" or "Roza"- system, a field-forest-alternating system still practised today. It has been discussed that the destruction of Indian agro ecosystems in the 16th century and only the marginal and extensive systems could survive.

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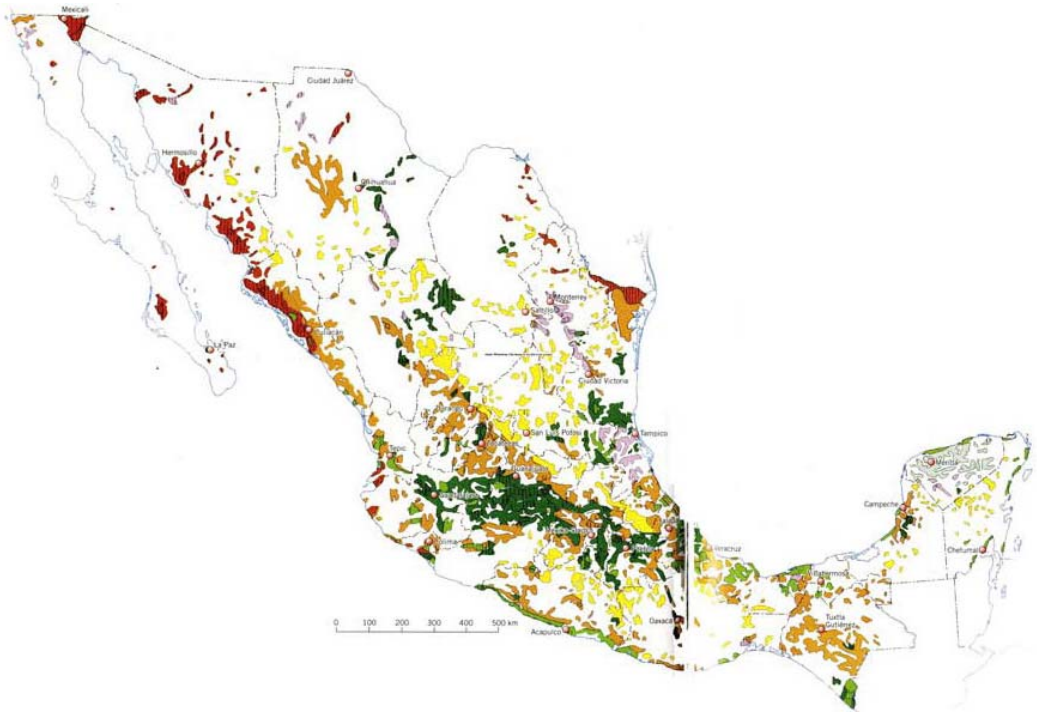

	Cropping system	Main Products	Market orientation	Productivity and development standard
	irrigated/ horticulture	cerals: wheat, millet, beans, vegetables, tomatoes, beans, chili	export, domestic market	high
	specialized cropping (monoculture)	maize, millet, beans	domestic market	medium to high
	diversified cropping	maize, millet, beans, chili, salad, curliflower, alfalfa	domestic market	medium to high
	extensive cropping	staple foods: maize and beans	subsistence and local markets	low
	fruit culture	zona semicalida and templada oranges, lime, grapefruit, tangerines. zona templada and semifria: apricots, pears, avocado, apples.	export, domestic market	medium to high
	tropical culture	papaya, mango, banana, coconut, pineapple, cocoa, coffee, tobacco, sugar cane	export, domestic market	medium to high
	fibre	henequén (agave)	domestic market and subsistence	medium to low
	irrigated cropping	irrigated cropping	?	?
	slash-and-burn cropping	forestry in the sierras, livestock breeding in the arid north, badlands		

Figure 2: Geographical distribution of agricultural production in Mexico with focus on market relevant products (Source: Atlas Nacional de México 1992 in Sommerhoff 1999)

Forestry in Mexico and Certification of Forest Enterprises

Miriam Guth

Introduction

Mexico is rich in temperate and tropical forests. It possesses about 1.3 % of the world's total forest resource. One quater of Mexico's total land area is classified as forest land. It is especially rich in pines. There are 72 species of pine which is about 50% of all known pine species. Conifers predominate in higher elevations of Mexico. Stands of oak, copal, and pine grow from 1000 to 1500 m. Palms are found in elevations up to 500 m, while mahogany, cedar, primavera, and sapote are found from 500 to 1000 m.

Temperate forests, tropical forests and other areas with natural vegetation make about 141.7 million ha which is 72% of the national territory.

About 30.4 mio ha are temperate forest in Mexico and about 26.4 mio ha are tropical and subtropical forest, mainly found in the south and southeast. The annual deforestation amounts to 508 000 hectares according to FAO calculations.

Table 1: Woodland in Mexico

Ecosystem	Area (million ha)	% National territory
Temperate forest	30.4	15.5
Rainforest	26.4	13.4
Arid zone vegetation	58.5	29.7
Wetland and saltmarsh vegetation	4.2	2.1
Disturbed woodland	22.2	11.3
Total woodland	141.7	72

Source: http://www.fao.org/docrep/meeting/x4702e.htm

It has to be considered that there are different definitions for forest, so that there are also different informations about how big the forest area in Mexico is. Here is the definition for forest as given by the FAO:

„Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use."

Forestry Production

About 90% of Mexico's forestry production comes from temperate forests, the main part of which are found in the states of Chihuahua, Durango, Jalisco, Michoacán, Oaxaca, Chiapas, and Guerrero. Tropical forests account for only 10% of forestry production, and exist in the states of Chiapas, Quintana Roo, Yucatan, Campeche, Tabasco, and Oaxaca.

Mexico's forestry policy is designed to protect and renew these resources, so that forests may fulfill their soil-protection functions and timber reserves may be exploited rationally and productively. Only about 30% of all forests are exploited, mostly in Chihuahua, Durango, and Michoacán. Mexico's ability to supply its own wood products needs are severely restricted by the limited timber available. Roundwood production in 2000 was estimated at 45.7 mio m^3 by the FAO; forestry imports exceeded exports by US$2.46 billion.

There are also many other useful products found in Mexico's forests other than wood. Annual forestry production also includes an estimated 100,000 tons of resins, fibers, oils, waxes, and gums. The indigenous peoples living in Mexico's rain forests are estimated to utilize up to 1,500 species of tropical plants to manufacture 3,000 different products such as medicines, construction and domestic materials, dyes, and poisons.

Forest Ownership

The ownership is divided as follows: 80% communal forests, 15% private forests and 5% state forests. Communal forest are either communidades or ejidos. Communal forests are used by the indigenas which have had this form of forest management already in the prehispanic era. Whereas the ejidos were founded in 1917 as a common property regime by Article 27 of the Mexican Constitution in response to the strong presence of agrarian reformists in the Mexican Revolution. Before the Revolution 1% of the population held about 97% of the land.

Important species in wood production

The most important species is pine (*Pinus* ssp). With 7.5 mio m³/year it makes almost 80% of the felling. It is followed by oak (*Quercus* spp.) and other temperate broad-leaved species. Only about 5% is tropical wood e.g. mahogany (*Swietenia macrophyllla*).

Most of the softwood production is used in domestic construction, mainly concrete forming. Other important uses of softwood are for finishing work such as parquet flooring and manufactured doors, windows and furniture. The main part of the hardwood consumed in Mexico goes to the furniture manufacturing industry. However the contribution to the nation's Gross Domestic Product (GDP) is hardly 0.6%.

Because the GDP is so low the government has not put much money into the development of the forest management and therefor the infrastructure is not very developed and it is hard to get access to the forests. The transportation cost is unusually high in the forestry sector, partly because of the low road density which is only 8 m per hectare – that accounts for only one third of the density recommended by the FAO. As a consequence wood production costs are 35-40 percent higher than the world average.

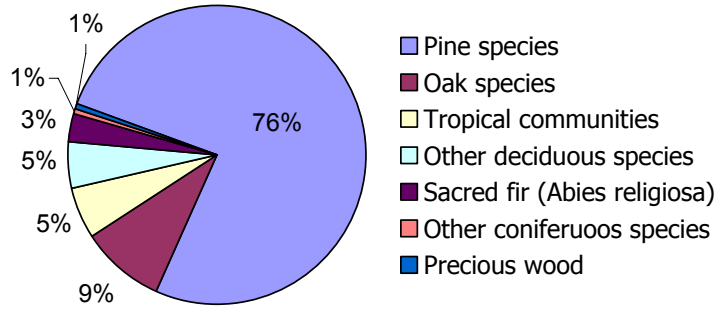

Figure 3: National wood production for species (Source: http://www.semarnat.gob.mx/gestionambiental/forestalysuelos/Anuarios/Anuario2004.pdf)

The graphic shows the percentage of the different species that were used in wood production in 2004 as reported by the Secretaría de Medio Ambiente (SEMARNAT) – the Mexican Ministry of the Environment and Natural Resources. The pine has a part of 76.1%, the ilex of 9.3% and tropical wood of 5.4%. The sacred fir (Abies religiosa) with 3.1% is also one of the more important species. It is a fir species that is native to the central mountain ranges and the south of Mexico. The rest is made up by other broad-leaved species (4.9%), other conifers (0.7%) and precious wood (0.5%).

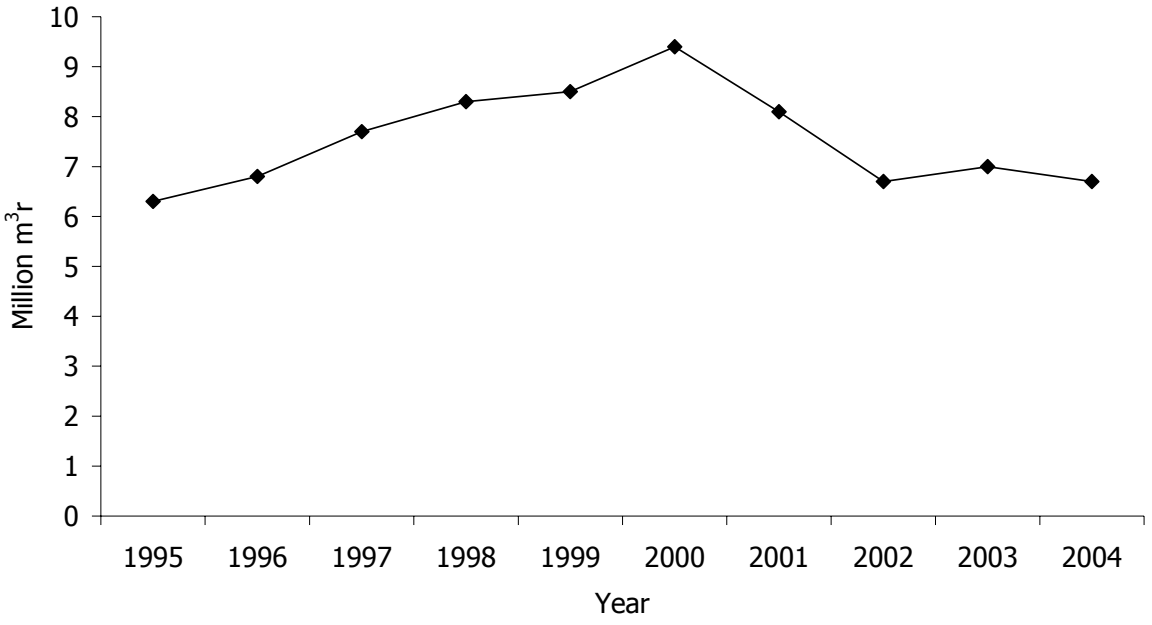

Figure 4: Development of wood production in Mexico (1995-2004) (Source: http://www.semarnat.gob.mx/gestionambiental/forestalysuelos/Anuarios/Anuario2004.pdf)

The states producing the highest amount are Durango (28.6%), Chihuahua (18.5%), Michoacán (9.4%), Oaxaca (7.5%) y Jalisco (6.0%), the total production equals 4.7 mio m³ per annum.

The species that were mainly used during 2004 were pine with 5.1 million m³ (76.1%), ilex with 0.6 million m³ and the other 1.0 million m³ (14.7%) correspond to other species.

Changes to develop forest industry

In recent years the government has chosen to develop the forest sector under the guidelines of sustainable forest management. The Mexican Constitution was amended and a new Agrarian Law enacted in 1991, which allowed the ejidatarios to lease or sell their land to individuals or corporation, with the approval of the group.

The land reforms also extended the length of time a concession may be granted: before the reforms concessions were limited to one year periods, which did little to encourage long-term investments in infrastructure. The government's intent is to demonstrate to national and international investors the Mexico's forests represent a good investment.

Despite these policy changes, investors have been slow to invest in Mexican forestry. According to several studies, Mexico offers much potential for forest production, particularly in temperate forests. However, achieving this potential will require further policy changes in the forest sector.

Why certification?

Forest certification came up through the concern over rapid tropical deforestation in the 1980s and 1990s. Approximately 17 million hectares of tropical forests were cleared in 1990, at a rate of more than an acre per second. Efforts to maintain biodiversity and environmental quality through improved forest management had emerged as an important part of an overall strategy. First the certification was meant only for tropical forests but today it is also used for temperate and boreal forests.

Certification in Mexico

Certification for forest use is favourable to the community in terms of ecology, sociology and economy. Since 1994, the Forest Stewardship Concil (FSC) is being used in Mexico. 772,166 ha were reported certified in Mexico in 2007. About 13% of the cultivated forests have certification in Mexico. States with highest amount of certified forests: Durango, Chihuahua and Oaxaca. 94 % of the certified forests are found in community forestry. In 2004 there were 36 FSC-certified operations covering 613,671 hectares in Mexico. Certified forests make up 44% of the total number of certified community sites and half of the certified forest surface area worldwide (Alatorre, 2003). Positive changes that have come through certification are improved forest management, recognition of silvicutlure developed by forest communities and cooperatives and access for those groups to national- and state-level resources that promote sustainable forestry and adaptive management. But there are also some negative aspects to it like the failure to address some important issues such as illegal logging.

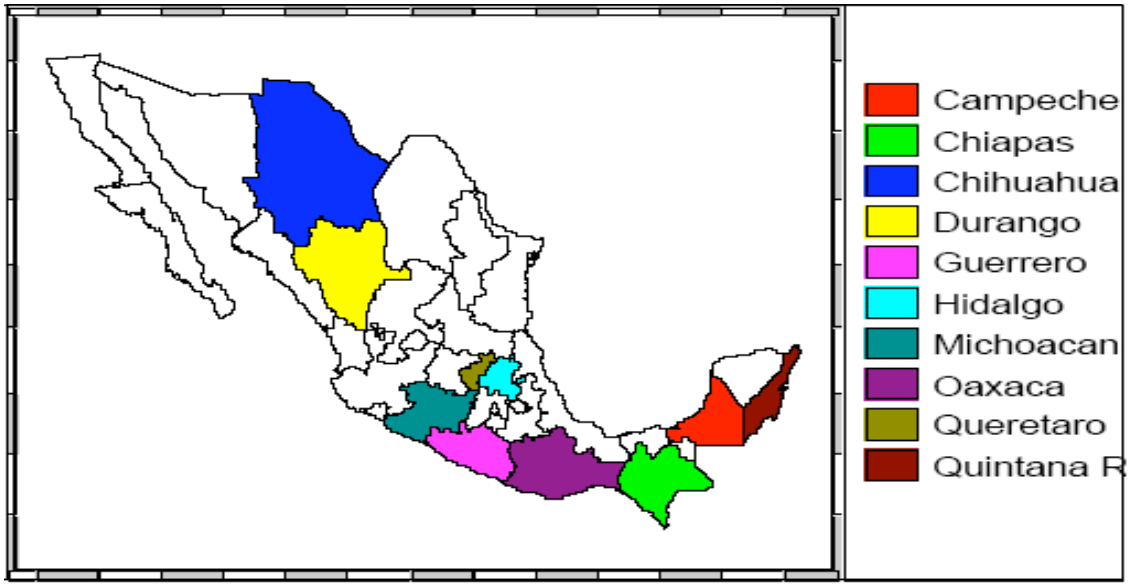

Figure 5: Mexican states with certified forest management

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Timber market and non timber forest products in Mexico

Hendrik Brand

Mexico is a country with many different vegetation types, there is a dry area with deserts, mountainous areas with temperate climate conditions and tropical rainforest with humid circumstances. This leads to a great variety of forest products.

In Mexico most of the forest is found in the temperate and the tropical humid zone. The total area of land is 1,972,550 km², with a population of 109,955,400; the population density is 55 people per km².

Mexico is called an upper middle income county, the Gross Domestic Product is USD 1.486 in total, per capita it is USD 14,119. Mexico is on the 54th place in the list of countries by GDP, and only 4% of the GDP is from agriculture. 29% of the total area is covered with forest and woodland, other land use systems are permanent pastures with a share of 41.9%, permanent crops (1.3%), arable land (13%) and other land types with 16% of the total area. The annual deforestation rate is -1,1% the estimation for 2020 is that the area of forest and woodland will decrease to 23% of the total area. That means that the estimated loss of forests will be around 20% which is a big number, there are already plantation incentive programs for cooperative and private landowners.

About 80% of the forest in Mexico is registered as ejido common land or indigenous communal property. For this management system, communities can organize this as community forestry enterprise (CFE) and use of the forest for the sources of food, fuel, fodder, medicines and building materials. Around 500 communities and common land is organised like that. In the last few decades, the changing international policies had a big influence on the CFE especially by the NAFTA agreement.

The import of forest products in Mexico in 2006 was USD 4,355,797 and the export USD 339,537,000 in compare with Germany that had an import of USD 16,197,138,000 and an export of USD 19,047,849.

Timber market

The importance of Mexico for the timber trade on the world market is not high, just 0,1% share of the world export and 0,7% of the world import. This means that Mexico is not a big player on the world timber market. Important is also a decrease of the production and an increase of the consumption in the last 20 years.

Round wood is wood harvested from forests or outside, it is with or without bark. The wood is roughly shaped direct after harvesting or there is already a small working process done, like it can be split or roughly shaped in other forms, it includes wood for charcoal, saw logs and veneer logs, pulpwood and other industrial round wood

The round wood production for Mexico in 2006 was 44,714,000 m³ and the consumption 44,874,000 m³, the import was 176 m³ and the export 16,000 m³, in compare to Germany the import and export is quite low, the import of Germany in 2006 was 3,452,000 m³ and the export 6,738,000 m³.

Sawn wood is produced from round wood, either by sawing lengthways or by a profile-chipping process, lumber is a form of sawn wood, wooden floors are excluded.

The production in Mexico of sawn wood in 2006 was 2,829,000 m³ with a consumption of 6,958,000 m³; the import was 4,193,000 m³ and the export 64,000 m³. In comparison to Germany in 2006 with a production 24,420,000 m³ and a consumption of 21,184,000 m³, import with 4,824,000 m³ and an export of 8,057,000 m³.

The recovered paper production of Mexico in 2006 was 4,302,000 m³ and the consumption was 6,005,000 m³, the import was 1,991,000 m³ and the export was 288,000 m³. In comparison to other South American countries, Mexico is the biggest producer. For example,

Brazil produced in 2006 3,497,000 m³ and consumed 3,508,000 m³, imported 13,000 m³ and exported 2,000 m³.

Important tree species in Mexico

Tropical area:

- *Alnus jorullensis* (warm temperate areas); the wood is used for construction, crates, household appliances, broomsticks, music instruments.
- *Cedrela odorata*; the wood is used to build canoes, sport boats, cigar boxes, furniture, interior work and music instruments.
- *Ceiba pentandra*; is used for construction wood, packaging material, furniture paper.
- *Cordia alliodora*; wood is used for shipbuilding, bridges, furniture, veneers.
- *Leucaena leucocephala*; used for firewood, paper, poles, masts, furniture and frames.
- *Swietenia macrophylla* (mahagony); this is one of the finest woods in the world, used for (artistic) carpentry, inlays and carving.

Temperate area:

- *Cupressus lusitanica*; the uses are for construction wood, paper and plywood.
- *Pinus oocarpa*; is used as saw log for constructions, interior work, paper and poles.
- *Pinus patula*; the wood is used for carpenter products, paper and packaging materials.
- *Prosopsis juliflora* (dry area); the uses are firewood, wood for charcoal, cartwheels, carpenter works, door/window frames.

Non Timber Forest Products (NTFPs) in Mexico

Non Timber Forest Products (NTFPs) are plant or plant parts as well as animal products collected from natural forests that have an economic value. This excludes timber, natural gas, oil, sand, stones that are covered under other sections. The products that are collected in forest ecosystems are mainly used in the household. They have cultural, religious and social purpose. The products are commercialised on the local, national or international market. NTFP are also further processed; oriented to the consumer market.

NTFPs are classified into edibles on non edibles. Edibles include edible plant, animal, honey, oils, meat (fish), exudates, spices etc. Non edibles include ornamental plants, fibre (weaving, basketing), medicinal products, exudates, oil for cosmetics, wood, handicrafts. Another identification is Non Wood Forest Products; this excludes all materials made from wood, such as fire wood and handicrafts, NWFP that have a greater commercial value or come from cultivation.

A more specific classification is dividing NTFP in four categories:

Edibles

Mushrooms are the most well known forest products; mainly they are important for the local market, as well as fruits, nuts, herbs and spices. Products with storage ability like some mushroom species, (dried) fruits, nuts, herbs and spices, honey and teas are also coming on the international market.

Medical/dietary supplements

This can include medicinal mushrooms, bark, roots, leaves, twigs. These products are used whole as natural medicines, or processed to concentrates for other medicinal properties.

Floral products

These products may appear in floral arrangements, like dried flowers, cutting greens, decorations made of moss, ferns, flowers, twigs and (pine) cones.

Speciality wood products

Product made out of wood, directly from trees not from timber for lumber products; that means a tree may not need to be cut down to produce these items. It includes handicrafts, carvings, music instruments, containers (baskets) and special furniture pieces (2007, Adepoju, A. A. and Salua, A. Sheu; Economic Valuation Of Non-Timber Forest Products (NTFPs), MPRA Pater No. 2689, http://mpra.ub.uni-muenchen.de/2689/1/MPRA_paper_2689.pdf).

The use of NTFPs has an influence on the forest. The intensity is the main factor, important is also how it is collected, non destructively or destructively. Non destructively means, there is not a big influence on the individual plant or area, this includes leaves, fruits, bark (ability to recover), seeds, flower, or exudates. Destructive collecting methods influence the whole plant or area mainly without recovering, this could be trunks, roots, tubers or the entire plant. Meat or fish collected from the forest could be also classified as destructive.

In Mexico there is a great variety of NTFPs, there are many different ecosystems due to areas with different climate conditions. Especially the tropical humid area has many useful products collected from the rainforests. There are approximately 1500 different useful species, ⅓ of the products are found in primary forest, ⅔ are found in the secondary forest. The 1500 species that are useful give nearly 3000 products, 33% of these products are for medical uses, 16.5% is edible, 15% are woods and wood products (whole tree; destructive), that includes timber and fibres, 36% is fuel woods, drugs, ornamentals (seeds), forage, resins, dyes, gums,, tannins, flavourings, sweeteners and (work) tools.

In Mexico most of the NTFPs are important for home consumption and the local market; it is also one of the few cash generating opportunities for women. In Mexico the ejido common land is important for the supply of NTFPs. For most of the communities the NTFPs provide a basic level of income.

In Mexico NTFPs provide basic incomes for indigenous groups especially in the southern states, as the indigenous groups mainly belong to the poorest section of the society. Most of the products are important for the households and the micro regional and domestic market. A few NTFPs are also exported to Europe, North America and Asian countries. The products for the international market are traded throughout Mexican wholesalers and companies, cooperation's (within communities) or NGO's. Dependent on the product there will be a processing done, if there is not a high level of processing needed.

Important NTFPs in Mexico

Resin

Mexico is a major producer of resin. In 1994 the production amounted to 36,731 tons. Part of this production is coming from plantations which are estimated at 259,000 ha. Resin is collected from Pinus species and has a high value in the state Oaxaca. There a many pine species that are used for resin production, but the production is principally done from the species Pinus montezumae, P. michoacana, P. leiophylla, P. pseudostrobus, P. teocote, P. oocarpa and P. hartwegii. Most of the pine forest is found in the northern part of the country but the main production is coming from southern parts due to a higher yield of resin for trees in warmer conditions. From the raw resin gum rosin and turpentine are derived. Gum rosin is used as an ingredient for printing inks, varnishes, glues, soap, paper sizing, soda and sealing wax, it is also known as a food additive E195 and a derived glycerol ester E445. Turpetine is used a source of raw materials in the synthesis of fragrant chemical compounds like camphor, linalool, alpha-terpineol and geranol, it is also added to many cleaning and sanitary products due to antiseptic properties.

Chicle

Manilkara zapota called sapodilla is in the tropics worldwide cultivated for the fruits. There are many cultivars, the fruit is also collected from wild trees but this is just important for own use. Chicle is latex tapped from *Manilkara zapota*, a tree native to rainforest in southern Mexico and certain parts of Central America. Chicle was used in chewing gum in the past, since the use of cheaper synthetic gums it lost his importance in the chewing gum industry. Nowadays chicle is occasionally used in Japan, Italy, Korea and the USA. Chicle production fluctuates every year in amounts. In 1990 the production was 685 tonnes, 510 tonnes were exported to Japan. The increase of the price per kg chicle could make it a more important NTFP, besides it is a rare product produced by only a few countries (Mexico, Guatemala, Belize and Honduras).

Mushrooms

Wild mushrooms are important in the Mexican diet. They are especially found in the local market. The use of mushrooms in Mexico is mainly as food; medicinal and hallucinogenic mushrooms are not important on the domestic market.

The state Oaxaca has a great number of useful species, important species are Boletus edulis, Amanita caesarea and Cantharellus cibarius. Thricholoma magnivelare; related to shi-take is an important export product, in 2000 about 4 tonnes was exported to Japan; the value of export fluctuates from year to year.

Seeds/Foliage

Chamaedorea palm is one of the most important NTFP for the export. It is a popular indoor plant in North America and Europe in USA, Chamaedorea is an important plant in the cut green industry (14% of the market). Chamaedorea palms are growing in Mexico and Guatemala in forest as an under storey vegetation. As an NTFP the seeds are exported to nurseries, in the floriculture the decorative foliage is used, especially in Palm Sunday church services. Chamaedorea elegans is used for both seeds and foliage production; it does not produce seed in plantation because artificial pollination is difficult and costly. Other uses are palm inflorescence as food produced by Chamaedorea tepejelote, but this is less important as NTFP. The production of seeds varies every year; in 1997 the state San Luis Potosi produced 113,000 tonnes for an average price of USD 17,000 per ton. In 1994 there was an annual production of 1494 tonnes of foliage (cultivated/wild); in 1999 the production was nearly 2000 tonnes.

Honey and other bee products

Wild honey is an important NTFP in Mexico. This can be collected during a time of the year when other crops are not harvested. Other collected bee products are royal jelly and wax. Wild honey is important for the households, but also traded on the international market. Mexico produced about 56,500 tonnes of honey and exported about 25000 tonnes in 1998 (cultivated, wild).

The future for NTFPs

NTFPs could protect the natural forest, by using forest ecosystems instead of changing the area into an intensive production. In this way species are protected and the biodiversity is secured.

The uses of NTFPs are influenced to some factors. In the region with other economic activities the use of NTFPs can change. Ecotourism can be a development for the area and can also protect the forest (35 projects 2000, http://www.fao.org/docrep/meeting/x4702e.htm). As the NTFPs are most imports for the low income groups, the use will go down in this way. This can also happen with an economic development on a national level, when for example more employment is created.

Upcoming economies can have an influence on the demand of NTFPs, if this is becoming higher, the prices could increase, and a better income is created for the participants. In this development a potential danger could be overexploitation.

If it is clear for consumer what they are buying and what the background of a product is, they are willing to spend more money for a specific product. There are three certification bodies that are already important for many products in social and environmental issues. For a sustainable forest production there is the Forest Steward Council (FSC) this is for the timber market, but can be important as well for other products made out of wood. Products coming from natural forests could be also certified as organic, this is already done on a small scale. The International Federation of Organic Agricultural Movements (IFOAM) has criteria for wild harvested products. The social component of the production is done by Fair Trade Labelling Organizations (FLO) to ensure the well being of the producers. A limited number of agro forestry products are already certified and the product range is increasing. Certification is often expensive and time consuming, but to ensure fair conditions this should be more developed for NTFPs.

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The Mexican Livestock Sector

Rita Khatir

General information

The United Mexican States are crossed by 2 mountain ranges, Sierra Madre Oriental and Sierra Madre Occidental, which are the extension of the Rocky Mountains from northern North America. From the east to west at the centre, the country is crossed by the Trans-Mexican Volcanic Belt known as Sierra Nevada. A fourth mountain range, the Sierra Madre del Sur, runs from Michoacan to Oaxaca. As such, the majority of the Mexican central and northern territories are located at high altitudes.

These conditions result in Mexico having one of the world's most diverse weather systems. The southern parts have yearly median temperatures between 24° and 28°C; the temperature difference between winter and summer is only about 5°C. The northern areas are hot and humid during the summer with yearly temperatures between 20° and 24°C. The third climate is found in the areas in the Valley of Mexico with altitudes above 2,000 m. They have a year-round temperate range of 16° and 18°C and cool nighttime temperatures throughout the year.

The total land area is approximately 1.9 mio km² consisting of agricultural land of about 1 mio km² and forest areas of about 63 thousand km². In 2007, Mexico had about 105 million people; annual population growth is more than 1% (World Development Indicators database, September 2008). Mexico is the world's 11th most populous country (Barkan, 1993; Wikipedia, 2009). Two-thirds of Mexico's poor people are farmers and farm workers and three-fourths of Mexico's extremely poor people live in rural areas (Levy & van Wijnbergen 1992 in Martin, 1993).

In 2006, the GDP of agriculture, livestock, forest, and fisheries accounted for 5.4% of the national GDP. The GDP of livestock activities accounted for 23% of the agricultural GDP (Semarnat, 2008). Thus, livestock is an important factor for the the development of Mexico's economy. Barkin (1990) stated that there is a phenomenal growth of the livestock sector due to the modernization of Mexican agriculture since 1965.

Livestock resources in Mexico

The production of cattle, chicken and pigs grew rapidly until the onset of the crisis in the 1980s. It was supported by government policy to change the Mexican agriculture instantly (Barkin, 1990). This expansion was accompanied by an industrial transformation. Natural pastures, household wastes, agricultural residues and other similar resources which were used for the traditional production of livestock were replaced by technologic systems that now rely on cultivated pastures, improved breeds of animals, heavy use of antibiotics, and confined feeding of balanced animal feeds (Suarez & Barkin 1990 in Barkin 1990). The conditions also led to the competition between humans and livestock for the use of the country's land and other agricultural resources to produce animal feeds (Barkin, 1990). In addition livestock activities were also having difficulties competing with imported products, although the situation varies in the different areas. But in general there were two factors threatening livestock activities, that is, the economic stagnation of the 1980s, and a lack of investment which led to an increasing technological gap with the USA (Chauvet 1993 in Appendini 1994). The recent development (1970-2007) of the livestock sectors is summarized in Table 1.

Table 1: Population of Livestock in Mexico (1000 head)

Year	1970	1980	1990	2003	2004	2005	2006	2007
Cattle	22,798	27,742*	32,054*	31,4767	31,248	28,763	28,649	29,000
Goats	9,127	9,638	10,439	8,991	8,852	8,886	8,897	8,900
Sheep	6,113	8,482	5,846	6,819	7,082	7,624	7,484	7,500
Pigs	10,298	16,890*	15,203*	14,625	15,177	15,342	15,370	15,500
Poultry	148,300	192,618*	248,055*	418,721	436,854	492,063	293,899	294,300

(Source: FAOSTAT, 2009 and *FAO report, 2005)

Cattle

There are three ecological regions determining the cattle industry: (1) the arid-semi arid north region; (2) the southern tropical region; and (3) the temperate central region. The three regions share the same proportion of cattle industries around 33 to 34% (Vega & Williams, 1996). Actually, the geographical conditions of the regions influence the central of human population and livestock population.

Approximately one million head of cattle are shipped to the United States yearly, especially from the northern Mexican states of Chihuahua and Durango. The purposes are for pasture, finishing, and slaughter (Skaggs et al., 2004). There is a special trend of cattle export-import in Mexico because Mexico is not only the largest exporter of the feeder cattle to the Unites States, but Mexico also imports back some cattle for the consumption and breeding (Barrett & Fabiosa, 1998). For example in 2005, Mexico exported nearly 1,258,758 head of cattle and also imported 84,701 head of cattle (FAOSTAT, 2009).

However, there is a decreasing trend in cattle population. Barrett & Fabiosa (1998) stated that this is influenced by the increase of slaughter, the increase of feed and veterinary costs, and the prolonged drought. Of course, the domestic need is also the most important purpose of cattle production. In the 1980s, beef was still considered a semi-luxury commodity that was consumed mostly by the middle- and upper-income households in Mexico (Barrett & Fabiosa, 1998). The situation was caused by the meat price that was higher than the prices for other products. So in 1982, the meat consumption was around 41.5 kg/capita/year (Vega & Williams, 1996). Due to the increase of socio-economic status, the consumption of meat per capita was around 58-59 kg/capita/year in 2003 (FAOSTAT, 2009).

In 2006, beef production has increased from 1,329 tons to 1,613 tons per year. It was also reported that the dairy industries produced more than 10 billion liters of milk (Semarnat, 2008). This shows that the cattle production both for meat and milk is a strong factor that should be accounted for in Mexico's livestock sector.

Sheep and goats

Mexicans are keeping both sheep and goats whereby number of goats is higher than the number of sheep, but the increase in sheep production is higher than that of goat. Sheep and goat production in Mexico is not sufficient for the domestic market so that imported sheep and goats in 2005 reached 84,002 and 3,176 head, however the number of imported head was reduced drastically due to the recent production increase (FAOSTAT, 2009).

Pigs

There are three types of pig production: (1) the intensive and technologically more advanced sector, (2) the semi-intensive or moderate technology sector; and (3) the rural or low technology sector (Vega & Williams, 1996). The production of pig showed a low increase during the period of 2003 to 2007. The trend of pig trade is different from beef trade

because there is a net import. In 2005, Mexico imported about 181,313 head of pigs (FAOSTAT, 2009).

Pig-meat consumption during 2000 - 2003 was stable at 12 kg/capita/year (FAOSTAT, 2009). The lower-income families consume most of the pork in Mexico (Barrett & Fabiosa, 1998) since the pig-meat price is lower than beef. Ricalde et al (2004) found that in rural communities one of the main species kept in the backyard is pigs. The rural communities also assume the pigs as "pig bank" which means that the pigs can be converted into money when cash is needed for any family emergency.

Poultry

Poultry industries can be categorized into: (1) small individual producers with 2000 to 10,000 birds that do not produce their own feed and that have little or no access to the main market channels; (2) associated producers, the owner of 10,000 to 50,000 birds that mix their own feeds and that have access to genetic materials; (3) semi-integrated producers that have about 50,000 to 100,000 birds; (4) large-integrated enterprises with more than 100,000 birds (Vega & Williams, 1996). Nearly 67% of Mexico's poultry production is located in the central region (Bierlen & Hayes, 1994 in Barrett & Fabiosa, 1998).

The main species kept are chicken (97%) and turkey (FAOSTAT, 2009). Compared to the other livestock resources, the production of poultry is the highest. The production of broilers accounts for 24% of the total livestock production (Semarnat, 2008). The increase of poultry production is stimulated by technological advancements, vertical integration, improved genetics, and better management practices (Barrett & Fabiosa, 1998). Starting in 2006, the poultry production decreased, but this number was still the highest compared to the other livestock sectors.

Livestock Unit

To evaluate the contribution of livestock simultaneously, the tropical livestock unit can be used. By using the conversion factors for cattle (0.7), sheep (0.15), goats (0.1), pigs (0.25), chickens (0.01), and turkeys (0.03), the total livestock units in Mexico are tabulated in Table 22 (FAO, 2003). Although there is a slightly decrease in the number of livestock units in the last two years, the livestock production has shown an accelerated growth in the last two decades (Semarnat, 2008). Contribution of different species to the total livestock number can be seen in Figure 6. The highest share has cattle, lowest share have sheep and goats.

Table 2: Total Livestock Units (LUs) in Mexico

	2000	2002	2005	2006	2007
Total LUs	27,616	27,619	26,006	25,912	26,193

(Source: FAOSTAT, 2009)

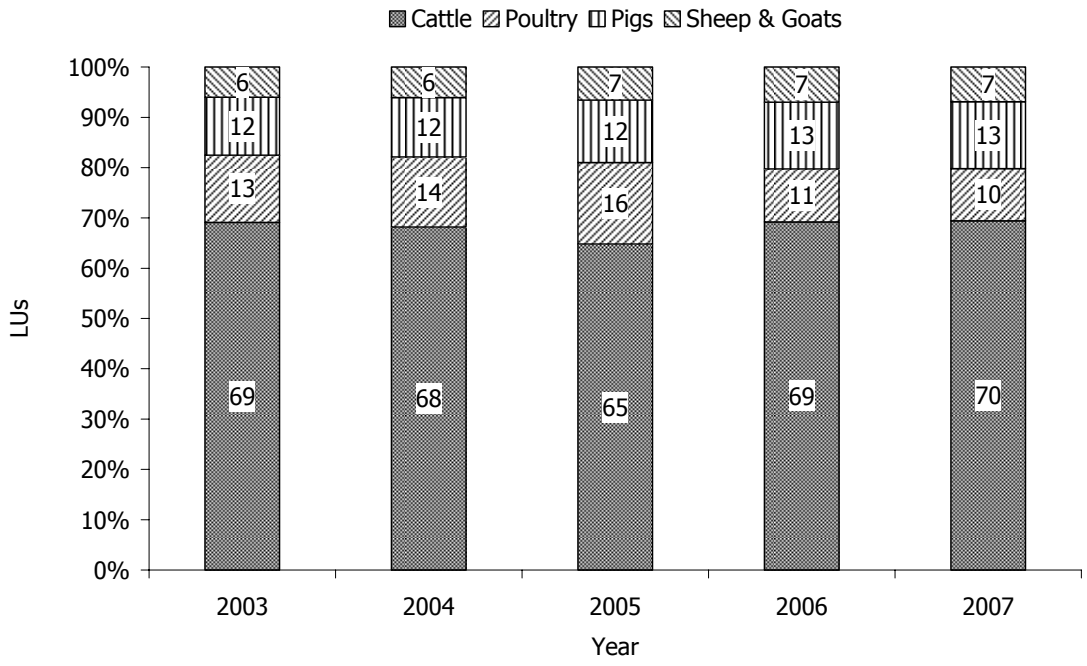

Figure 6: Contribution of different species to the total livestock

Conclusions

The livestock sectors plays an important role in Mexico's economy, but its growth was much influenced by government pressure. The main livestock resources are cattle, sheep and goats, pigs, and poultry. Meat consumption of cattle and poultry has increased, whereas meat consumption of pigs is stagnant. Poultry industries produce the highest numbers, but cattle industries produce the highest value due to LUs.

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The Aztecs and the Mayas - two contrasting powers in Mesoamerica

Sandra González Monge & Edinson Rivera Aedo

Introduction

The most important Mesoamerican pre-Columbian civilizations were Aztecs and Mayas. The first were the biggest and most powerful of America's Empire in just two hundred years. It had a large development in architecture, medicine, agriculture, philosophy, art, religion, politic, cosmology and astronomy, which were inherited and developed by other old civilizations such as the Teotihuacanos, the Mayas and the Toltecos.

On the other hand, the Mayas were distinguished because of their large contribution to the knowledge in areas such as astronomy, mathematics and other sciences, besides their amazing architecture, sculpture and art. An example of that is the Mayan calendar, which is most precise than the Greek calendar. At the same time the Maya civilization is one of the biggest mysteries for humankind. Why is it in the ninth century they left their cities behind without an apparent reason? It is difficult to believe that an "Isolated" civilization could achieve such astronomical calculations and create a precise calendar. These are just some questions that don't have any answer yet, which makes the enigmatic world of the Maya more interesting.

Origin

These amazing civilizations have their origin in different ages and places. The Mayas had their first settlement in the Pre-classic period around 2500 B.C. in the geographic area of Guatemala and its surroundings specifically in the mountains of western Guatemala. Than, approximately in 1600 B.C. the Maya settled in the Peninsula of Yucatan, and in 900 B.C in the region of Tabasco. Their cities with temples, palaces, murals and other objects could be founded in the tropical jungle, rugged mountains, as well as in vast plains throughout peninsula of Yucatan and Central America, this region is known as Mesoamerica which includes the Peninsula of Yucatan, the state of Quintana Roo, The Mayor of Tabasco, Chiapas, and the Isthmus of Tehuantepec in Mexico, Guatemala, Belize, the western part of El Salvador and Honduras, and a small part of Nicaragua.. Hence, the Maya civilization developed in a territory of approximately 400,000 square kilometers in Mesoamerica, where the main cities could be found, Mani, Dzibilchaltún, Komchen, Izamal, Tikal, Copan, Chichen Itza, Kabah, and Loltun. This territory has a large geographical biodiversity: mountains, marshes, plains, tropical forests, mountains forests, therefore the Maya had different kinds of climates, soils, rainfall and vegetations. At their age, the Maya of the Yucatan Peninsula were the second Mesoamerican people of Mexico in terms of numbers. In the Classic period, the cultural process of the Maya achieved its maximum development, as well in the technological field as in the social, economic, politic, religious and artistic sphere. This time was named "Época de Oro" (Golden Age).

The Aztecs had their origin in Mexico's Valley around 1272, but their most important city Tenochtitlan was founded in 1325 in the middle of Texoco Lake. At first the Aztecs were only seven Tribes, coming from a place called Aztlán. They were guided by priests and leaders, namely Tlatoani (Tlatoani is a Nahuatl word, it is mean king). They established in Chapultepec where they were known for their aggressiveness and their ritual slaughter. In 1319 they were defeated and expulsed to the Tizapan after a confrontation with another tribe in the region. After that, they allied with the Colhuas another small tribe, but in a wedding ceremony they sacrificed the Colhuas king's Daughter. They were chased and banished to the Texoco Lake where in 1325 they found Tenochtitlan. The reason they found Tenochtitlan in this place was because warlord Tenoc had a vision, that he had seen an eagle landing on a cactus and eating a snake. They believed that it was a sign of the gods.

The Aztecs were divided into different ethnics groups, which were widespread over the Mexican valley, sharing a common Aztecs culture, language, economy and religion.

Architecture

The Aztecs and Maya invented engineering systems, which were outgoing in their age; therefore their civilizations are comparable to the Roman Empire in the level of sophistication. They had the best technology that they could have considering their standards of living. Aqueduct, palaces, pyramids and temples were built as a tribute to the gods. In the case of the Aztecs their greatest achievement was their brand-new capital, Tenochtitlan. The drawings of the city were designed by Acampapichtl in 1376. To build Tenochtitlan he based his model on Teotihuacan or City of Gods, which was built by the ancestors Aztecs a long time ago. However, the Aztecs faced an important problem in achieving this because Tenochtitlan was located on an island in the middle of the lake, where the soil was too soft. Thus, the Aztecs revolutionized the architecture techniques of the age, using wood pillars and volcanic rocks on the base, and than on this structure they built the pyramids, temples, houses, and other buildings. Beside to communicate the city with the whole region the Aztecs built some ways, which were connected with the nearest provinces, replacing the use of boats.

Another problem facing the Aztecs was the necessity of water, as this was controlled by neighboring tribe the Tepanecas, to which the Aztecs honored. The Aztecs demanded free water and help to build the aqueduct for the city. Nevertheless, the answer was the murder of the Aztec's warlord. The Aztecs wanted revenge but they needed help from Nezahualcoyotl to defeat Tepanecas; who was a warlord in Texoco. Hence, the Aztecs could take control of the water and dominated the whole valley. They began a series of big projects around Tenochtitlan gaining the reputation as the greatest American Engineers; being one of the most important projects the aqueduct, follows by the dam around the city designed by Nezahualcoyotl to control the level of water and to prevent floods. Another amazing construction was the pyramid in the center of Tenochtitlan. It was fifteen floors high and was built to rend honor to the gods of rain and war, where the ritual sacrifices took place. This construction had an influence from the Maya, who had built hundreds spectacular pyramids and temples throughout the peninsula of Yucatan and Central America, which lasted until the present and could be admired by many people. These buildings are around 70 meters high and monuments with hieroglyphic symbols, which represented historic events. In fact, Chichen Itza was declared a World Heritage Site by Unesco and in the last year was elected as on of the new seven wonders of the world because its beauty and the impressive of its pyramids. Other remarkable constructions were the Uxmal Palace, the Jaguar Pyramid, and the highest pyramid of the world "La Danta", all are located in the area of Guatemala and peninsula Yucatan and; some of them with many rooms. The Toltecas had some influence on the Mayan culture, which was reflected on art and architecture. Examples can be noted, the construction of the "El Castillo", the group of the Thousand Columns and the Great Ball Game. In some rivers, lakes and lagoons they built canal irrigation for increasing the cultivable area for the production of basic products and for consumption and trade.

Economy

The Aztecs based their economic activities on agriculture. They cultivated some crops such as maize, beans, amaranth, and squash. Furthermore, the Aztecs knew the techniques of fallow and irrigation, there were dams to control water for canal irrigation and they used animal- and vegetal fertilizers. The irrigation systems had crucial role in the economy because they ensured that farmers had sufficient water with which to grow the different types of crops they had. Another example of the agriculture activity was the Chinampas, which were floating pieces of land on the lake (90 meters long and 10 meter width), built with woods, juncos and grass, and adding on the juncos mud from the lake. The Chinampas

were a great method to ensure food and to impulse also the military expansion of the empire, as they could be harvested seven times in one year, enabling Aztecs to create new land to cultivate and to live, ensuring the food for the citizens. It took eight days to build the Chinampas and it needed five men. They were connected with the city through canals, which were built before. Despite the intensification in agriculture, the increase of the population caused shortages food and famine, resulting in period of malnutrition and social unrest.

The trade was based on barter, where the cacao's seed were used to change or to equal some differences for small purchases. There were artisans that produced luxury goods and women that produced cotton textiles for all social classes. The textiles were used as form of money in marketplaces for valuable purchases and also to honor them. There was a marketplace in every city-state, an example of that was the marketplace in Tlatelolco where around 60,000 participants (professional merchants) met.

For the Maya, the most important economic activities were concentrated in picking up fruits, hunting and fishing, and they had also seasonal agriculture, which was developed by the construction of irrigation canals. After that they improved their agriculture and the trade took more importance within their economy, an example of that was the trade relationship with the Olmecas, which resulted in the introduction of the Maya calendar and the incipient writing, and also leading to the flourishing in the territory of major centers such as Tulum, and Xelha Muyil. The Itza power was concentrated in Chichen Itzá, because of this reason the military, politic, commercial and religious center experienced an amazing transformation.

Social Organization

The Aztecs society was divided into different social classes. First was the nobility whose members had controlled the most important resources of the Aztecs and controlled the highest political positions. The king was the most important person within this group and in the whole Aztec's society. Lords were chiefs with important military and political roles, the priest and merchants were in the same level. The following group in the Aztecs social organization was the Commoners. This group included more than 90% of the population, mainly peasants and artisans, who must pay tribute to the noble. The commoners could be grouped to form the Calpolli, which was a territorial -social group responsible for allocating the plot to individual farmers too. At the bottom of Aztecs social organization were the slaves, who were the labor force and were used in the ritual slaughter, of course they did not have any privileges. The commoners could not become nobles, though they could raise their position in society, for example if they succeeded in the battlefield.

The Mayan social organization was made up of social classes perfectly structured so paramount, each with its own functions performed for the welfare of the people. Thus, we can find the following social groups: Priests, responsible for doing the sacred rites; Artisans, responsible for building different kind of buildings; Warriors, who were responsible for the defense of the city, Farmers, responsible for ensuring the food, and the Merchants, who were responsible for trading woods and cultural exchange as well. Their government was theocratic; it means that the authority is performed directly by God or by priests as his representatives. Thus, in the government resided the civil and religious powers, which were strongly connected. In the Post Classic Period the Maya culture had decadence, maybe because of some kind of epidemic, conquest by barbarian people or drought. However, some cities like Coba, Uxmal, Izamal, Kabah, Loltun and Acanceh flourished in this period.

Religion

The Aztecs were polytheistic. The most important prominent deities included Huitzilopochtli (God of the sun), Coyolxahuqui (God of the Moon), Tláloc (God of the rain) and Quetzalcóatl (God of learning and patron of priests).In the Aztec religion human and animals were sacrificed in public and private rituals in honor of the gods. They believed that gods had used their blood to create the earth, the humans, and all things; thus they had to repay the blood of the gods. In the ritual, a special priest took a knife cutting the chests of victims on altars

atop tall temple-pyramids, taking the heart of the victim and offered it to the gods, to end the ritual the body was thrown down the pyramid steps. Most victims were soldiers captured in battle but sometimes the Aztecs soldiers offered themselves to sacrifice for important ceremonies, because it was similar to die in battle.

The sense of this ritual was also to ensure the continuity of the human, animal, and the whole nature existence on the earth. If they did not do that, the earth would have died.

The Maya religion was the center of social activities. The Mayas believed that a cosmic energy crossed to people, animal, and plants, printing them their reason for being; when the charge of energy was bigger, the importance of each life was higher. They believed also that blood was a very valued nutrient for the Gods, because of that, they did human sacrifices. Thus, in the ritual the whole people participated. The rituals consist in dancing, singing, drinking, and reflecting. The Maya believed in the immortality of the conscience, of the soul, and the spirit too, therefore, they did not fear death.

Another important ritual among Maya culture was the Ball Game, in the field of game player could challenge the God of Murk, facing them and beat to death. The ball was made of rubber, and it was heavy and hard. This ball could be hit with elbows, the hips and knees. Generally the match ended when on of the teams scored the first goal. The captain of the victorious team reached the honor and glory, and could be offered to the Gods, they were sacrificed.

Astronomy

The Aztecs had two calendar based on their astronomic observation. The first was the solar year, 365-day cycle, divided into 18 months of 20 days, with 5 leftover days, which were called bad luck days. The second calendar was a 260 day cycle made up of 20 days and 13 numbers. These two cycles can be represented schematically as two intermeshing "gears".

The Mayas depended on agriculture, therefore they observed the stars which influenced seedtime. Several cities had buildings which acted as legitimate observatories, for example "El Caracol" located in Chichen Itza. They gave us as legacy astonishing precise calculations, for example the solar cycle, which was established in 365.2420 days and the lunar cycle in 29.53086 days. The actual Gregorian year have 365.25 days and some others calendars establish a system of 27 or 28 days for the Lunar cycle. Recently, Scientists with modern methods and equipment have calculated that the solar year has 365.2422 days, which means that the Maya calculated the precession of solar year with 3900 % more exactitude than the European cultures and the lunar precession with 15833% more exactitude than any other culture in the world. The calculation of this calendar was based on the Mayan numerical system, which is better than the Arabic numerical system. For instance, the Mayas developed the concept of cero 800 years before the European and they also knew the perfect proportion (Golden ration equals to 1.618) of animals, human and buildings.

Empire and Conquest

The Aztec Empire conquered over 500 city-states in northern and central Mesoamerica such as Xochimilcas and the Tlahuicas that had the same language, the Nahuatl. Nonetheless, one region could not be conquered, it was Michoacán where lived the Tarascos a powerful state and the strongest Aztecs enemy. In spite of that, some excavations in Mexico demonstrate that the Aztecs and Tarascos traded with one another. In 1440 was elected "Moctezuma I" as tlatoani, who ordered to enlarge the empire's boundaries in all directions. (Each elected king had to undertake a campaign of conquest then he could fully invest as king). In 1448 Tenochtitlan and others city-states formed an alliance "The triple Alliance", it was the creation of the Aztecs empire. In 1486, tlatoani Ahuizotl assumed and began enlarging the boundaries taking all regions, which were not under the control of the Aztecs, and also to get more captives to sacrifice in honor to the gods. At this time the empire had fifteen million habitants and it extend more far than the Mexican valley. In 1502, Moctezuma II assumed

and he was tlatoani when Spanish conqueror arrived. The empire had 25 million habitants and 212,000 square kilometer from Mexican gulf to Pacific Ocean until Guatemala. This age was the gold age for the Aztecs Empire.

In 1519 the Aztecs civilization, different to the Maya was at its height when the Spanish conquerors arrived under the order of Hernando Cortés to the Gulf of Mexico. They conquered many small city states and murdered many natives too. However, a lot of cities allied with the Spanish conqueror against Aztecs Empire. Hernando Cortes was helped by Malinche, a daughter of a king in a small city-state. She was his interpreter and later gave him a child too. The conquerors were received in Tenochtitlan and could appreciate the wonderful city. But one day, they kidnapped "Moctezuma II" it was the beginning of the end for the whole empire. In 1521 the Spaniards were expulsed and chased, but they came back months later with thousands more and decided to destroy the city. As the destruction of Tenochtitlan, million of Aztecs died during the last month of resistance, and 90% of the population died after the conquest because of virus, which was brought by Spaniards. Nevertheless, some Aztecs survived and married with Spaniards. Nowadays, there are still over one million people, who speak Nahuatl in rural areas of Mexico.

On the other hand, the Mayas had their heyday of its development in the period between 200-900 a.d they built temples and ceremonial centers comparable to the pyramids of Egypt. They developed a more precise calendar than the one currently used , charted the course of Venus, correctly predicted lunar and solar eclipses, invented a complex writing system and implemented highly sophisticated farming techniques. However, after this extraordinary progress this civilization suddenly and mysteriously dropped. In fact, nobody knows why the Mayan ceremonial centers were abandoned, though experts in the fieldwork believe that the same Maya were responsible for their own downfall. The main ceremonial centers throughout the region were abandoned in the early 900 and were gradually buried by jungles of Chiapas and Guatemala. Hence, when the Spanish conquerors arrived under the order of Francisco Hernandez de Córdoba to the Peninsula of Yucatan in 1517 the Maya was only the shadow of former glory. However, the last Maya and their descendants could not be defeated by the Spanish at the first attack in 1519, just in 1546 the conquerors achieved to dominate the most of the peninsula; nonetheless, the Maya refuted constantly the Spanish rules.

Thus, these two civilizations, Aztecs and Maya, evolve in Mesoamerica, and give us amazing knowledge in different areas however, there are still mysteries about them.

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From political independence to the revolution with Emilio Zapata & Benito Juárez

Verena Tigges & Matthias Klaiß

Late colonial New Spain

The late colonial New Spain period began with the coming into power of the Bourbons as Spanish kings at the beginning of the 18th century. Its evolution is mainly characterized by the Bourbon Reforms that led to an increase of immigration and economic growth for the colony which entailed at the same time social contrasts and stratifications. On the other hand the Bourbons set high taxes, officially for the modernisation of the country but also the mother country Spain benefited of the revenues. Therefore large army was necessary to avoid uproars and to provide security (Hamnet 1999, Ewald 1994).

Administration and dependence of the "Mother Country" Spain

The administration was under the rules of the vice king and two judges (Oidores). All orders came from the Spanish crown, but were performed by the vice king and the oidores, that has legislative and executive functions. But as the mother country was quite far away and it took several weeks to carry information and orders from one side of the ocean to the other, New Spain's authorities, especially held a lot of power and kept a certain autonomy. Nevertheless the country depended on the decisions and political events that took place in Spain as shown in the economic rise caused by the Bourbon reforms. And, in fact, the struggles in Spain and the appointment to Spanish king of Napoleons brother Joseph in 1808 were one of the major reasons that lead to the independence movement in New Spain. (Ewald 1994, Merill, Miro 1996)

The role of the church

Different religious orders like the Jesuits played an important role in the economy of the colony. They owned great parts of the land in New Spain which they got as donations. With their farsighted management they had a stabilising effect on New Spains economy. Because of the huge wealth of the orders, which members had no personal property, they served as largest "credit institute". Furthermore they cared for the education of the colonies offspring. But because of their influence and their wealth the Jesuits were expulsed by the Spanish crown in 1767. This stirred up a widespread opposition against the crown in New Spain.

Religion was always a source of political energies, changing expectations and issue of conflict. In the example of Mexico's history this fact becomes manifest for example in the time of the Conquista. But on the other hand Jesuits like Bartolomé de Las Casas in the 16th century fought for the rights of the Indios. And, not to forget, although the church and their organs profited from the privileges set down in the colonial law, it were catholic priest that started and lead the first independent movements, waving a banner with the Virgen de Guadalupe and shouting "¡Viva la Indepencia!" ("Grito de Dolores"). These opposed effects of the church and their representatives on the Mexican history show the enduring ambivalence of their role (Archer 2003, Ewald 1994).

Social and economic contrasts

A small circle of businessmen dominated the principal economic activities. These actors hold a great personal wealth. The display of their wealth was in contrast to the living conditions of the majority of the population that was working in the mines, as campesinos (peasants) or as peons on the big haciendas. Agriculture was dominated by the Haciendas, large land-holdings that were an end in themselves as the marks of status. In the agricultural sector mostly the Hacienda owners profited from the revenues. Another source of stratification was the existence of different ethnic groups. The Peninsulares, citizens coming directly from the mother country, thought of themselves to be superior. They were in important positions in the administration and usually had a better education than the Criollos, citizens from Spanish

origin that were born in the colony. The indigenous people were not much respected. Their personal rights and territories were protected by the law that was often avoided (Hamnet 1999, Ewald 1994).

The Independence

Most historians agree that the Mexican Independence movement came not out of certain planning from the side of the Mexicans but was mainly determined by coincidence and the political events in Europe. Only a combination of social and cultural factors enabled a large-scale popular mobilisation in the former loyal colony. The change of the dynasty in 1810 increased state pressure on the revenues and the jurisdiction of the church. It was the first time that all classes in the colony agreed with the fact that taxes were economically and psychologically intolerable. The historian Eric van Young expressed the situation like this: "The rebellion resulted form a fundamental sense that something had gone wrong in the world and that the external realities no longer conformed to the moral order of country people". But the immediate cause of the insurrection of 1910 was the collapse of the viceregal government's legitimacy. In 1808, the French removal of the Spanish bourbons caused confusion in the colonies about governments legitimacy. While the Peninsulares asked the citizens to wait for further development in Spain, the Criollos demanded the autonomy of the country (Hamnet 1999, Ewald 1994).

The Insurrection of 1810

The insurrection of 1810 was led by father Miguel Hidalgo, a parish pries of Dolores in the dynamic province of Guanajuato in the North of Mexico City. He had an open house for all classes where social and political issues were debated. Being persecuted by the Spanish army, he called the people of his parish to join the struggle of independence and did the speech that is still known as the "Grito de Dolores". This event is still celebrated today as the day of independence in Mexico (16th September). This movement found many supporters in the Criollo population and led to armed hostilities in the whole county. But many of them were deterred by the cruelty of the movement killing all peninsulares that were against the autonomy. After Hidalgos execution in 1811 he was followed from 1812-1815 by father José María Morelos, who had a small disciplined army that avoided needless deletion. In the following years the ruthless behaviour of the Spanish army and its leaders led to a loss of sympathy with the Spanish in all classes in the colony (Miller 1986, Hamnet 1999).

Iturbide

The wars of independence came to an end with the collaboration of Iturbide, the leader of the Spanish forces, with the rebels. Different reasons for his change of mind were mentioned. On one hand it is alluded that he, as a conservative, didn't agree with the liberal movements, anticlerical laws and the general chaos in Spain. On the other hand he seemed to cope with the ideas of the rebels and declared 1821 the "Plan of Iguala". The major ideas of the document were the "three guarantees": Independence, supremacy of the Catholic faith and equality of the creole and peninsular classes. These ideas were a base to build a coalition for the parties that for almost ten years had been fighting one another. As no European monarch was found to be crowned as the King of Mexico, Iturbide was crowned in 1822 as Emperor Augustín I. But as he reigned with rigour and military force he abdicated two years later and the congress nullified the election of Iturbide as emperor. In 1824, a republican constitution was drafted creating the "Estados Unidos Mexicanos" with Guadalupe Victoria as its first President.

The young republic

The new state was a federal republic that was based upon the US constitution. It integrated the ideas of Montesquieu in the separation of powers. In the eyes of its creators it should have been the base of a prosperous new country. But the long period of the war of

independence and the fact that nobody was prepared for the independence posed several challenges to the young republic.

First they faced economic problems. The eleven years lasting war of independence was very expensive and the economy was shattered. The important mining industry was in disarray. Agriculture was similarly impacted, Hacendados murdered and the fields burned, livestock killed or dispersed. Commerce with Spain was at a standstill and no new supply lines were established. When Iturbide set down in the treaty of Cordoba, which gave Mexico the independence from Spain, he also agreed in compensations for the Spanish possessions. Because of the constant thread of an invasion by the US or European armies, the Mexican army had doubled in size and took up a huge share of the state budget. To keep up the regime, Mexico was forced to take credits in Europe but soon lost its creditworthiness in the judgement of the international banking community.

Another obstacle was the political instability. The egoism of all pressure groups and the "caudillismo" complicate an agreement. No president was able to unite the different classes and interest. Between 1833 and 1855 the presidency changed 30 times, General Santa Ana was elected 11 times. Conservative and liberal presidents alternated. Many of they came to power by a coup d'état or violently (Miller 1986, Ewald 1994).

Wars

The instability led to civil wars, like the Texas War of independence and several uproars. The two Indian wars (Yucatan Secession and the Yucatan rebellion) were caused by the oppression of the indigenous people. The Haciendas usurped their land and water rights. That caused poverty, hunger and dependence on the Criollos in the indigenous population.

In the same way, instabilities made Mexico to be regarded as an easy prey for other nations like the US, England and France which were interested in the enormous mineral riches and unrealized agricultural potential. They used the slightest provocation to attack the country. A good example is the Pastry war 1838 when France attacked Mexico because they didn't accept to pay compensation to a French Pâtissier that had been robbed by Mexican soldiers ten years before.

In the War with the United States, Mexico lost half of its territory which is represented today by California, Nevada, Utah, New Mexico, Colorado, Wyoming and parts of Arizona. Whereas the war is forgotten or seen as a triumph by the US, the legality of this war is still seen as debatable from the Mexicans which haven't accepted the defeat (Miller 1985, Ewald 1994, Hamnet 2003).

Table 3: Mexican Wars from Independence to the Revolution of 1910

1810-1821	Mexican War of Independence
1822-1823	Central American Federation War of independence
1835-1836	Texas War of Independence
1838	First Franco-Mexican War "The Pastry War"
1839-1843	Yucatan Secession
1846-1847	US.-Mexican War
1847	Yucatan Rebellion
1859-1861	Civil War: War of the reform
1862-1867	Second Franco-Mexican War
1899-1904	Yaqui Indian War
1910-1920	Mexican Revolution/Civil War

Benito Juárez

Benito Juárez was the first Mexican President that was able to reign Mexico for a long period and who was able to unite liberals and conservatives. Furthermore he was the first president that did not have a military background. He tried actually to bring its country peace and tranquillity. He is still admired by the Mexicans for his services on the Mexican State. His integrity, his simple way of life and his abilities to reign a country under adverse conditions caused the admiration of his contemporaries. Lincoln's secretary of state, Wiliam H. Seward declared Juárez the greatest person he met.

Benito Juárez was born as the son of zapotec parents and orphaned in a young age. Due to the gratitude of a priest, he was able to get educated. He received a law degree, entered in politics and became governor of Oxaca in 1848. Inspired by European intellectuals like Rousseau, his liberal policy led to his exile by President Santa Ana. Like other liberals he was regarded as dangerous for his regency.

He returned after the liberal revolt of 1855 and initiated, first as justice minister, later (1861) as President, the liberal reforms. These reforms were meant to abridge the wealth and power of the Catholic Church and to abolish slavery and all titles of nobility.

Unintentionally by the liberals, the reforms were seen by the church as an attack on church dogma and led to the Reform Civil War which ended two years later with the victory of the liberals. But the war led to a radicalisation of the laws. Later on, Juárez added laws to make education mandatory and to reduce government purchases by reducing the size of the army. But he was not able to find a solution for the chronic economic problems of the country. His inability to pay the interest on Mexican foreign debts caused a war with European Nations. The defeat of the Mexican army was followed by a 6 years lasting bizarre episode of regency of the Habsburg Maximilian I. After his death, Benito Juárez was re-elected and continued his regency until his own death in 1872.

The zapotec presidents popularity increased the esteem of the indigenous people. But unfortunately his regency worsened their situation, a development that continued under the following Porfiriato (Miller 1986, Hamnet 1999, Ewald 1994).

Conclusion

Mexico came to its independence "by default", influenced more by external than internal developments. Hence, the country and its citizens were unprepared and not ripe for independence. Economic problems and internal disaccord led to numerous wars which worsened the situation for the country. The reasons for disaccord were founded in colonial times, and no president was able to reach reconciliation of all classes.

From Porfirio Diáz to the Mexican Revolution

The Era of Porfirio Diaz

Born in 1830 in Oaxaca City, Porfirio Diáz grew up in decent conditions. His parents had a mestizo background. As his uncle was a priest and later on Bishop of Oaxaca, he was sent to a seminar to become priest as well. After breaking up with his family he went to University to become a lawyer after the Mexican-American War. As a student he occasionally came in touch with Benito Juarez, who was in several occasions a professor and director of the institute he studied. Being fascinated and convinced by liberal ideas, he gave publicly his vote for Alvarez instead for Santa Anna and he broke with the establishment in the university and started his military career. As the public support for Lerdo de Tejada decreased fast, he took his chance and occupied in November 1876 Mexico City, forced de Tejada to abandon and took over the government. Inspite of his earlier conviction of "No-Reelection" (a president should be in charge for that duty only for one legislation period), he managed to rule for 7 legislation periods, only interrupted by the installation of president Manuel

Gonzalez (1880-1884), who continued the direction started by Juarez and Diáz (Ewald, 1994). The time of his reign is known as the Era of Porfirio Diáz (1876-1910).

Situation in the country

After 55 years of independence, Mexico's economy lagged hopelessly behind the USA and Western Europe. Education, culture and modern technology were only accessible for a small part of the population. Plans to built a railway infrastructure existed but were not carried out. The sheer amount of external debts inhibited the self-development of the country. The average government since then lasted one year, only two governments completed a full legislation period. Now, as peace had been established and maintained only by the military forces, the focus of Porfirio Diáz became the economic development of the country. He became the president of order and progress; he tried to enhance the development by attracting foreign investments, repayment of all debts and maintenance of inner stability under all circumstances (Ewald, 1994). To attract foreign investments, internal security, governmental concessions and subsidies, cheap labour and rich natural resources were maintained. In the year 1910, investments from US and EU mounted up to $ 2 Billions, the half them were from the US (Miller, 1986).

In contrary to the former presidents, Diáz restricted the freedom of speech and the press. Knowing about the undermining effects of the press to the former governments, he justified this action with the statement that Mexico was not ready for it. His policy of "pan o palo" (bread or the stick) rewarded those who conformed with the regime and punished the opposition. He enlarged the hated police troops "rurales" to keep riots down and to suppress the population. He even cut his own salary, fired a lot of useless public officials and tried to cut down the smuggling activities. Under Diaz the dormant Universities were activated, scientists called "scientificos" arose as consultants of the government, with the intention to solve all the problems of the country with scientific methods, with statistics and sociology. (Miller, 1986). For example British engineers solved the flooding problems of Mexico City. Others tidied the national finances (Ewald, 1994). The rise of western influence and science in the government caused a Europeanization of the upper class; the idea of social Darwinism infected the educated circles (Miller, 1986). The inner stability on the surface of the country was in sharp contrast to the suppression and marginalisation of the poor masses. In contrast to the former governments, the church enjoyed a comeback to Mexico.

The industrialitzation

In 1884, Diáz started the industrialization of Mexico. Around the turn of the century, Mexico had for the first time a positive balance (assets), the country was internationally recognized for his efforts to develop. By the time Diáz took over the country, only 617 km of railway existed. In the year 1911 the railway network was extended to 25000 km. After the transcontinental railway had been built in the US, American companies invested in the Mexican railway system. Diáz bought the majority of the shares of the most important tracks for the Mexican government. With that significantly improved infrastructure, other industries started to develop, primary production started to boom. Within a few years, the use of modern sophisticated technology revolutionized especially silver mining. But also other resources were dug, like copper, zinc, iron, and more and more oil. By the year of 1910 more than 100000 Mexicans were working in the mining sector. Most of the mines were owned by American citizens, from the 1030 mines at this time 840, Mexican citizens owned 148, the rest was property of British and French citizens (Ewald, 1994).

Influence in agriculture

In agriculture the access to the markets via railway changed a lot. Since the middle of the 19th century and especially during the presidency of Diáz foreign capital and knowledge was attracted to use the capital and the technical knowledge. A lot of arable land was developed where before only animal grazing was possible. Especially near the railway the large-land holdings experienced a industrialization of their production methods. The use of machinery,

the application of new and more productive breeds and modern agricultural production methods revolutionized agriculture. In Yucatan the large scale production of sisal for the north American market allowed a decent wealth on the haciendas. The competition for production resources like land and water became apparent.

The land distribution became successively unequal, by the year of 1919 834 persons owned more than 90% of the arable land, in contrast to 9-10 mio of landless workers. The family Terrazas in Chihuaua owned 405,000 ha alone.

The native Mexican population and their traditional small scale agriculture had to experience the dark side of the industrial bloom under Diáz. In addition, the competition for water and land, in which the traditional Mexican village had no voice, the downgrading and marginalizing of the natives by the regime of Diàz caused a severe insult on the native communities. Thousands of the not repacified Yaqui and Mayo were killed or enslaved and shipped to work on the sisal plantations in Yucatan.

The inner stability allowed the population to increase by 62% from 9,500,000 in 1876 to 1,520,000 in 1910, which lead to a huge surplus of workforce in rural areas. One aspect of the big production units was that they were able to produce enough surplus food for the enlarged population, whereas the traditional small scale agriculture would have had no capacity of doing that.

The ongoing sell-out of the country to foreigners caused an increasing anti-foreignism in the population. Some critics stated that "Mexico became a mother to aliens and stepmother to own citizens " (Miller, 1986)

The Great Revolution (1910-1940)

The Great Revolution can be divided into two main phases. First, the military phase from 1910-1920, second, the restoration phase from 1920-1940.

It was the fight for social justice partly as a legitimate request, partwise also as a political parole. To a large extend, the situation after 1910 in the country was comparable to that after the independence war: anarchy and chaos reigned. A lot of different groups and leaders with different ideas were involved in the fighting, even foreign governments tried to influence the fighting for their benefit, in terms of weapon distribution or even secret service activities. Some groups fought for equal land distribution, others for protective labour laws or nationalization of utilities, limitation of church power and many other changes. They were villagers, intellectuals, soldiers who wanted to make their fortune, unemployed factory workers, hacienda peons, teachers, students, newspapermen and many others (Miller, 1986).

Destruction, bloodshed and calamity came over the land. Between 1910 and 1920 almost 1 million people lost their lives. The revolution was prepared by leftwing intellectuals, postulating the fee education for all, an eight hour working day, a six day workweek and the prohibition of child labour. Especially the situation on the huge haciendas, the annihilation of the native ejidos, the former communal land, was a cause of grievances. In these days the term "campesino" for small scale farmer, started to substitute the term "péon", for landless farm worker (Ewald, 1994).

It all started when Diáz in 1908, 78 years of age, gave an interview to an American journalist, which was supposed to be published only outside Mexico. Díaz stated that Mexico was now ready for a democracy and he would retire in 1910 (but he had no intention to retire). He was very embarrassed to see the interview published in Mexico. The opposition formed, amongst them Francisco Madero, a rich, vegetarian cotton farmer with mild manners and a high pitched voice. He wrote a critical book about the regime of Don Porfirio, spoke to the masses and challenged the dictator by becoming a presidential candidate. He believed in a democratic change, not a revolution. After his release from jail he fled to Texas, where he

gathered other Mexicans living in exile and published a call to arms. The uprising started, riots started everywhere, and Madero was surprised. He entered the revolution.

He had a lot of followers, the most famous amongst them Emiliano Zapata and Pancho Villa, they fought a lot of battles against the troops of Diáz.

Finally Diáz withdrew and went to exile in France, with the comment, that Madero had unleashed a tiger, and he would be interested how he would control him (Ewald, 1994).

Madero became provisional President in 1911, but apart from three revolutionaries the cabinet posts were still held by Porfirio Diáz holdovers. It appeared that the Revolution was over, but it just began. Unable to start important reforms and being an inexperienced, utopian president ruling in accordance to the law, he lacked the support from cabinet members, church and the military.

Disappointed by the slow reforms, many of his followers broke with Madero to start their own revolution. Zapata, operating more in the southern states around Morelos wanted to give back the hacienda land to his campesinos, whereas Pancho Villa, operating in the north, fought for a democratic Mexico (Miller, 1986). Madero was caught by his enemies and shot in 1913 on the way to prison.

The next president, the officer Victoriano Huerta, maintained his influence and got rid of his enemies by murder and governmental troops. Under his reign a lot of schools were built and at least some efforts were made to integrate the native Indians; some of the stolen land was given back to them. As the constitution did not allow expropriation, Huerta tried to break the haciendas with high taxes. As he had a lot of enemies, American warships conquered the harbour of Veracruz in 1914 and Zapata and Villa won a lot of battles against governmental troops. Huerta retired in July 1914. The situation in the country got out of control, every state of Mexico had now his own revolution and battles.

Under President Venustiano Carranza (1859-1920), who was supported by the American President Woodrow Wilson, Mexico was given an new constitution in 1917. He was properly elected and experienced in politics. The new constitution was very much more opposing the church compared to the one from 1857 and made with article 27 a expropriation of haciendas and the redistribution of land to the native Indians possible. Foreigners were excluded from the possession of land, also divorce was legalized and dept peonage prohibited. For Zapata and Villa the new President acted too slow, and he opposed the expropriation of the big land holdings, which may also have been the reason he was the most successful politician in this decade. Anyway, being responsible for the killing of Emiliano Zapata in 1919, he was killed only one year later during a military coup of two subsequent Presidents, Alvaro Obrégon and Plutarco Elías Calles.

Under President Obrégon, the efforts to continue the integration of the native and rural population in the Mexican society was continued with extensive education programmes. Knowing the suffering of landless, he knew as well that the large land holdings were needed to feed the population. He pacified the country for a short period, so that Plutarco Elías Calles could be elected 1924 in normal circumstances.

Calles cut back the military, tried to increase the military quality and brought the forces under governmental influence again. He structured merciless the national finance. For the first time after a long time an American ambassador came to Mexico and negotiated as an equal; Calles granted oil mining concessions. He carried out his social reforms more aggressively than his former colleagues. To balance the the production losses from the land redistribution, he invested in irrigation projects. To avoid speculation, the land was given to the campesinos in the ejidos only under the condition that it was cultivated.

As the archbishop of Mexico City in 1926 stated, that the Catholic Church would not accept the anti-church constitution, Calles acted without compromise and applied the laws for the first time and a lot of clerical institutions were closed. The church announced a strike,

refusing the worship and other spiritual services to the population. The population started a civil war against the anti-clerical government, the so called Cristo-Movement. It was cruel and brutal, approximately 100,000 people died.

The last president of the time of the revolution was Lázardo Cárdenas. He is considered to be one of the most radical of all Mexican Presidents. He supported labour unions and strikes, in his presidency alone there were 2800 strikes. He caused massive expropriations of hacienda land all over the country and redistributed it to the campesinos. He also welcomed the expropriation and collectivization of industry and service companies. He started with the development of tourism in Mexico by setting up a tourism ministry, he gave asylum to the fugitives from the Spanish civil war in 1936-39 and also for a lot of Jews in the second world war (Ewald, 1994).

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Political and economical overview of Mexico

Fabian Cruz Uribe & Sergio Araujo Enciso

From Pri to Pan

The United Mexican States are a federation whose government is representative, democratic and republican based on a presidential system according to the 1917 Constitution. The Government has three levels: the federal union, the state governments and the municipal governments.

In the recent history of Mexico, three political parties have played a main roll in its politics and government.

Institutional Revolutionary Party (Partido Revolucionario Institucional, PRI): The PRI is a party far from a socialist party in the traditional sense and more often than not, its policies are seen to be like those of a center-right party that ascribes to social democracy. It was founded on 6th March 1929 by Plutarco Elias Calles as National Revolutionary Party (Partido Nacional de la Revolución PNR), and transformed as Mexican Revolution Party (Partido de la Revolución Mexicana PRM) by Lázaro Cärdenas on 30th March 1938. Finally their succesor on the Republic Presidence, Manuel Avila, gave to the party the name PRI on 18th January 1946 (PRI, 2008). The party, under its three different names, contributed in the processs of modernization and stabilization of Mexico, but also, it was slowly acquiring a reputation for corruption, admitted by some of its affiliates (Camou, 1996).

National Action Party (Partido Acción Nacional, PAN): It is a center-right conservative party founded on September 17, 1939. Mexican Roman Catholics, together with other conservatives (mainly Manuel Gómez Morín), founded the party (PAN, 2008). They were looking for a peaceful way to bring about change in the country and to achieve political representation, after the years of chaos and violence that followed the Mexican Revolution. The PAN has been linked to a conservative stance in Mexican politics since its inception, but the party does not consider itself a fundamentally conservative party. The party ideology, at least in principle, is that of "National Action" which rejects a fundamental adherence to left- or right-wing politics or policies, instead requiring the adoption of such policies as correspond to the problems faced by the nation at any given moment (Villasana, 2007). This theory of National Action politics, rejecting a fundamental adherence to right or left, is held within a strongly christian context, and falls under the umbrella of Christian Democracy. The PAN currently occupies the right of Mexico's political spectrum, advocating free enterprise, privatization, smaller government, and liberal reforms as well as opposition to same-sex unions and abortion (PAN, 2008).

Party of the Democratic Revolution (Partido de la Revolución Democrática, PRD): As consequence of corruption, members of the PRI left went on to form their own party as the Party of the Democratic Revolution (PRD). It was founded in Mexico City on May 5, 1989 by Cuauhtémoc Cárdenas Solórzano, Heberto Castillo, Gilberto Rincón Gallardo, Porfirio Muñoz Ledo, other prominent PRI members and left-wing politicians. It is considered a center-left party, created by the coalition of socialists and liberal parties, such as the National Democratic alternative (PRD, 2008). The party was originally founded by including many smaller left-wing parties such as the Partido Comunista Mexicano (PCM, Mexican Communist Party), Partido Socialista Unificado de México (PSUM, Unified Socialist Party of Mexico), Partido Mexicano Socialista (PMS, Mexican Socialist Party) and Partido Mexicano de los Trabajadores (PMT, Mexican Workers' Party). The PMS donated its registration with the Federal Electoral Commission (CFE) to enable the new party to be established (Villasana, 2007).

After the Mexican Revolution of 1910, the country had a deep political instability. Despite the armed phase of the revolution ended in 1920, Mexico had continued to encounter political

unrest, and presidential elections were usually preceded by military uprisings (Rodriguez, 1988). After the assassination of the elected president, Álvaro Obregón, in 1928, the national political crisis led to the founding of the National Revolutionary Party (PNR) in 1929 by Plutarco Elías Calles. The objective of such party was to gather all the armies and forces under a single government. Although the aim was to bring peace, governance and democracy to Mexico, the presidents elected during the period 1929-1934; Emilio Portes Gil, Pascual Ortiz Rubio and Abelardo Rodríguez; were puppets of Calles (Camou, 1996).

In 1936, Lázaro Cárdenas arrived at the presidency, and arrested Calles and his corrupt associates. He became, perhaps, Mexico's most-popular 20th century president. Some of the reasons for the success Cárdenas' government were the the expropriation of the oil interests of the United States and European petroleum companies (Rodriguez, 1988), the establishment in 1938 of the national oil company PEMEX (Petroleos Mexicanos), and the party PRM. As a person of leftist ideas, he provided many social institutions which are dear to the Mexican people. Cárdenas' successor Manuel Ávila Camacho gave to the party PRM, its present name PRI (Partido Revolucionario Institucional) in 1946 (PRI, 2008).

The PRI held an almost hegemonic power in Mexican politics since 1929. The first four decades of government of the PRI are dubbed the "Mexican Miracle", a period of economic growth through substitution of imports and low inflation. Much of the growth was spurred by successful national development plans which provided for major investment on infrastructure (Camou, 1996). From 1940 to 1970 GDP increased sixfold and the population only doubled while the peso-dollar parity was maintained (Rodriguez, 1988).

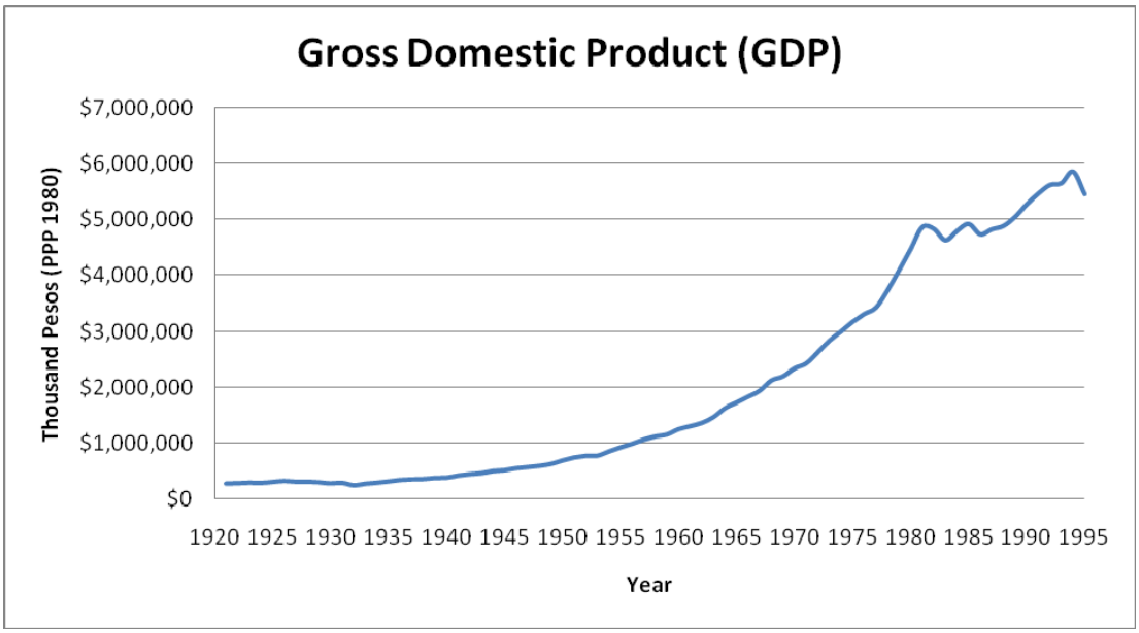

Figure 7: Evolution of the GDP in Mexico (1920-1994)

Source: Own figure elaborated with data from the National Institute of Statistics Geography and Informatics (INEGI, 2008)

But after several decades in power the PRI became a symbol of corruption and electoral fraud. Critics claimed that voter suppression and violence were used when the political machine did not work and elections were just a ritual to simulate the appearance of a democracy (Villasana, 2007).

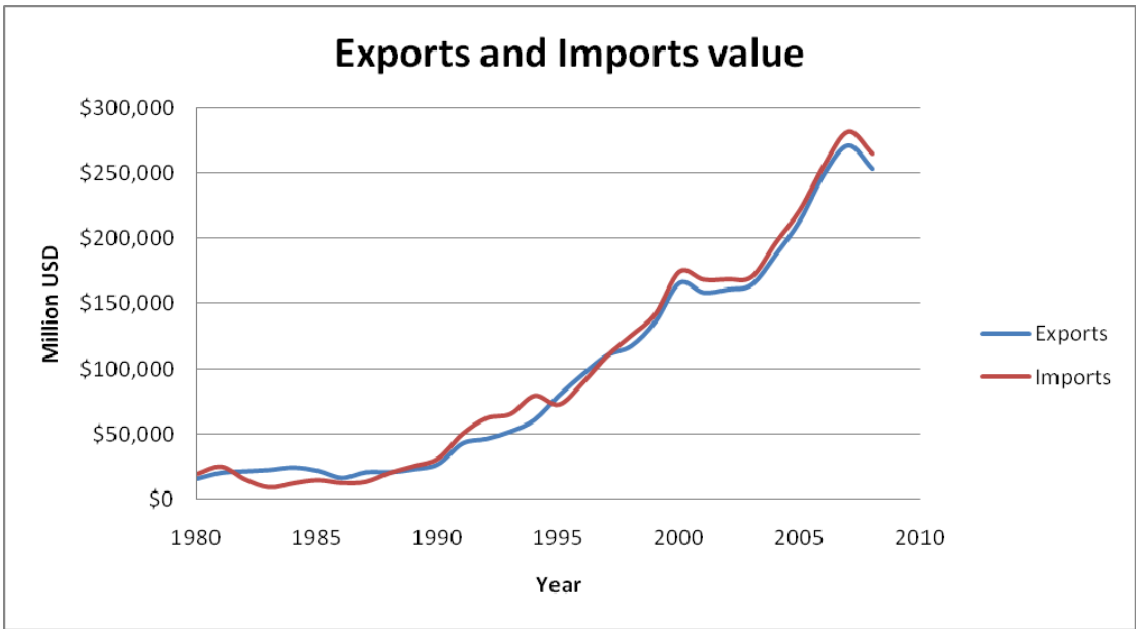

Figure 8: Evolution of exports and imports (1980-2007)

Source: Own figure elaborated with data from the National Institute of Statistics Geography and Informatics (INEGI, 2008)

The conservative National Action Party (PAN) became a stronger party after 1976 when it obtained the support from businessmen after recurring economic crises. Since 1977 consecutive electoral reforms allowed opposition parties to win more posts at the local and federal level (Larrosa et al., 2005). In 1982, Miguel de la Madrid was the first of a series of economists to rule the country, to implement neoliberal reforms (Camou, 1996). This resulted in currency devaluations to finance spending. An earthquake in September 1985 added more woe to the problems. Galloping inflation continued to plague the country, hitting a record high in 1987 at 159.2%.

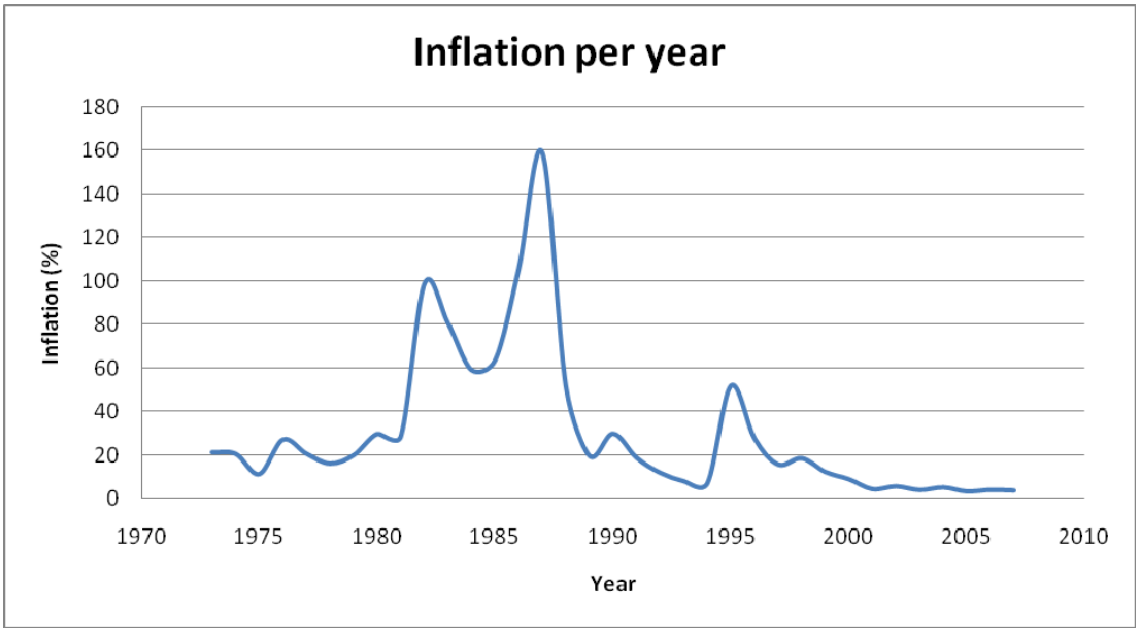

Figure 9: Evolution of Inflation per year (1973-2007)

Source: Own figure elaborated with data from the National Institute of Statistics Geography and Informatics (INEGI, 2008)

In 1994, for the first time since the revolution, a presidential candidate was murdered, Luis Donaldo Colosio Murrieta. His campaign director, Ernesto Zedillo Ponce de Leon, was subsequently elected in the first presidential election monitored by international observers (Camou, 1996). The 1994 economic crisis in Mexico, caused the PRI to lose its absolute majority in both chambers of the federal congress for the first time in 1997. This process culminated in the 2000 presidential elections in which Vicente Fox, candidate of the Alliance for change ("Alianza por el cambio"), formed by the PAN and the PVEM, won 42.5% of the popular vote and was elected president of Mexico. He became the first non-PRI president to be elected in 71 years. Today, PAN is the first political force of the country, and maintains the control of congress (Villasana, 2007).

Figure 10: Evolution of the GDP in Mexico (1994-2003)

Source: Own figure elaborated with data from the National Institute of Statistics Geography and Informatics (INEGI, 2008)

On July 2, 2006, Felipe Calderón (PAN) secured a plurality of the votes cast. Less than one percent behind was Andrés Manuel López Obrador (Candidate PDR), who unsuccessfully challenged the results of the election (Villasana, 2007). Their party PRD now its the second politcal force of Mexico, and it has electoral presence in central and southern Mexico (Espinoza, 2002). It has won gubernatorial races in some states including Baja California Sur, Chiapas, Guerrero, Michoacán and Zacatecas and it has also maintained control over the Federal District (Mexico City) since 1997 (PRD, 2008).

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The first post-modern revolution – the insurrection of the 'Zapatistas' in Chiapas

Daniel Stout

Introduction and background to the rebellion

On 1st January 1994, the same day as the North American Free Trade Agreement (NAFTA) came into effect, the Zapatista Army of National Liberation (EZLN) seized several towns in Chiapas, declaring war on the Mexican state. This will be elaborated in the next section, but first some background to the EZLN is necessary:

EZLN was founded in 1983 by non-Indian leftists from central and northern Mexico; its bases in Chiapas are very much indigenous, and since the uprising all the commanders have been indigenous (Quiroz, 2004). The forces behind the movement are based in the injustices felt by Chiapas' rural population over many years, combined with more recent, natural demographic and environmental pressures, such as soil erosion. Peasants have felt forced to move from the traditional Indian highlands into the tropical lowlands, where they have often conflicted with non-Indian cattle ranchers and the private forces of large landholders, as well as with each other. Furthermore, economic development through seasonal non-agricultural employment has led to greater inequality and increased divisions in indigenous (and non-indigenous) communities (Stavenhagen, no date). Many independent credit, marketing and land rights movements had been organising since the 1970s, and so it was these that provided much of the Zapatistas' base (Stahler-Sholk, 2007).

The inauguration of NAFTA was viewed as the correct moment for the Zapatistas to begin their uprising. The agreement had also entailed a reform of Article 27 of the 1917 Mexican Constitution; peasants could no longer petition collectively for land, much reducing their prospects for a secure subsistence (Stahler-Sholk, 2007). Furthermore, prospects for Mexican farmers generally were worsened due to the opening of the market for American food products, and the removal of Mexican agricultural subsidies.

The Rebellion, 1st January 1994

On this day the EZLN seized several towns in central and eastern Chiapas, proclaiming a revolution. Other EZLN members travelled into the mountain areas to promote their cause and seek new members from the peasantry. Tourists and civilians were treated with courtesy, whilst circulars were distributed and broadcasts made from a captured Ocosingo radio station. The broadcasts encouraged other Mexicans to join the insurgency and to help dispose the 'illegal dictatorship' of the Mexican government, whilst calling on international organisations to come and monitor any violations of the Geneva Convention (Collier and Quaratiello, 1999).

The Mexican government responded by mobilising 12,000 troops. Within days, following a few small battles and an estimated 150 dead, the Zapatistas retreated into the eastern tropical lowlands. However, the Zapatistas had acquired the support of the media, and consequently the national and international public. They also had the support of the influential bishop of Chiapas, Samuel Ruiz. Throughout Mexico, many anti-government actions followed in the weeks following the government's ceasefire offer (12th January), such as the seizing of town halls, whilst peasant and indigenous organisations stated their approval of Zapatista demands (Ibid).

On 21st February, peace talks began; The Zapatistas' spokesperson was Sub-comandante Marcos. However, the talks were hampered by a national crisis and confusion relating to confidence in the legitimacy of the government, and internal government conflict and accusations. This led to the rejection of the tentative peace accord by the Zapatistas on 12th June, in favour of a national convention which would reform the constitution (ibid).

Government actions

Whilst the government initially tried to portray the Zapatistas as native, gullible peasants led by foreign subversives, it later came to acknowledge that the Zapatistas had justifiable grievances (Collier and Quaratiello, 1999). The government preferred to suggest that the ultimate problem was poverty and that this could be solved by development aid and foreign investment, rather than choosing to deal directly with the demands of various organisations including the Zapatistas (Stavenhagen, no date).

The government kept troops in Chiapas to inhibit the EZLNs activity, and in February 1995, the government illegally broke the ceasefire by moving into areas previously held de facto by the Zapatistas. It was perceived by many as an attempt to capture Marcos, whilst the government stated that it was intended to bring the Zapatistas back to negotiations (Stavenhagen, no date). There has also been selective government assistance to those communities which have confirmed their anti-Zapatista stance (Quiroz, 2004).

There has been an increase in paramilitary activity in Chiapas, which is government-linked (although the federal army denies any involvement). Although the story has varying accounts, 45 unarmed, supposedly pro-Zapatista Indians were massacred in December 1997 by an unidentified paramilitary group (which many believe was linked to the government) (De Huerta and Higgins, 1999). There have also been various accounts of violence including murders, torture and abductions of Zapatista sympathisers and presumed EZLN members (Stavenhagen, no date).

The government has also made it harder to foreign observers to visit Zapatista communities, with the expulsion of 134 Italian observers in May 1998 being most notable (De Huerta and Higgins, 1999). Furthermore, in communities were autonomous and official governments coexisted, conflicts between the community members about Zapatista affiliation sometimes produced jurisdictional disputes and consequent clashes between the competing authorities, which the government used as pretexts for coercive intervention against the Zapatistas (Stahler-Sholk, 2007).

Critiques of 'development' strategies

The government has been accused of dishonestly and hypocritically using the language of sustainable development, agrarian reform and indigenous rights to promote so-called biopiracy (i.e. the commodification and commercialisation of natural resources, including in this case biodiversity, and even indigenous multiculturalism as a marketable asset for ecotourism). For example, indigenous settlers were removed from the Montes Azules region in order to make a 'biosphere reserve'; meanwhile, ecologically-destructive schemes such as African palm and eucalyptus plantations have continued to go ahead (Stahler-Sholk, 2007).

There has been no independent evaluation of the impact of investments (at least until 2000); increased spending will not necessarily lead to an improvement of rural livelihoods, especially where most investment has occurred in cities, and without community participation (Stavenhagen, no date).

Zapatista demands, ideas and initiatives

The Zapatistas did not aim to capture central power, but rather to revolutionise Mexico by building networks with civil society, and by proposing alternative national political reforms (Quiroz, 2004). They also aimed to unite members of differing religions by offering a new unified identity which validated class and indigenous collective identities; this applied especially to followers of catholic liberation theology and protestant denominations, which were separate from the 'traditionalist' Institutional Revolutionary Party (PRI) catholic religion (Stahler-Sholk, 2007).

The EZLN convened the Forum for the Reform of the State, which was a meeting of various political and social forces, aiming towards national proposals related to justice and democracy (De Huerta and Higgins, 1999). The Zapatistas are critical of the 'neoliberalism'

project, stating that it disenfranchises and controls those who lack capital, and that collective priorities should be defined independently of the global market (Stahler-Sholk, 2007). A common statement that backs the Zapatistas' critiques is that the neoliberalism project (including NAFTA) has not improved living conditions for Indians in Mexico, but rather has caused increased inequalities, and consequent losses of communal networks and social compensatory institutions (Stavenhagen, no date).

The Zapatistas have periodically produced public documents ("Declarations from the Lacandón Jungle"). The first stated their basic objectives, namely: work, land, housing, food, education, independence, liberty, democracy, justice and peace (Stavenhagen, no date). Regarding individual rights, they state that the task is to recognise that there are infinite differences between people, and that all people should have equal access to the rights they need, and so a politics of tolerance and inclusion is necessary (De Huerta and Higgins, 1999).

A more direct relationship between authority and society is proposed, whereby decisions are taken by those who will be affected by them. It is stated that a politician's role is not to direct society, but to fulfil a function which is decided by society, and that politicians should thus be placed under vigilance and sanction. There should be a system for evaluating a government's work, and society should be able to reverse electoral decisions if the government is not performing its agreed role. Finally, the EZLN believes there must be an equity between the powers behind different political ideas, since traditionally some political parties have had greater financial power and other devices than other parties (De Huerta and Higgins, 1999).

Moves towards autonomy

The EZLN proceeded towards creating their own autonomous communities regardless of any potential agreements with the government. This has occurred in several stages:

- December 1994: EZLN announced their organised presence in 38 municipalities, in response to the military's attempted encirclement of the Cañadas region, which they had assumed to be the Zapatistas' centre.
- October 1996: EZLN boycotted municipal elections, refusing to recognise the elected authorities. They chose instead to follow their own systems, such as the traditional indigenous usos y costumbres (a system of choosing leaders in open community assemblies).
- Post-1997: Further institutionalisation of the EZLN autonomous systems, frequently including the expelling of the municipal government.
- August 2003: Regional representative Juntas de Buen Gobierno (good-government councils) were formed. These consisted of a governing council of two representatives from each autonomous municipality within a particular region, with the representatives changing each 10 to 15 days (Stahler-Sholk, 2007).

Models of autonomy

The Zapatistas state that they insist each community can develop or choose its own model of autonomy, as well as its own network of relations. One of the biggest challenges for the Zapatistas, however, has been to provide resources to its support-base communities, without converting back to dependence on those resources owned by external forces. This had been made more difficult by the surge in land invasions following the 1994 rebellion, by non-Zapatista communities. Furthermore, it is believed that the government has attempted to impede land acquisition and the keeping of existing land. The Zapatistas have been able to maintain 'self-sufficiency', though only via cross-community trading (Stahler-Sholk, 2007).

Two important aspects of the Zapatista communities' self-management have been community-controlled education and administration of justice. The education reforms

included the expulsion of the teachers from the national Department of Education; this thus meant the loss of the meagre resources that had formerly existed, but also the gain of greater community control in designing relevant curricula. The Zapatistas have identified a consequent challenge of this new power over curricula: the design of the curricula without leaving behind those communities not affiliated with the Zapatistas (ibid).

The EZLN has been accepting support from NGOs; however, only following careful negotiations in each case, in order to avoid the dictation of the NGOs' preferences over the communities. The Zapatistas have criticised the NGOs by claiming the tendency of them is to decide what the communities need without actually consulting them. The Juntas de Buen Gobierno have sometimes charged a 10% tax for a region receiving an NGO project, with the funds then going into other communities in order to counterbalance the uneven development. Thus, the Zapatistas have been able to some extent to escape from the 'autonomy without resources' trap, without compromising their autonomy (ibid).

The San Andres Peace Accords

The San Andreas peace talks began in September 1995, some months following the breaking down in 1994 of the original tentative peace talks. Congress had enacted a law for 'dialogue and peace in Chiapas', thus establishing the ground for the talks. The National Mediation Commission (CONAI) headed by Bishop Samuel Ruiz, played a strong role in facilitating the discussions (Stavenhagen, no date). It led in February 1996 to the signing of the Accord of San Andres on Indigenous Culture and Rights, which meant the constitutional recognition of autonomy through usos y costumbres and collective land ownership. The demands put forward were a combination of those from various indigenous interest groups (De Huerta and Higgins, 1999).

However, the talks fell into trouble, and so although previously a discussion on seven topics had been agreed, the remaining six topics (such as the second topic on 'democracy and justice') never began. In December 1996, a commission of representatives from the various political parties, named COCOPA, was formed to try and rescue the peace process. It attempted this by negotiating separately with both the EZLN and the government, and then making a text compromising the separate demands. This text was then accepted by the EZLN, but not by the government. The latter produced in January 1997 their own agreement which had been stripped of most of the indigenous rights that had originally been agreed. The Zapatistas naturally rejected this, before deciding to quit the negotiations and return to their Chiapas strongholds (Quiroz, 2004). The Zapatistas later stated that they would resume talks if certain previous conditions were upheld, namely the adherence to the original San Andres Accords, the partial removal of the federal army to the positions held before the illegal 1995 manoeuvre, and the removal of paramilitary groups from the region (Stavenhagen, no date).

Development post-2000

The situation took a hopeful turn in 2000 when Vicente Fox was elected, making him the first president from the centre-right opposition party in modern Mexican history. Within the first month of his office, the federal army retreated from positions demanded by the EZLN, and over 100 EZLN members were released from prison. Then in early 2001, the COCOPA Indigenous Rights Initiative was sent to congress. However, following the March 2001 speech of the EZLNs Comandante Esther in support of the originally accepted COCOPA version, congress decided to approve a newly modified version, in which the right to indigenous autonomy had been approved, but not in a national context – each federal state was to define their own legal meaning of 'autonomy'. Thus, the EZLN again rejected the law and severed contacts, making the talks a failure (Stahler-Sholk, 2007).

Brief summary, and some concluding remarks

The Zapatista movement was built on a history of injustice felt by the indigenous and non-indigenous rural peasants of Chiapas. Following a brief rebellion in 1994, a peace process began which, although for a time was looking hopeful, has failed to achieve success. The Zapatistas have proceeded to create autonomous communities, regardless of the failed peace talks, with all the consequent new challenges and opportunities. As suggested by Stavenhagen (no date), it is thanks to the EZLN that the awareness and respect for Mexico's indigenous population has become greater. Furthermore, the survival of the Zapatista communities, in spite of government efforts to undermine and divide them, is no doubt an inspiration to other movements in Mexico and beyond which seek to create local and national alternatives to neoliberalism (Stahler-Sholk, 2007).

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Catholicism in Mexico

Alison Roberts & Nina Rakow

Catholicism in Mexico: From La Virgen de Guadalupe to Liberation Theology

This essay attempts to give a brief introduction into Catholicism in Mexico as it began and how it has evolved to its current form. The first chapter of this essay is broken down into more historical sub chapters on the arrival of the Spaniards (1.1), the Virgin of Guadalupe (1.2), and the widely celebrated Day of the Dead (1.3). Afterwards, chapter two will look at Catholicism in present-day Mexico and how it relates to liberation theology (2.1), and look at the present state of the institutional church (2.2), which will be followed by a section about the rise of evangelical charismatic churches (2.3).

The arrival of the Spaniards

As with all the other Spanish conquistadors that set out toward the New World before him, Hernán Cortés was required by the Spanish crown to convert the native populations to the Catholic Church. The legal guideline behind the Spaniards actions was the so-called Requerimiento. The Requerimiento, which was written by Juan López de Palacios Rubios and which was backed by the Inter Caerta put forward by Pope Alexander XI, gave supreme power to the Spanish crown over all lands and peoples in Latin America at the start of the conquest. The Spaniards, in return, had the task of converting the local population to Christianity, and they often did so with brutal force (Stephens, 1998). Cortés took this instruction seriously and as he plundered through the county he insisted local indigenous populations to erect crosses and shrines to the Virgin in lieu of their idols. For this purpose Cortés brought with him a Franciscan friar, Bartolome de Olmedo and a priest, Juan Diego. One of the key figures in conquering the Aztecs and subsequently converting the local population was La Malinche, a young woman from Tabasco who spoke not only Nahuatl and Maya languages, but also Spanish. La Malinche (also known as Doña Marina) served as Cortés´ translator and later bore him a son, Martín. Lenchek (2000) writes that she was a "fervent Christian" and worked hard to convert her people to Catholicism during the early years of the Conquest of Mexico. Between 1519 and 1524 a total of twelve friars arrived in Mexico, with the main aim of converting the indigenous populations to Catholicism. Because the same papal decree deemed that the native population had "souls", many of the "converted" were simply baptized without any follow-up and the Spaniards continued to treat the native population with a mixture of paternal indifference and hostility.

The Rise of the Virgin of Guadalupe

All of this changed after 1531, when the Virgin of Guadalupe first appeared in Tepeyac. According to the legend, Juan Diego, a recently converted indigenous man, was walking in the hills surrounding Tepeyac on the morning of the 9th of December, 1531 when the Virgin Mary approached him on the hillside. It should be noted here that Tepeyac was and continues to be a pilgrimage site for indigenous peoples who wish to honour Tonantzin, the Aztec goddess of fertility and nurturing. Dressed in a long blue-green mantle, the dark-skinned Virgin spoke to Juan Diego in his native Nahuatl and asked that he erect a shrine in her honour. Juan Diego, described as a "poor and humble person with a pure mind", went directly thereafter to see the Archbishop Juan de Zumárraga, who was rather sceptical of Juan Diego´s story and thus demanded proof of the Virgin´s apparition. On the following day Juan Diego returned to the hillside and the Virgin reappeared. The next day, December 12th, Juan Diego´s uncle fell ill and he walked again in the direction of the hill to find a priest and on his way the Virgin appeared for a third time. She instructed him to pick roses at the top of the hill, despite the fact that it was December and no flowers were in bloom. Juan Diego did so and returned to the Virgin with his tilma (cloak) full of flowers and she rearranged them and instructed him to bring them to the Archbishop. Upon doing so, an

image of the Virgin was imprinted on his cloak and his uncle was miraculously healed (Andersson: 71). Naturally, a temple was quickly built at the site of the apparition and the story spread throughout the country. Over time, the original church has been replaced by newer and larger churches (the last one constructed in 1976) and in 1990 Juan Diego was canonized as a saint.

Little by little, the story of the apparition of the Virgin of Guadalupe gained credibility throughout the country and her image became an important new symbol of Mexican identity. The first book published about the Virgin, namely Miguel Sánchez's 1648 Imagen de la Virgen Maria Madre de Dios de Guadalupe milograsamente aparecida en la Ciudad de Mexico, was written more than 100 years after the Virgen's apparition and claimed that Mexicans were the chosen people in the Promised Land (Andersson: 121). Another less-known account of the Virgin's apparition is Luis Laso de la Vega's Huei tlamalhuicoltic (Nahuatl: "The Great Happening") which was written in Nahuatl in 1649. Vega's account of the apparition uses a colloquial style, poetic descriptions, and Nahuatl's use of diminutives, thereby lending the text a decidedly un-European feel (Brading: 81-83). In 1629 a series of floods affected the region and the Virgin's image, which was hurriedly carried to the cathedral in a canoe, was said to be responsible for stopping the floods and thus she rose to the status of Patrona Principal in the region and in 1756 she became the Patroness of the entire Viecroyalty. In 1810 Miguel Hidalgo y Costilla, leader of the Mexican independence movement, brought masses of Mexicans together against the Spanish colonial rule, which was crystallized in the infamous Grito de Dolores: "Long Live Our Virgin of Guadalupe! Death to the Spaniards!" (Andersson: 125). Taking into account the popularity of the Virgin amongst Mestizos and Indigenous peoples alike, Mexico's first president even changed his name from José Miguel Ramón Adaucto Fernández y Félix to Guadalupe Victoria. Even the Zapatistas in southern Mexico have adopted her image; an image of the Virgin, known as Guadalupe Tonantzin, has appeared on flags during the Zapatista 's demonstrations.

Today, the Virgin's image can be found in a plethora of places in modern-day Mexico such as in taxis, buses, government offices and schools. Mexicans demonstrate their affectionate relationship with her in the numerous diminutive nicknames for her: Lupe, Pita, etc. Every year on the 12th of December Mexicans across the country celebrate her apparition and tens of thousands of Mexicans make the pilgrimage to her shrine near Mexico City. Andersson's dissertation (2000) , entitled "The Virgin and the Dead", discusses how the Virgin of Guadalupe has contributed to Mexican nationality and points to six common perceptions of the Virgin in present-day Mexico, namely A) the Mother or Queen of Mexico; B) the maker of miracles; C) the compassionate Mother Mary; D) She who symbolizes unity; E) another version of Tonantzin and F) the Virgin (76-77). Whether the Virgin's syncretic composition was a clever method of the conquistadors to convert indigenous populations to the Catholic belief or whether she is (was) simply a Christian disguise for indigenous peoples to continue honouring their indigenous idols (similar to Voudou in Haiti or Candomble in Brazil) is a debated matter that may well never be agreed upon. However, what is important to note is that she has remained a strong symbol of Mexican identity over centuries, and can be said to be a uniquely Mexican phenomenon.

Day of the Dead in Mexico

Día de los Muertos (Day of the Dead) is another event in Mexico that, like the Virgin of Guadalupe, combines Catholic and indigenous symbols in a unique way and, as such, deserves mention here. Essentially, Día de los Muertos is a holiday that provides Mexicans with a portal to communicate with and commemorate the deceased and as such might be considered the country´s most popular holiday. It coincides with the Catholic holidays of All Saint's Day and All Soul's Day, which take place at the beginning of November, and is rigorously celebrated throughout the country. The central belief is that on these days it is easier to the souls of the dead to make the journey back to Earth and communicate with the living. For this purpose, Mexicans construct ofrendas (alters) in their homes, on which the

favourite foods and beverages are displayed and said to be consumed by the dead (Palfry). Andersson (141) mentions that public ofrendas have been constructed in the past for famous Mexicans like Frida Kahlo or Emiliano Zapata, or for victims of natural disasters, like those who died in the hurricane that hit Oaxaca in 1997.

Preparations for the Day of the Dead commence in mid-October, when families begin to purchase the necessary supplies for the ofrendas, cleaning their homes and clearing away any weeds or roots that may have sprung up over the last year in the graveyard. Around the 31st of October, families construct an elaborate ofrenda in their homes, usually on a table. On this table a combination of the following items can be found: candles, bread shaped in the form of bones, various foods, beverages, cigarettes, pictures of saints, feathers, skulls made of sugar (calaveras) and marigold flowers. In fact, some families also place a bucket of water, soap, towels and a blanket on their ofrendas because they believe that the dead have travelled a great distance and might be in want of a shower and a sleep. Oftentimes the holiday takes on a jovial and relaxed atmosphere, as families tell jokes and anecdotes about the dead, for it is believed that the dead are not only present, but also listening (Andersson: 140-141). The 1st of November, also known as Día de los Angelitos (day of the innocent ones), is believed to be the day when the souls of dead children and infants arrive and commemorate with the living. Later on that evening the deceased adults arrive and partake in the ofrenda´s offerings. On the night of the 2nd the dead accompany their families to the graveyard, where the tombstones (panteones) are decorated with marigold flowers and candles. The families stay in the graveyard, oftentimes playing instruments and telling stories, usually until dawn when it is believed that the dead return to their world (Slenczka: 58).

"The Mexican," according to the Mexican Nobel prize novelist Octavio Paz, "in contrast, is familiar with death. (He) jokes about it, caresses it, sleeps with it. It is one of his favourite toys and his most steadfast love" (http://thinkexist.com/quotes/octavio_paz/3.html). Indeed, death has always been a central theme in Mexican consciousness. The Aztecs, for example, believed that life and death were two sides of the same coin; they believed that the dead played a vital role in the regeneration of the Earth, which led to the Aztec´s strong emphasis on (human) sacrifice and the belief that the dead ancestors were key in determining the fertility of the land and the subsequent well-being of humankind.

It was for this reason that the Aztecs celebrated the dead in a cycle of holidays, the largest of which being the festival of Mictecacihuatl ("The lady of the dead") which was celebrated for an entire month around August (Slenczka: 64). It should be mentioned here that in Aztec believed that upon his or her death, an individual would be sent to one of the following four afterlives: Tonatiuh ichan (for those who died in childbirth, on the battlefield or on the sacrificial altar- these were considered the most noble deaths), Tonacaquauhtitlan (for children that died), Tlalocan (for those who died in natural disasters or drowned), and Mictlan (for everyone else). It can generally be said that the Aztecs held the first three afterlives in a positive light, whereas Mictlan had a somewhat negative tone (Slenczka: 65).

Catholicism in Mexico Today

This Chapter mainly deals with liberation theology in the southern part of Mexico and the reaction of the institutional Catholic church in the whole country. The last part of this chapter will describe the changes caused by Evangelical charismatic churches that became of significant importance mainly in southern Mexico in the last sixty years.

To recognize the relevance of the Catholic religion in Mexico one must consider the high percentage of Catholics, which is about 89 % (see http://en.wikipedia.org/wiki/Mexico#Religion). Mexico has the world's second largest number of Catholics after Brazil. About 6% of the Mexican population is evangelical. Among the evangelical Christians, the Mormons, the Jehovah's Witnesses and the Seventh-day Adventists have growing numbers.

Through this high number of Christians one can imagine that the Christian faith and the church play an important role in everyday life in Mexico, although Mexico has no official religion and the government is independent from the church.

Liberation Theology

Liberation Theology has a central meaning in Chiapas, the most southern state of Mexico. This is linked up with the addressees of Liberation Theology who are people that suffer because of hunger, malnutrition, illiteracy, and bad medical supply. Although Chiapas has a high amount of mineral resources like oil and a high biodiversity, people are poor. There is a high rate of indigenous people, about 70%, who are predominantly small-scale farmers or even do not have land to live on (Möller: 14).

This situation has not really changed over the last 500 years. When one of the mentors of Liberation Theology, Bartolomé de las Casas, came to Hispaniola in 1502, the indigenous people were slaves of the European colonialists. In his first years abroad, las Casas worked in the colonialist structures of the Catholic Church, but the more he got to know about the situation of the indigenous people, the more he criticized how the Spaniards handled them. Since 1514 he campaigned for the abolishment of slavery.

But he was not totally against the colonization, either. His proposal was to replace the soldiers with monks in order to have a „peaceful colonisation". In 1543 Bartolomé de las Casas became the first Bishop of Chiapas. He lived in Ciudad Real, the town that since 1844 is named "San Cristóbal de las Casas". But as he fought for the abolishment of slavery, he refused the absolution to those who did not free their slaves. His opponents reacted by cutting off any financial support to the diocese and so the diocese asked him to leave the town in 1547 (Möller: 10).

About 420 years after that, in the 1960`s, Liberation Theology was founded, mainly through the second council of the Vatican that took place from 1962 to 1965 and the second assembly of the Latin American episcopate in Medellín (Colombia) in 1968. The council of the Vatican set one focus on the "Church of the poor" (Möller: 19) that was then amplified by the Latin American episcopate to an "option for the poor". This option also implies the "option for the others". Poor people are in the context of Liberation Theology not only socially infirm persons but also ethnically excluded people. Therefore most churches based on Liberation Theology consist of indigenous people.

One of the Founders of Liberation Theology was the Bishop Samuel Ruiz García, a man who held office in Chiapas from 1960 to 2000 (Möller: 29). He followed in the footsteps of Bartolomé de las Casas through his commitment to indigenous rights. By founding ecclesiastical base communities that strengthen women's rights, medical supply, and self defence, he followed one main concept of Liberation Theology that is to reach liberation through sensitazion by education. Ruiz García did not only ensure that indigenous people got the opportunity to learn reading and writing, but also motivated them to reflect on their situation as oppressed peoples. Therefore he took care that the Bible was translated into indigenous languages such as Tzeltal, Tzozil, Chol and Tojolabal so that the people could read the Bible themselves and make their own interpretations (Möller: 29). In the 1990s Ruiz García acted as intermediary between the government and the Zapatistas at the negotiations of San Andrés (Möller: 39).

One group that is also involved in the conflict between the Zapatistas and the government are „Las Abejas" (English: "the bees"). This group of indigenous people consists of about 40 Catholic villages in the Chiapanecan highlands. Since 1997 the administration centre of these villages is the village Acteal, which lies in the north of San Cristóbal de las Casas. Before December 22nd in 1997, Acteal was inhabited by Zapatistas, PRIístas and people that belong to the "pueblo creyente" (English: "the believers"). But on the December 22nd the military and paramilitary troops committed a massacre where 45 people were killed. When the Zapatistas heard rumours of the planning of this massacre they flew into the mountains. But

the Christian community stayed praying in the church of Acteal, where some of them where killed (http://en.wikipedia.org/wiki/Acteal_massacre).

The victims of the massacre in Acteal are said to fly all over the world in the form of bees to collect people who get to know about the situation of the indigenous people in Latin America. Therefore the Catholic communities are now called "Las Abejas".

Reaction of the Institutional Church

The Institutional Catholic church does not support Liberation Theology because they are of the opinion that the believers of Liberation Theology are Marxist and that they only use the Christian religion to legitimize their political commitments (Kruip: 48). The Institutional Catholic church is not willing to change the state of indigenous people. They want to keep the differences yet they are willing to help the helpless and give support to the poor. But the opinion of the Institutional Catholic church is that the Europeans do not live on exploitation (dependency theory) but rather on deeds of good work (development theory) and so they do not want the indigenous people to get a better state because they have to learn to do good work before they receive their earnings (Kruip: 51). The Institutional Catholic church is dominantly led by office holders with European origin. Furthermore, important conferences concerning the situation of Latin America are often held in Europe. Because of this one could say that the behaviour of the exponents of the Catholic church towards the indigenous in Latin America mimics the behaviour of the Spanish conquistadors towards the Aztecs.

Evagelical charismatic Churches

In the last sixty years especially in the south of Mexico many people converted and became part of Evangelical charismatic churches. The basis of belief of these churches is the literal interpretation of the Bible, the bodily resurrection of Christ, "The second coming" of Christ on Earth and the personal rebirth because Jesus died for their sins. With these contents these churches mainly attract poor people and as the indigenous people in Chiapas are very poor they are not only the addressees of Liberation Theology but also of Evangelical charismatic churches, as well. But in contrast to Liberation Theology these churches do not want the people to become independent and self-determined but rather to gear their lives on their faith and live for God. Earthly poorness should be conquered by a strict and godly lifestyle. In these churches symbols like frankincense, candles, alcohol and idols like the Guadalupe are forbidden (Möller: 59). Leaders of Evangelical charismatic churches translated the Bible in Mayan languages and gave alphabetization courses. The translation of the New Testament in Tzeltal was already completed in 1954 (Möller:58).

Through the conversion in Chiapas the number of Catholic Christians dropped to 70%. Until 1994 one third of the Tzeltales were converted. But the Tzozilles did not convert that much. In San Juan Chamula, a Chipanecan village next to San Cristóbal de las Casas, converted Tzoziles were banished out of the village (Möller: 60 f.).

Conclusion

Although Mexico and especially Chiapas played an important role for the Liberation Theology through the effects of Bartolomé de las Casas and Samuel Ruiz García, Liberation Theology plays only a small role in Chiapanecan everyday life today. Also the officiating Bishop of Chiapas, Felipe Arismendi, is more geared to the position of the Institutional Church.

But the situation of the indigenous people did not change and because of that it remains to be seen if the rising Evangelical charismatic churches will find an earthly solution for the conflict in Chiapas or if the Institutional Catholic church will change its course to reach the indigenous people again.

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http://en.wikipedia.org/wiki/Acteal_massacre

Plan Puebla – Panama and other efforts to modernize Mexican agriculture

Arnd Zschocke

Introduction

This paper is intended to give a brief overview over efforts to modernize Mexico's agriculture. A first example is the "green revolution" of the 1940s, which is presented with it's short and long term effects. The second part focuses on the Plan-Puebla-Panama as a mega-project to develop Mexico's southern regions. The Plan's goals and intended ways to achieve them are contrasted with common arguments against it. In the end a conclusion is drawn and some questions are asked for the reader to think about and maybe draw his/her own conclusion during and after our excursion to southern Mexico.

History

The development of agriculture in Mexico is very strongly linked to land rights and land distribution which are very political issues and throughout the history of Mexico always were reasons for conflicts and revolutions.

In times when the land was/is owned only by a few wealthy landowners and cultivated by their slaves/laborers there were/are usually bigger plots and more capital available for a systematic increase of the efficiency through mechanization and the use of external inputs. If modernization is understood as such an increase in labor efficiency then the modernization of Mexico's agriculture mainly took place in times and regions where the land was only owned by a few.

The Green Revolution

After the Mexican revolution and World War II Mexico was faced with a situation of a growing population (especially in the urban areas) and an insufficient national supply of staples, especially wheat.

At the request of the Mexican government the Rockefeller and Ford Foundations financed a research program starting in 1944 which was mainly carried out by North-American scientists to improve the productivity of Mexican agriculture. The efforts focused on four major areas:

- Irrigations systems: The building of dams and big irrigation channels made it possible to cultivate crops in arid regions and thus extend the agricultural area especially in the dry northern regions of Mexico.
- Synthetic fertilizers: The large-scale introduction of synthetic fertilizers into Mexican agriculture increased yields and promoted plant growth also on poor soils.
- Synthetic plant protection agents: The introduction of synthetic pesticides, herbicides and fungicides reduced the loss of crops through these hazards.
- Breeding technology: Through modern breeding technologies, HYVs (high yielding varieties) were developed. The focus was on wheat and to some extent on corn. Some improvements were higher nitrogen uptake, shorter stems, disease resistance and increased yield through hybridization.

The most prominent North-American scientist involved with the breeding program was Norman Borlaug, the father of the "Green Revolution", who later won a Nobel Peace Prize for his work. Out of the initial Office of Special Studies in 1963 the CIMMYT (the International Center for the Improvement of Corn and Wheat) was formed which was the first international agricultural research institution and in a way lay the foundations of the CGIAR (Consultative Group on International Agricultural Research) which was established in 1971.

Short and mid-term effects

The effects of the "Green Revolution" in Mexico especially for the production of wheat are impressive and led to efforts to copy the methods worldwide. From an importer of wheat (1943: half of the consumed wheat was imported) Mexico became an exporter (1964: 0.5 Mio t were exported). The wheat yield was increased from 750kg/ha in 1950 to 3200kg/ha in 1970. The big irrigation projects more than doubled the irrigated area from 1.5 Mio ha in 1950 to 3.5 Mio ha in 1965.

Long term effects

There a critics of the "Green Revolution" who state that there are also negative environmental and social long-term effects of the introduction of modern agriculture in Mexico and other countries:

- Improper irrigation system can lead to the salinization, erosion and subsequent desertification (in Mexico, 384,163 ha in a total drained area of 5,203,346 ha are in a state of salinization)
- The energy efficiency (calories put into production / calories harvested) of the modern production methods is not better and often worse than that of traditional agriculture which is mainly owed to the high amount of energy put into the production of synthetic fertilizers and plant protection agents.
- Agrochemicals and monocultures are a threat to natural ecosystems and a health risk for farmers and consumers – the dietary diversity is also reduced.
- Most of the intensively produced crops are cash crops for export. In Mexico crops from irrigated fields account for 70% of the agricultural exports and although being the origin of corn cultivation, Mexico has to import almost half of its corn.
- The social effects are very complex but can be summarized in a growing inequality between the big landowners and the smallholders or landless laborers and a growing dependence on the providers of inputs on the one hand and international markets on the other.

Unequal regional development

As discussed previously the agricultural development in Mexico advanced much faster in the north, where the ownership structure of the land is characterized by the predominance of large scale landowners who produce cash crops for the (international) market. In the rural south of Mexico there are much more smallholders, and the ownership is characterized by a predominance of communal ownership (ejido system). Extreme poverty (defined by insufficient dietary intake) is at 47% among the southern Mexican population while in the north it is at 12%.

This is often also attributed to the lower agricultural production of the smallholders in the south.

This uneven development has been identified and especially the South has been the subject of different governmental development projects like PROCAMPO, a direct cash transfer program or ALIANZA, a matching grants program for investments in the modernization of agriculture.

Plan Puebla-Panama

The Plan Puebla-Panama (in the following called PPP) is a joint international (the Central American countries plus Mexico) programme to develop and integrate the Central American region from the city of Puebla in Mexico down to Panama.

Rationale of the Plan

The PPP was first announced by Mexican President Vicente Fox on March 12, 2001 and officially launched during a Central American summit conference in El Salvador on June 15, 2001.

The overall goal was to improve living conditions for the population, and the initial objectives were:

1. Human / social development
2. Participation of the civil society
3. Structural change of the economic dynamics in the region
4. Use of comparative advantages
5. Promotion of productive investments
6. Sustainable natural resource management
7. Consolidation of joint plans and strategies between the Central American countries
8. Modernization and strengthening of institutions.

It included the nine southern states of Mexico as seen in Figure 1 and the Central American Countries with Colombia joining later.

Components of the Plan

To reach the objectives eight areas were identified where cooperation between the partners would be needed to implement projects. Each work area was assigned to on partner country to coordinate, which were:

1. Energy Sector Integration (Guatemala)
2. Transportation Integration (Costa Rica)
3. Telecommunications Integration (El Salvador)
4. Trade Facilitation (Honduras)
5. Sustainable Development (Nicaragua)
6. Human Development (Mexico)
7. Tourism (Belize)
8. Disaster Prevention and Mitigation (Panama)

To work together on these topics, the partners organized themselves along two main axes: Human Development and Productive Integration.

When Colombia joined in 2006 it became responsible for the topic of biofuels and took over tourism from Belize which in turn became responsible for climate change matters.

Additionally an executive commission (CE), an inter institutional technical advisory group (GTI) and a commission for promoting and securing funds for the projects were formed. After a 2004 summit in Managua, Nicaragua, an executive directorate in San Salvador, El Salvador was established.

At a meeting in Villahermosa, Mexico, in June 2008, the PPP was renamed to "Proyecto de Integración y Desarrollo de Mesoamérica (Proyecto Mesoamérica)".

Development of the Plan

Due to some criticism the PPP developed slowly but nonetheless until 2008 projects with a joint value of over 8 bil US$ were financed. The priorities of the spending are such: transportation 85.2%; electrical 11.1%, tourism 1.3%, human development 0.8%, disasters 0.7%, trade 0.6%, sustainable development 0.4%; and telecommunications 0.03%.

In the transportation sector a special focus laid on inter-oceanic corridors between the Pacific in the west and the Caribbean or Gulf of Mexico in the east. The projects include roads and highways as well as port facilities.

The energy integration is mainly focused on projects to connect the different national grids and this way also connecting Central America to the North American grid. In the first phase of the PPP there were also several big hydroelectric dam projects planned, which were dropped after public criticisms. Also the development of Biofuels is focused.

The telecommunication part of the PPP is mainly about submarine fiber optic connections and fiber optic cables bundled to the main electrical grid to connect the region to a "Central American Information Highway" Autopista Mesoamericana de la Información (AMI).

In the other sectors there are mainly administrative projects of less cost for new infrastructure.

Criticism of the Plan

From the beginning the PPP was heavily criticized by social movements and indigenous people.

- One concern are the big hydroelectric dams, which would mean the displacement of many people and the destruction of important ecosystems.
- Another concern is that the economic integration will attract investors which would buy up the land and start industries which would exploit the people and natural resources.
- The critics also opposed the establishment of a Central American corridor of nature reserves and protected areas, because they fear that local population will be displaced while multinational investors profit from the screening and sourcing of potentially valuable plant material and biodiversity.
- The main complaint is that decisions are made without participation of the affected population and that there is a bias favoring cooperate investment which many feel will only benefit the wealthy and drain resources from the region.

Conclusion

The green revolution and agricultural development brought tremendous increases in yields and revenues especially to northern Mexico, while in the long term it contributed to the degradation of the soil and other environmental problems. It also did not solve but rather contributed to social inequality. Also the integration of markets with the NAFTA-agreement brought benefits only to a few. That is why a wider public is very skeptical about similar projects like the Plan Puebla Panama, to develop the poor southern states of Mexico. The assessment of social and environmental impacts of such mega projects is often done only very superficially because the economic goals are in focus. Often the affected people do not profit from such developments (or only for a short time). That is why participation is important on every level.

The questions the reader should think about and investigate are:

Is participation on every level possible for such big projects?

What is agricultural development and does it mean the same for all stakeholders?

Who gains and who loses in the process of modernization?

Is there a way to achieve a win – win situation or will there always be loosers?

Maybe the trip to Mexico will bring us closer to find some answers to this question.

Some further reading

Website of the PPP and Projecto Mesoamerica: http://www.planpuebla-panama.org

Archive of Global Protests PPP site: http://www.nadir.org/nadir/initiativ/agp/free/colombia/puebla/

CIEPAC page on the PPP: http://www.ciepac.org/archivo/ppp.htm

The ‘Ejido’ system and the perpetual question of land property rights

Heike Pannwitt & Julian Plagemann

The year 1992 was a historical turn around in the Mexican agriculture. The article 27 which was the main achievement of the Mexican Revolution of 1910 was reformed.

The system of the Ejidos in Mexico means landownership by agricultural communes. And has its roots in pre-Columbian time. The question of land property rights was one of the central themes in the Mexican history. During the 19th and 20th century, farmers and Indian communes were fighting for a piece of land to live. The central point of the Mexican Revolution was reestablishing land property rights which they lost by the liberal agricultural policy in the 19th century. Before the revolution of 1910, 92% of the rural population were landless and only 1% controlled 97% of the arable land.

The constitution of 1917 includes the article 27 which names three forms of landownership: national, communal and private property. “La tierra a quien la trabaja” (The land to the people who cultivate it!), as one slogan of the revolution. So ejidos were founded by groups of landless farmers mostly in the 1920-1960s, and the government disappropriated great land owners for compensation. At first the progress was very slow but in 1970 43% of the arable land was distributed to 66% of the rural population. In 1991, 29,951 Ejidatarios were cultivating 102,876,789 ha equalling 53% of the national agricultural area. But ejido also created two classes, 1/3 of the Mexicans were authorized to be Ejidatarios and 2/3 were not.

How does an ejido exactly work? It consists of 2 unequal parts, the bigger one is called Allmende and the smaller ones are parcels. Each member of the ejido has the individual land use rights for his own parcel. This right is only transferable by inheritance. Therefore this member is called Ejidatario. An Ejidatario cultivates his parcel for his own benefit and is registered in the Registro Agrario National, R.A.N. The Allmende as the bigger part of the ejidoland is a common used property. Mostly the Allmende consists of forest or pasture. The idea of the commonly shared land is that even landless people are allowed to cultivate a part of the Allmende after the meeting of the ejido accepted the application of the landless, who is now called cumero/-a. Every third year the there will be an election of a leader of the ejido. This leader has the task to take care of the problems in the Ejido.

The reason for the turn around in agricultural policy was the inefficient constitution of the Ejidos. Almost the whole production is for subsistence. An example for the inefficiency is that only 3,700 working tractors are used on over 100 mill. ha of land. So most of the work is still done by hand.

The consequences of the reformed article 27 are the division of the one land title to two different owner titles. With the new tiles it is now possible to transfer each separately. The ejidatario becomes the private owner of his parcel and is able to sell his land. At the same time the ejidatario will be a co-owner of the Allmende. This ownership is also transferable.

The fundamental characteristics of the new constitution should be the same but that’s not clear. With the reformed article it is still not allowed to sell the Allmende. But every Ejido has the right to divide the Allmende in pieces and assign it to the Ejidatarios. This assignment is possible with or without reward and this is nothing else then an act of purchase. Another point is the prohibition of execution. But the right of use of parts of the Allmende is transferable to companies by leasehold; accept a guarantee or a hypothecary credit. This means in case of insolvency a temporal distress. Another point is the non-transferability: the new law permits the transfer of the right of ownership and use by lease. It makes sure that the leaseholder has the purchase option in case of insolvency. This fact has the consequence that even non-Ejidatarios have the right to buy land from an ejido. In the old law the

Allmende was indivisible which was the basic of an Ejido. With this law it was possible to integrate landless by giving them a piece of the Allmende to cultivate and get the chance to become a member of the Ejido. In summary with the new article 27 the ejido becomes divisible, seizable, marketable, transferable and individually classifiable. So the aim of the reformed law is the elimination of the ejido and the new philosophy seems to be that people eat what is cheap and not what they harvest by themselves.

The consequences of the realization of the new law by the Procede will be shown in one example. The ejido Sayula is situated 100 km south of Guadalajara and consisted of 112 members in 1998. Through the program for privatization (Procede) it came to fraud and murder and land robbery like that some parcel became smaller by the land surveying. All in all more land is leased then sold. Most of them are leased to so called Agromaquilas which are big companies. The decision whether the land will be leased or not depends on its ecological quality like the susceptibility to erosion or the lack of water. Finally the Procede produced a lot of problems in the ejido Sayula since 1993. Some of them are the defalcation of the ejido cash box from wood sell, the unequal division of the Allmende, land robbery which concerned 30 of 112 ejidatarios and another point is the arbitrary decision of the allocation of the land title.

As it is shown with the example Sayula the the reformed article 27 induced land conflicts and has the aim to abandon the ejido to make the Mexican agriculture more efficient. But the problem is the way of the turnaround which creates corruption and social injustice.

The massacre of Tlatelolco and the 1968 movement

Sabrina Leupolt

Introduction

On October 2, 1968, the government of Mexico killed 300 – 400 student protesters in Mexico City. The massacre of Tlatelolco was the climax of the political and social protests in Mexico City during the summer of 1968. The protestors were students questioning and criticising the authoritarian, paternal and centralized state.

The massacre of Tlatelolco

Tlatelolco is a district of Mexico City and a symbol for modern conflicts and catastrophes. Because on October 2, 1968 the horrible massacre took place on the Plaza de Las Tres Culturas of Tlatelolco. The Aztec Pyramid, the Spanish Templo de Santiago and the building of the ancient office for foreign matters represent this place. Despite of the cultural beau the focus should be on the massacre which occurred on this place. The day of the massacre was affected by student protest and violent clash of students and police. Students and other people demonstrated, gathered on the place and had a plenum. Suddenly there was a shot, probably of the secret police. Consequently violence broke out. There was no escape for the people to flee because they were surrounded by the police. As a result 300-400 demonstrators were killed and hundred persons were kept by the police and military.

Participants of the protest

Participants of the protest were intellectual people, teachers, workers and mainly students of the Universidad Nacional Autonoma de Mexico (UNAM). The UNAM is the biggest university of Latin America and involved in numerous uprisings.

Reasons for the massacre and the 1968 movement

The motives for demonstrating and the reasons for the movement of 1968 are to be found in the political background of Mexico. Mexico was in this period a very authoritarian state. October the 2 1968 was not the first day of protest because there were also other social protests, strikes and labour movements as well in the 1950s and 1960s because of dissatisfaction with the government. The demonstrators criticized the political trend in view of the economic growth. Because the government spent more money for industry and banking than for needs of the Mexican people. Even financial corruption occurred commonly. Low wages were another driving power for the people to go to the streets and to demonstrate for their rights. Furthermore the participants of the protest criticized also the bad justice and the paramilitary and military violence in their state. And the aims were better human and equal rights and social standards.

The changes in youth culture, modernity and popular music created a new political awareness. Also other movements from other continents and countries inspired the young people to demonstrate against their government. The students were intensely inspired of the Cuban Revolution, Fidel Castro and Che Guevara. The Cuban Revolution from 1953 to 1959 was the downfall of the Cuban dictator Fulgencio Batista and there was a new beginning for the regime headed by Fidel Castro. With a rebellious policy Fidel fought along with Che Guevara for human rights and social reforms.

Olympic Games in Mexico

Another important event should be put in context with the massacre that is the Olympic Games in 1968 which took place only 10 days after the massacre. Mexico was the first nation to host the Olympic Games in a developing country. Consequently Mexico would present itself as a modern country, so the government built a new metro and a new stadium and other investments. The fact is that the Mexican people did not accept the high capital

expenditures for the Games. So the Olympic Games were also the reason for the Mexicans to go to the street for demonstration. Because the governmental expense for the Games contributed to the dissatisfaction with the state. Due to the fact that the eyes of the world were upon Mexico, the country which hosted the Olympic Games, the president Diaz Ordaz and the other members of his government desperately needed to gain control of an increasingly embarrassing situation. It seemed that the massacre, carried out by governmental police, had a controlling function to stop the revolts and demonstrations. And furthermore to control and stop the apparent danger based on human population which could prevent and manipulate the Games. It was bizarre that the opening of the Olympic Games occurred as if nothing had happened the days before. There was no solidarity of the sportsmen and politicians with the victims of the massacre.

Government and presidency

The massacre took place under the government of Gustavo Diaz Ordaz, who was president of Mexico from 1964 till 1970 and belonged to the PRI. The government described itself as a modern state, but to see behind the curtain an authoritarian, corrupt and manipulating state dominated which impinging upon human rights and ignoring social standards. Someone was the guarantor for the massacre and to shift the blame on others the government payed newspapers to tell lies and to spread that the students began to shot and not the police. The newspapers wrote wrongly that only 29 protestors were killed and not, as is generally said, 300-400 people. The trouble was that the government did not feel responsible for the massacre. Therefore the clearing of the crime was still insufficient.

Man in charge

Only after about 30 years later the man in charge was discovered. The responsible person for the massacre was Luis Echeverria. Luis Echeverria was the Interior Minister of Diaz Ordaz and the president after Diaz Ordaz from 1970 till 1976. Echeverria was captured but released of prison because the crime is time-barred.

The importance in 1968 and after 40 years

The massacre of Tlatelolco and the 1968 movement were classified as a point of inflexion in Mexico. The repressive past, the authoritarian power structure and the fights for rights of students, workers and peasants in Mexico belong to the past. So why to be engaged in Mexico 68? The revolt of students, the movement of 1968 in Mexico was a symbol for the beginning of demography. The movement was affected by internationalism, by the feeling to be a part of the global connectivity. A lot of activities like the civil rights movement and the student activism characterise new forms of protest, in Mexico and even elsewhere. Spain, Italy and Japan experienced political crises because students and workers protested. In Germany, the year 1968 is perceived as a second foundation of the Federal Republic of Germany after the formal foundation in 1949, added with democratically consciousness of citizens. 1968 was also an upraise in art and culture, thus an unpolitical youth revolt which afforded a multiplicity of lifestyles and the freedom to choose any lifestyle. Did the youthful ardour effect a change in awareness and a focus on the problems in the own country? There was no abrupt modification to democracy after the movement of 1968. On the contrary repression, hectoring and militarization still existed in Mexico. Of course after the massacre the students were charged with emotions. Some were disappointed, afraid and awed and others were angry and not ready to capitulate but ready to fight further for their rights. The president of Mexico from 2000 till 2006, Vicente Fox, seemed to be a certain glimmer of hope because he belonged not to the PRI party but to the PAN party. This meant an important political change for Mexico. Fox promised democratic liberties and justice but his administration disappointed because a reform of the juridical system never occured. Nevertheless, 1968 can also be currently an inspiration for democratisation, protests and resistance.

Summary

In 1968 Mexico did appear to be on the brink of entering the modern world with the Olympic Games, the rising economy and a vibrant cultural life. But already in July young men and women rioted in the streets and required political change. „Solution to the problem, not repression. Dialogue yes, bayonets no!" This quotation from the book "Plaza of Sacrifices" show the appeal of the people and their desire for better social rights. The massacre of Tlatelolco had profound effects on society and culture. Violation of human rights had happened. The senate declared October 2 a national commemoration day.

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The Chinampas of the Valley of Mexico

Jonas Hagmann

What are chinampas, the so called "floating gardens"?

The name chinampa derives from two words of the Aztec language Nahuatl: *chinánitl*, meaning "an enclosed bed surrounded by cane or stakes" or "net of branches" and *pan*, meaning "on or above the surface" (Frederick 2007). Thus, the name describes somewhat how chinampas were built and what they look like: mostly rectangular, narrow artificial islands in swamps or shallow lakes, surrounded by canals with water (Figure 11) (Lumsden et al. 1987; Zuria and Gates 2006). Hence, Chinampas are a form of wetland or irrigated agriculture (Jiménez-Osornio and Gomez-Pompa 1991; O´Mack 1991). Their surface is at about 25 to 100 cm above the water level (Crossley 2004) and initially they had an area of about 500 to 1,000 m² (Mireles et al. 2004).

Figure 11: Aerial view of the Chinampas of Xochimilco, Mexico City.

Source: http://homepage.mac.com/helipilot/.Pictures/vistasaereas/Xochimilco.jpg, 12.01.2009.

Although the chinampas are often referred to as "floating gardens" the chinampas themselves have never really floated. Therefore, the seedbeds (almácigos), in which the seedlings were grown until planted on the chinampa, were the only floating garden. Those seedbeds were actually floating woven mats of dead reed, covered with muck from the lake (O´Mack 1991). Nowadays, the seedbeds are prepared on the chinampas. The mud is dried and cut into cubes. With the finger a hole is made in the cubes, where the seeds are put in (Crossley 2004). The almácigo was covered with mulch or a mat, thus protected against heavy rains, sun and frost (O´Mack 1991).

The materials used for construction were lake sediments, aquatic vegetation, and imported materials such as earth, sods, turf, branches etc. (Siemens 2004). It is known that there

existed different ways to construct a chinampa (Frederick 2007). In shallow lakes, for example, an underwater fence was built and filled with the building materials (Onofre 2005) or sods were piled up until they reached the water surface and then covered with mud (O´Mack 1991). In swamps, the soil from the trenches that were dug around the fields was thrown on the plots to raise them over the water level (O´Mack 1991). Also, imported building materials were used if the chinampas were not high enough (Lumsden et al. 1987) or soil from old chinampas that had risen too high was applied (Frederick 2007).

There is not much archaeological knowledge about the chinampa system (O´Mack 1991; Frederick 2007). Thus, there are many different figures given in the literature for when the chinampas were introduced in the Valley of Mexico. Jiménez-Osornio (1990) writes about 3,500 years before present, supported by Wirth (1997) who mentions 3,000 years. Others state 2,000 years (Matheny and Gurr 1983; Lumsden et al. 1987) whereas Onofre (2005) sets the date at 1265 of our time, surely referring to the expansion of the already existing chinampas during the rule of the Aztecs (Losada et al. 1998).

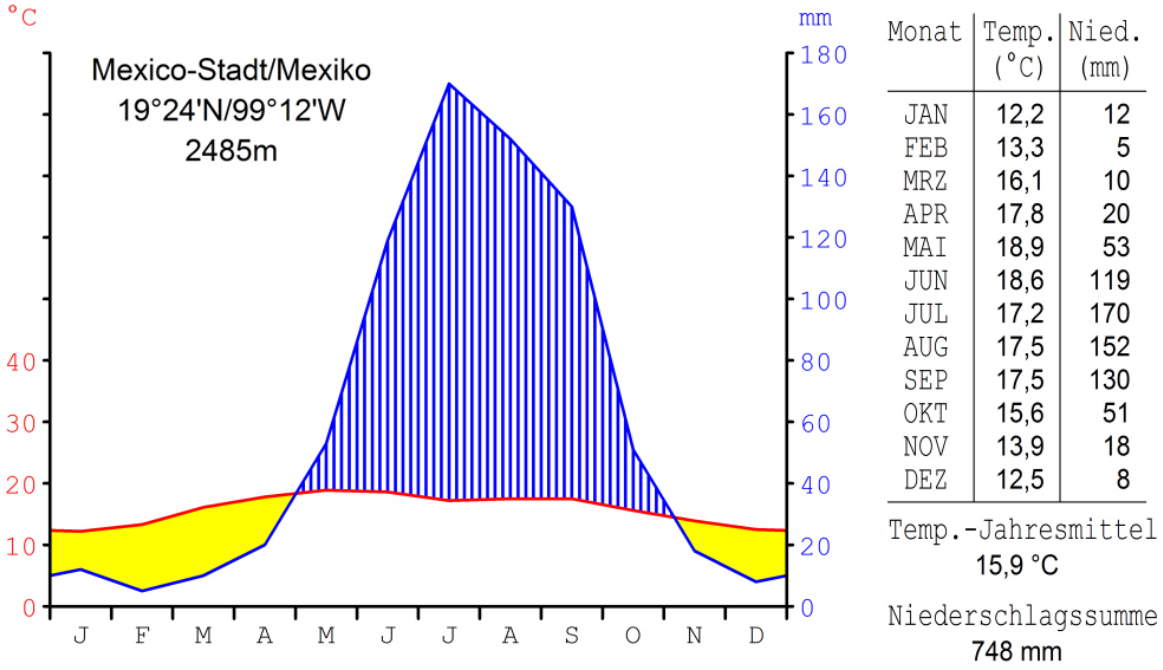
Yet, it is widely recognized that chinampa agriculture was the key to the growth of population and political power in the Valley of Mexico (Jiménez-Osornio and Gomez-Pompa 1991; O´Mack 1991; Wirth 1997; Losada et al. 1998). The expansion of the Aztec empire corresponds with the expansion of chinampa agriculture in the Late Aztec phase from 1350 to 1520 of our time (Wirth 1997; Arco and Abrams 2006).

Background

To understand the importance of the chinampa agricultural system for the Aztec empire, knowledge of the environmental circumstances under which the system was established is necessary.

The Valley of Mexico is a closed basin formed by mainly extinct volcanoes (Wirth 1997) of up to 3,880 m above sea level (Torres-Lima et al. 2000). The surface of the valley lies between 2,000 (Smith and Tolstoy 1981) and 2,500 m above sea level (Losada et al. 1998; Torres-Lima et al. 2000). The climate in the Valley of Mexico is not uniform. After Losada et al. (1998) it is temperate humid in the south and temperate dry in the centre and the north, with permanent snow in the mountains. Torres-Lima et al. (2000) classify it as temperate, Matheny and Gurr (1983) as semi-arid. According to Figure 12, at least the current climate in Mexico City must be classified as semi-arid or sub-humid with only little or no rainfall from November until April. During the middle of the rainy period from May until October, a drought of several weeks may occasionally occur (Smith and Tolstoy 1981). The annual rainfall ranges between 100 and 1,400 mm (Torres-Lima et al. 2000) and the mean annual temperature is 15 °C (Jiménez-Osornio and Gomez-Pompa 1991), respectively it ranges between 18 and 24 ºC (Torres-Lima et al. 2000). The restrictive factor for crop production is the date of the last killing frost in the spring and the first killing frost in the fall (Smith and Tolstoy 1981).

The main soil types found in the basin are litosoles, andosoles, faeozems, regosoles and solonchaks (Torres-Lima et al. 2000). The natural vegetation consists principally of pine forests and in higher altitudes grassland (Losada et al. 1998).



Monat	Temp. (°C)	Nied. (mm)
JAN	12,2	12
FEB	13,3	5
MRZ	16,1	10
APR	17,8	20
MAI	18,9	53
JUN	18,6	119
JUL	17,2	170
AUG	17,5	152
SEP	17,5	130
OKT	15,6	51
NOV	13,9	18
DEZ	12,5	8

Temp.-Jahresmittel
15,9 °C

Niederschlagssumme
748 mm

Figure 12: Climate diagram of Mexico City.

Source (modified): http://upload.wikimedia.org/wikipedia/commons/1/1e/Klimadiagramm-metrisch-deutsch-Mexico-Stadt.Mexiko.png, 24.12.2008.

In pre-Hispanic times, the floor of the basin was covered by an interconnected system of shallow lakes (up to three meters deep) and swamps, covering about 800 to 1,000 km^2 (Figure 13) (Wirth 1997). Fresh water came from several springs on the southern boundaries as well as rivers and streams from the east and the west. In the dry winter, evaporation reduced the level of the lake, so that five (four) independent lakes were formed (Johnston 1970; Arco and Abrams 2006). From the north to the south those were Lake Zupango, Lake Xaltocan, Lake Texcoco, Lake Xochimilco and Lake Chalco, the latter two not separated by land, thus a single water body (Lake Chalco-Xochimilco) even in the winter (Arco and Abrams 2006). However, the lakes were no open water bodies but covered by a thick layer of aquatic plants (O´Mack 1991; Arco and Abrams 2006). Furthermore, due to the missing drainage of the basin, the lakes were quite saline, especially the big Lake Texcoco, because it was the deepest and somewhat lower than the others (O´Mack 1991). The figure given by Humboldt for Lake Texcoco is 2.5 to 3.0% of dissolved salts which almost reaches the content of open ocean salt-water of 3.3 to 3.75% (Johnston 1970). Yet, Lake Chalco-Xochimilco was fed by fresh water springs in the south, therefore its water being much less saline. Consequently, the most important chinampa zones could be found there (Johnston 1970; O´Mack 1991). **Error! Reference source not found.**3 gives an overview of what the Valley of Mexico might have looked like just before the conquest of the Aztec capital Tenochtitlán by the Spanish.

Figure 13: Map of the Valley of Mexico short before the arrival of the Spanish conquerers.

Source: http://sidewalksprouts.files.wordpress.com/2008/04/lake_texcoco …, 12.01.2009.

The Aztec capital Tenochtitlán was built on an island in the western part of Lake Texcoco that usually fell dry in the winter (O´Mack 1991). The natural space on the island for agriculture was very limited (Johnston 1970) and food production not sufficient for the population of Tenochtitlán, which is estimated to have counted about 250,000 heads at the arrival of the Spanish in 1521 (Torres-Lima et al. 1994). Moreover, the Aztecs entirely relied on human portage or manually powered boats for transporting food, because they lacked the wheel as well as domestic animals for haulage, thus making proximity of the agricultural production area to the population of the capital a key factor (Wirth 1997). Yet, not only the agricultural land on the island was naturally limited, but also the total land suitable for crop production in the basin was (is) restricted due to climatic factors. O´Mack (1991) states: "Since the basin floor and the lakes lie at about 2,240 m elevation, and since the maximum elevation at which there is sufficiently long growing season for maize is about 2,700 m elevation, the total area of dry land available for maize agriculture in the basin is fairly restricted. Agricultural production is further restricted by the unpredictable onset of the rainy season, sometimes delayed until well into the frost-free season for much of the basin, making irrigated agriculture especially attractive because planting with irrigation can begin at the very start of the frost-free season whether or not the rains have started" (O´Mack 1991: 93).

Archeologically, nothing is known about the chinampa system of the Aztec capital Tenochtitlan, because Mexico City is literally built upon it. Nevertheless, it surely was a chinampa city but still, Lake Chalco-Xochimilco was the main source for staple foods (O´Mack 1991). Chinampas occupied thousands of hectares in the Basin of Mexico (Lopez-Recendez 2003; Zuria and Gates 2006) and alone in Lake Xochimilco the pre-Hispanic chinampas covered some 120 km² (Wirth 1997).

A problem for chinampa agriculture was the saline water of Lake Texcoco, because when the summer rains came and the five lakes merged, the salty waters of Lake Texcoco would flood the chinampa gardens around Tenochtitlán and in Lake Chalco-Xochimilco (Johnston 1970). This problem of saline water from Lake Texcoco was solved by the construction of the Dike of Nezahualcoyotl in the fifteenth century (O´Mack 1991). This dike extended approximately 16 km across the lake from the north to the south (Figure 13) and sealed off the chinampas from the rest of Lake Texcoco, leaving them in a freshwater lagoon (Johnston 1970; Smith and Tolstoy 1981; Onofre 2005). Yet, this huge dike was not the only one built by the Aztecs. They also constructed a variety of smaller dikes used for water regulation and over water access to their capital, allowing the control of water levels to prevent seasonal flooding and careful regulation of soil moisture on a year round basis (Smith and Tolstoy 1981; Wirth 1997; Lopez-Recendez 2003).

Productivity

Crop yields in the chinampas are higher than in many of the modern agricultural systems in Mexico (Jiménez-Osornio and Gomez-Pompa 1991). In the mid 1950s, for example, maize yields from chinampas of 3.5 to 6.3 t ha^{-1} were quantified, being the highest long-term yields achieved anywhere in Mexico up to that time. The average maize yields in the USA in 1955 were 2.6 t ha^{-1}, and did not pass the 4 t ha^{-1} mark until 1965 (Altieri 1999). In addition, figures of three flower yields and five or six radish (*Raphanus sativus* ssp. *sativus* L.) or purslane (*Claytonia perfoliata* Donn ex Willd.) yields per year are cited in the literature (Torres-Lima et al. 2000). Matheny and Gurr (1983) even write about up to seven harvests per year of different crops from a single plot. Yet, it does not become clear how these data were obtained. Nevertheless, the chinampa agricultural system is considered to be one of the most productive agro-ecosystem ever (Lumsden et al. 1987; Jiménez-Osornio and Gomez-Pompa 1991; Puig 1994). Figure 14 shows intensive vegetable production on a modern chinampa in Xochimilco.

Figure 14: Intensive vegetable production on modern chinampas.

Source: http://www.mexiko-lexikon.de/mexiko/images/7/7c/Chinampas2.jpg, 22.12.2008.

Those high levels of productivity result from several factors:

- Water availability

There is plenty of water available throughout the year for the growing crop, even if there have been no rains (Altieri 1999). The surrounding canals, ditches and trenches drain and irrigate the fields (Lumsden et al. 1987) and also store the water (Siemens 2004). Natural sub-irrigation by infiltration from the side is possible under certain combinations of field morphology, crop type, and soil properties (Crossley 2004; Zuria and Gates 2006). Yet, manual irrigation by bucket as well as irrigation by hoses connected to gasoline-powered pumps have been common practices on chinampas (O´Mack 1991; Crossley 2004; Zuria and Gates 2006).

- Soil fertility

Chinampa soils maintain a high level of soil fertility despite the continual harvest of crops because they are supplied with high quantities of organic fertilizers such as aquatic plants, canal mud, crop residues, weeds, animal manure and muddy water (for irrigation) (Altieri 1999; Juárez-Figueroa et al. 2003). Originally, also human excrements were widely used and composted for fertilization. Mulching with water vegetation against heat and cold was and is a common practice (O´Mack 1991). Figure 15 shows modern chinampa farmers throwing aquatic vegetation on a chinampa.

Figure 15: Modern chinampa farmers throw aquatic vegetation on a chinampa. Source: http://www.moplants.com/blog/wp-content/uploads/2007/08/chinampa%20farmers.jpg, 12.01.2009.

The high content of soil organic matter of the chinampa soils is largely recognized, contributing to soil fertility and plant health (Lumsden et al. 1987; Altieri 2000; Crossley 2004). Especially the suppression of plant parasitic nematodes by chinampa soils compared to sterilized chinampa soils or other soils has been studied and proven by several authors, concluding that the high content in soil organic matter enhances biological soil activity and thus antagonists of soil born pathogens such as plant parasitic nematodes (Lumsden et al. 1987; Zuckerman et al. 1989; Chen et al. 2000).

The chinampa soils analyzed by Crossley (2004) showed that their mineral grains in general are primarily derived from weathered lava fragments and redeposited volcanic ash, well known as fertile parent material. The soil texture was consistently fine, with very fine sands

and coarse to fine silt dominant in each sample. Lumsden et al. (1987) found a high macro nutrient content, cation exchange capacity and water retention capacity in a chinampa soil.

- "Floating gardens" – the *almácigos* (seedbeds)

Based on those seedbeds, cropping on the chinampas is nearly continuous; only rarely is the chinampa left without a crop (Altieri 1999). On the chinampas, several crops of different kinds at different stages of growth can be found, with a range of *almácigos* preparing the next rounds of each crop to replace the others immediately after harvest (O´Mack 1991).

- Biodiversity

The chinampa system is the biologically richest agro-ecosystem known today (Jiménez-Osornio and Gomez-Pompa 1991; Torres-Lima et al. 2000). In one region of Xochimilco, 146 plant species, belonging to 36 angiosperm families were found. The chinampa system provides an excellent example of an efficient and self-sustaining agricultural system in which stability and sustainability are based on, and productivity is enhanced by management and maintenance of the high level of biodiversity in space and time (Jiménez-Osornio and Gomez-Pompa 1991). Already during the Aztec rule the system included sophisticated methods of cultivation such as multiple cropping and crop rotation (Torres-Lima et al. 1994).

During the pre-Hispanic Aztec period aquatic plants were very important for the diet and also included non-cultivated plants collected from borders of the chinampas (González-Jácome 2004). Mainly two types of crops were grown on the chinampas, namely food crops and ornamental plants (Puig 1994).

The food crops grown during the Aztec rule were (Jiménez-Osornio and Gomez-Pompa 1991; Puig 1991):

- Amaranth (*Amaranthus leucocarpus* L.)
- Beans (*Phaseolus* spp.)
- Tomatoes (*Lycopersicum* spp.)
- Chilies (*Capsicum annum* L.)
- Maize (*Zea mays* L.)
- Gourds (*Cucurbita* spp.)
- Sorrel (*Oxalis acutifolia* Prog.): edible tubers
- Chia (*Salvia hispanica* L.): oilseed

Ornamental plants (indicative of the importance of flowers in pre-Hispanic times) were (Puig 1994):

- Tagetes (*Tagetes erecta* L.)
- Aztec lily (*Tigridia pavonia* [L. f.] DC.)
- Dahlias (*Dahlia* spp.)

There have been many changes in the flora of the chinampas since pre-Hispanic times, the most important event being the Spanish conquest of Tenochtitlán in 1521 and the subsequent introduction of new crops from Europe. Those new domesticated species were incorporated into the system without replacing the traditional crops, thus increasing biodiversity (Jiménez-Osornio and Gomez-Pompa 1991).

Nowadays, Xochimilco has agricultural and cattle areas within the canal system (Solís et al. 2006) with vegetable, ornamental and dairy production (Losada et al. 1998; Torres-Lima et al. 2000). The remaining chinampas at Xochimilco combine tourism and agriculture (Losada et al. 1998) with the main cash crops being introduced species (Jiménez-Osornio and Gomez-Pompa 1991; García-Gómez et al. 2002; Onofre 2005).

The use of weeds growing on the chinampas adds to the biodiversity as well as the productivity of the system (Jiménez-Osornio and Gomez-Pompa 1991). Weeds increase the useful biomass of the field, improve the nutrition of farmers and provide shade as well as green manure (Vieyra-Odilon and Vibrans 2001). Some non-domesticated species, such as *Chenopodium ambrosioides* L. are encouraged to grow by the farmers (Jiménez-Osornio and Gomez-Pompa 1991). *C. ambrosioides* is known to have effects on viruses, bacteria, fungi, nematodes, insects and also allelopathic affects on germination and growth of other plants (Hegazy and Farrag 2007). Therefore, it is suggested that *C. ambrosioides* may be used for plant protection (Jiménez-Osornio et al. 1996).

- Microclimate

It is suggested, that the danger of night time frost known for dry land at the same elevation is reduced due to the heat retention capacity of the water in the canals (O´Mack 1991; Crossley 2004).

- Last but not least, the large amount of individual care given to each plant in the chinampa contributes to the high yields (Altieri 1999).

Development

As stated above, the Spanish conquest of Tenochtitlán brought fundamental changes for the Valley of Mexico (Losada et al. 1998). Following the conquest, a series of drainage projects with the construction of large canals reduced the lakes (Smith and Tolstoy 1981; O´Mack 1991). With this change of the environment, also a change of the chinampa system can be noted. Evidence of the widening of fields since earlier times can be found in numerous sources. The chinampas still seen today – in rapidly declining numbers – were constructed at very different times and it is highly likely that all of the fields have been significantly transformed, rebuilt and reworked numerous times over the period of their existence. Besides, lining the chinampas with Ahuejote trees (Bonpland willow, *ahuejote*, *huejote* or *sauce* trees [*Salix bonplandiana* Kunth]; USDA 2008) characteristic of the chinampa landscape over the last century, is probably relatively new to the farming system (Figure 16). Lately, the trees have been disappearing rapidly (Crossley 2004).

Figure 16: Ahuejote trees lining chinampas. Source: http://homepage.mac.com/helipilot/.Pictures/vistasaereas/XochiNiebla.jpg, 12.01.2009.

Challenges

Chinampa agriculture is a sustainable agricultural system endangered by modern pressures (Torres-Lima et al. 1994). The changes that have influenced the system have been imposed on the chinampa farmers and not produced by them (Jiménez-Osornio and Gomez-Pompa 1991). Siemens (2004) states, that "the output of publications on chinampas now seems inversely proportional to the degradation of the system itself" (Siemens 2004: 249).

Most of the problems of the current chinampa system can be traced back to the change in the water regime due to the urbanization of Xochimilco (Wirth 1997; Losada et al. 1998; Crossley 2004; Siemens 2004; Onofre 2005) and with it the diversion of water from the chinampa region to Mexico City (Jiménez-Osornio and Gomez-Pompa 1991; Losada et al. 1998; Juárez-Figueroa et al. 2003). Only a small section of the chinampas near Xochimilco, a larger section near Texcoco and a few small sections in the north of the basin are left, which might also be eliminated with the growth of Mexico City (O´Mack 1991; Wirth 1997). The water supply for the canals comes from a few remaining springs and partially treated sewage from Mexico City (Jiménez-Osornio and Gomez-Pompa 1991; Wirth 1997; Juárez-Figueroa et al. 2003).

The uncontrollable urban spread of Mexico City (23 millions inhabitants [Onofre 2005]) since the 1950s has been mainly at the expense of agricultural land (Losada et al. 1998; Torres-Lima et al. 2000; Crossley 2004; Siemens 2004). Hence, agricultural production decreased considerably after the 1950s due to the abandonment of 53% of the chinampas (Wirth 1997). Communal land was sold for house building and canals disappeared to make room for bridges and vehicular accesses to cultivation areas (Crossley 2004; Siemens 2004; Onofre 2005).

With the tapping of springs in 1913 to provide the city with potable water and the drilling of deep wells in the 1950s, the ground water level was significantly reduced, which caused the

desiccation of most springs in the 1960s and of the canals in the 1980s (Wirth 1997; Crossley 2004; Carrillo-Rivera et al. 2008).

Additionally, the deforestation and destruction of vegetation has created conditions of rapid run off of rains which reduces the quantity of rain water absorbed and channeled to underground aquifers. The annual rainfall in Xochimilco region has declined by 30% in the last century and temperatures are slightly higher (Wirth 1997).

To replace the water lost from the springs, raw sewage was pumped into the Xochimilco canals (Wirth 1997; Crossley 2004; Carrillo-Rivera et al. 2008). Also, residents from irregular settlements utilize the canals for drainage and discharge of all household wastes (Wirth 1997; Juárez-Figueroa et al. 2003; Siemens 2004; Onofre 2005). Today, the former used human excrements unintentionally reach the chinampas via the canals (O´Mack 1991).

With the partially untreated sewage, the canals are receiving a continuous load of micro organisms and other contaminants. Increased concentrations of heavy metals, detergents and pathogenic organisms in the water are reported (Losada et al. 1998). In a study, the levels of fecal coliforms measured exceeded the figures recommended by the Mexican regulations for irrigation water in some of the agricultural area sampling sites and in all urban sites (Solís et al. 2006). Thus, vegetables can become vectors of pathogenic micro organisms and other polluting agents (García-Gómez et al. 2002). García-Gómez et al. (2002) found positive results for *Salmonella typhi* Lignieres in all vegetable samples. Additionally, there is high prevalence of *Giardia intestinalis* Kofoid and Christiansen infection among children from urban settlements in the Xochimilco area (Juárez-Figueroa et al. 2003). Chinampa farmers are trying to overcome this problem by adding disinfectants to their vegetables to sell them in better sanitary conditions (García-Gómez et al. 2002).

Another problem that cannot be wiped out with disinfectants could be heavy metals. Although elements such as Fe, Cu, Zn and Pb are present in the dissolved fraction in the Xochimilco canals, they are at levels below the maximum Mexican limits (Solís et al. 2006). Yet, some elements such as Cr, Co and Cu are present at levels considered potentially hazardous in soils. Cu is present in soils as well as in plants at levels that exceed those considered as being toxic (Mireles et al. 2004).

The levels of water and soil pollution are further increased due to the use of chemical fertilizers and chemical plant protection agents (Onofre 2005; Losada et al. 1998), as well as the excessive use of organic fertilizers such as cow dung within the chinampas. To some gardens, the equivalent of 800 t ha^{-1} $year^{-1}$ of manure is applied, augmenting the risk of nitrate contamination of the surface and groundwater (Torres-Lima et al. 2000).

Apparently, long-time watering of crops with polluted water has resulted in degraded soils due to salinization (Wirth 1997; Losada et al. 1998). In a study conducted close to Mexico City, due to the accumulation of pollutants in the topsoil caused by a 90 years long application of sewage water, spore abundance of arbuscular mycorrhizal fungi in the soil was lower than in a soil only having been irrigated for five years with wastewater (Ortega-Larrocea 2001).

All these factors have led to a continuous loss of biodiversity, thus threatening the sustainability of the chinampa system. Deterioration is observed and only certain plant species can be grown (Mireles et al. 2004), sensitive crops such as tomatoes have disappeared (Losada et al. 1998; Onofre 2005). Between 1975 and 1991 at least 20 plant species disappeared from the chinampa towns of Xochimilco and Mixquic, most of which used to be part of the diet of local people (Jiménez-Osornio and Gomez-Pompa 1991).

Future

In 1987, Xochimilco was declared a World Heritage Site of the UNESCO (UNESCO 2008). In 1990, the Government of Mexico signed an accord that included specific plans for protection of the agricultural land, the restriction of urban development in chinampa zones, the

advanced treatment of the sewage water and at the same time the utilization of the chinampas and protected zones for tourism (Wirth 1997). Unfortunately, those principally responsible for the success of the chinampa system, the farmers, were not consulted in the planning process and also did not receive any benefits from the UNESCO designation (Jiménez-Osornio and Gomez-Pompa 1991). At least until 1997, the government only offered the usual assistance in loans for tractors and fertilizers, even though these are no proper technologies for the chinampas. Tractors are not useful for small parcels of land and chemical fertilizers can be a further source of water pollution (Wirth 1997).

Nevertheless, the significance of the chinampas for Mexico City can not be overlooked: Xochimilco is one of its most important sources of vegetables (García-Gómez et al. 2002) and some 15 percent of the agricultural products for the Federal District, as well as a substantial quantity of the city's flowers are being produced there (Wirth 1997). The author further stresses that "in the case of Xochimilco, the need for environmental protection is directly linked to the current economic well-being of Mexico City, including jobs and food for the city" (Wirth 1997: 13).

The chinampa system is not just a hopeful model but also a successful management strategy for the recent agro ecological circumstances that are present in one of the world's biggest cities, Mexico City (Torres-Lima et al. 1994).

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Organic agriculture in Mexico

Moritz Reckling

Latin America and especially Mexico has an ancient agricultural tradition and organic cultivation methods have been very common for millennia. Those include crop rotations, seed selection, soil fertility management (composting, mulching), sophisticated irrigation systems (especially the Aztecs with the chinampas) and community land management. Latin America and Mexico are especially famous for their hundreds of varieties of corn, over 90 varieties of chillies and very many different tomato and squash varieties (Lernoud 2007).

The agro-ecological situation is most suitable for organic production of some crops and most especially organic coffee production. Coffee is the leading Mexican organic crop that is cultivated in an ecological forest management system creating a valuable alternative to the deforestation process that is taking place in the area and generating income for thousands of small-scale farmers (Cruz 2007).

Organic Producers

Mexico has by far the most organic certified farmers worldwide with 126,000 farmers, followed by Uganda with 87,000, Italy with 45,000; Germany has in contrast only 17,600 organic certified farmers, as shown in figure 17 (approximate numbers, Willer et al. 2008). The number of farmers developed quickly, from 33,600 organic farmers in 2000 to 126,000 by the most current data (2006) (Willer et al. 2008).

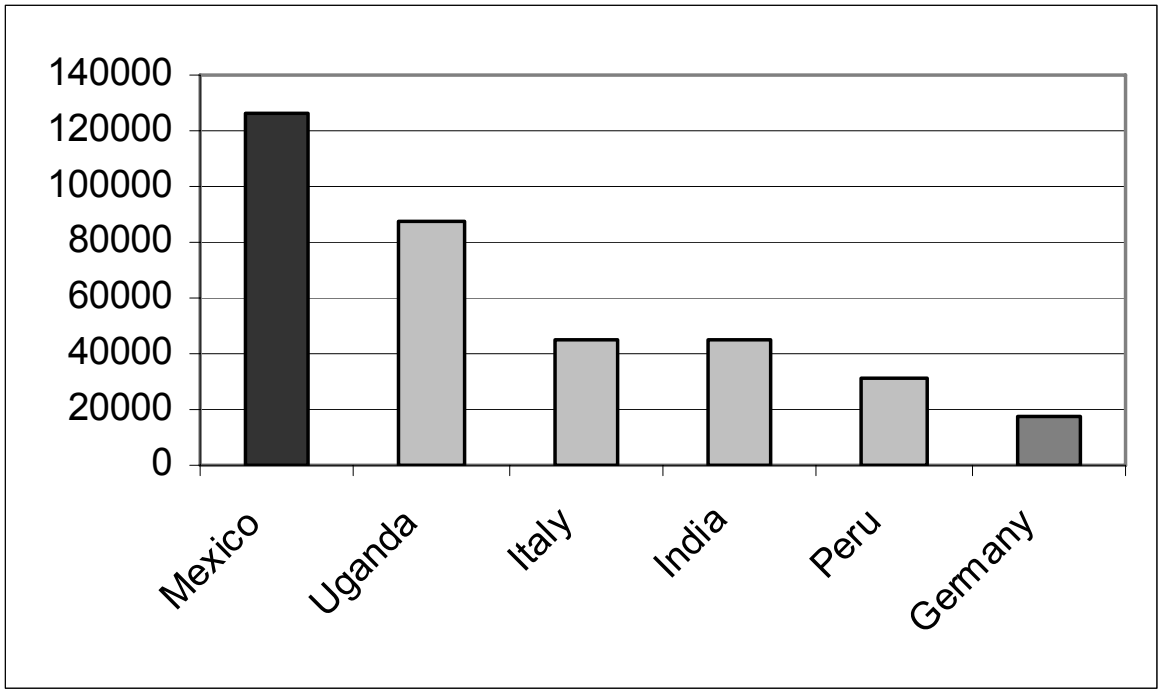

Figure 17: Number of organic farmers of the five worldwide leading countries and Germany. Source: Willer et al. 2008.

Mexico has this high number of farmers due to the dominance of indigenous low-income small-scale producers who make up for 98.6% of the organic producers (Cruz 2007). They are organised in cooperatives and certified organic using an Internal Control System (ICS) (Lernoud 2007). Besides export crops they cultivate gardens for subsistence production, e.g. vegetables and corn. They farm an average land size of 2.25 hectares per farmer (Cruz 2007). They farm 84.1% of the total organic farmland and generate 68.8% of the income

earned in foreign currencies through organic exports (Cruz 2007). They depend on farming, on the one hand for the income through the sales of the export crop and other cash crops for the local markets, and on the other hand for food and family labour. Figure 8 shows a Mexican small-scale coffee farmer harvesting matured Arabica coffee fruits.

Figure 18: Mexican small-scale coffee farmer harvesting matured Arabica coffee fruits

The remaining 1.4% of organic producers are large-scale private enterprises that cover 15.9% of the organic farmland with sizes of 100 to 2,000 hectares. The owners are investors rather than farmers, employing labour for the production of the crops, earning 32.3% of the foreign-currency income (Cruz 2007).

Organic Area

Due to the small-scale nature of the farms, the total organic land is quite small in Mexico that holds the 14th position in the world ranking with 404,000 hectares of certified organic land. In Latin America, Argentina leads with 2,220,000 ha of organic certified land due to large-scale cattle pastures. Germany has with 850,000 hectares more than double of the size of Mexico. Certified organic wild collection plays an important role for the Mexican organic sector and covers 12,650 hectares. However, the size of organic certified land in Mexico grew very quickly in the last years and doubled from 2002 (216,000 ha) to 2006 (404,000 ha). The share of organic certified land of the total agricultural land in Mexico is very low with 0.4% (Willer et al. 2008).

The main producer states of organic agriculture are Chiapas, followed by Oaxaca, Guerrero, Michoacan, Chiuahua, Jalisco and Veracruz (Cruz 2007) as shown in figure 19. In the southern states, organic coffee is the dominant crop and in Chiuahua intensive irrigated cultivation of vegetables and fodder crops for the USA.

Figure 19: Map of Mexico showing the main producer states of organic agriculture.

Source (modified): http://upload.wikimedia.org/wikipedia/commons/f/f5/Mexico_states_aguascalientes.png, 29.01.2009; Cruz 2007.

Markets

Export is the main purpose of Latin America's organic sector. Around 85% of the products are destined for export to the USA and Europe (Lernoud 2007). Products are mainly sold in the non-processed stage and value is added in the importing countries. According to Willer et al. (2008), the organic exports from Mexico valued 430 million USD in 2007, while growing rapidly (Cruz 2007).

Products. Mexico is among the leaders for the world production of organic coffee, tropical fruits, cocoa and citrus fruits. 80% of Mexico's organic produce is coffee and it is the biggest organic coffee producer worldwide with 150,000 t. It is followed by Peru with half the production (75,000 t), and Sri Lanka (35,000 t). It produces 40% of the coffee production in Latin America. Moreover, Mexico leads the organic tropical fruit production (26,000 t), followed by Paraguay (20,000 t) and Ecuador (18,000 t). It is second in organic cocoa production (17,000 t) after the Dominican Republic (32,000 t) and followed by Ecuador (13,000 t). Besides, it produces 1,800 t of citrus fruits, thus being the sixth world wide (Italy 18,000 t and the USA 4,000 t). Other organic products are apples, olives, rice, vanilla, honey, vegetables, sesame seeds, medicinal plants, soybeans, palm oil and nuts. Mexico also produces organic wheat and corn as fodder for the USA and Europe. Some organic products also enter the fair trade market including coffee, cocoa, quinoa, honey, hibiscus, bananas etc. (Willer & Yussefi 2007).

Domestic markets. Domestic markets for organic products in Latina America and Mexico are still very small although the demand for organic products grows in the big cities like Mexico City, Buenos Aires and Sao Paulo. Very common are the 'neighbourhood fairs' which are small informal markets in the cities where producers sell their organic products directly to consumers. Furthermore, annual organic fairs called 'Exporganicos' promoted by rotating

federal governments aim to unite the organic producers. Mexico City has a weekly organic fair called 'Tianguis' that builds on the tradition of local trade of the indigenous communities. Some supermarkets sell organic products like in Mexico City the 'Monterrey y Guadalajara'. Domestic sales are building on trust to the producers and often use participatory certification schemes such as the Participatory Guarantee System (PGS). This is a locally focused quality assurance system based on active participation of stakeholders and is built on a foundation of trust, social networks and knowledge exchange (IFOAM 2008). Generally the organic prices are higher compared to the conventional one but in a few cases as described by Lernoud (2007) organic prices are at the same level like the conventional ones, which producers make a political point with the motto "let all the consumers choose freely, not only the rich" (159). Another important organic trade system is the box scheme applied in the big cities that opens up public interest for organic products and leads to a growing domestic demand. Moreover, consumers involve themselves in the planning and financing of organic products in the 'La Comunidad Sustenta a la Agricultura' that is following the principle of the 'American Community Supported Agriculture'. Consumer families get together with a farmer and plan what to sow, develop a budget respecting the needs of the consumer and the producer. Consumers give an advanced payment to enable the production and therefore share the risks and fix the prices (Lernoud 2007).

Other Stakeholders

Government support. Governments in Latin America including Mexico give no subsidies or economic support to organic production. In general organic development has grown with own efforts but in Mexico there is a strong interest of national and state agencies as well as donor support from Europe especially Germany (Cruz 2007).

Education and research. One university in Mexico offers a study course in agro-ecology including organic agricultural sciences (Universidad Autonoma Chapingo) and does research on organic agriculture cooperating with the Swiss Research Institute of Organic Agriculture (FiBL). Besides the university, the research centre Agricultura Ecologica Campesina (AECA) carries out organic on-farm research involving small-scale farmers (Cruz 2007).

Certification

Mexico still relies on foreign organic regulations such as the National Organic Program of the USA and the EG 834/2007 of the EU. A national organic regulation is in progress but not yet implemented (Lernoud 2007).

126,000 small-scale farmers organised in associations are organic certified using an Internal Control System (ICS) which is the only group certification scheme accepted by the authorities of the EU and the USA. The ICS reduces certification costs significantly and opens up the organic markets for the small producers organized in groups (AgroEco & Grolink 2008). A study by Schuster (2006) shows that 48 Mexican cooperatives of the international farmers association Naturland have only few difficulties complying with the organic standards although Fürst (interview) mentions that many incompliances with the organic standards appear currently. Reasons are assumed to be lack of investment in the ICS e.g. in terms of staff requirements. However, Lernoud (2007) indicates that generally the reasons for the difficulties of producers to meet the international quality and certification standards are the lack of information and support from the government and traders to develop capacity on quality control.

Certification is carried out by CertiMex, the only Mexican accredited certification body and many international certification bodies. Among others, Naturland is a farmers organization very active in Mexico with 56 cooperatives representing 16,000 farmers and cultivating 44,000 ha of land, producing mainly coffee which represents 10% of the total organic certified area (Naturland 2008).

Besides organic certification there is a wide range of other eco-labeling efforts in Mexico but according to Bray et al. (2002) organic certification is the only successful scheme supporting environmentally friendly agriculture and social aspects.

Figure 0 shows the different organic labels. The first is the new EU organic label, followed by the organic label of the USA. The third is the label of the national certifier Certimex and the last of the international farmers' association Naturland.

Figure 20: Organic labels of the EU, the USA, the national certifier Certimex and the international farmers' association Naturland

Challenges

The cultivation of genetically modified organisms (GMO) endangers the high biodiversity of corn in Mexico and threatens the integrity of organic production. There is a high risk of contamination of organic wheat and corn with genetically modified cultivars of soy and corn that have become mainstream on the continent in conventional agriculture. Furthermore, GMO contamination in consumed corn is very common and it is assumed that every Mexican tortilla contains GMO residues (Cruz 2007).

While organic agriculture is often seen as an income-generating production strategy for small producers of the global South, a study by Tovar et al. (2005) suggests that Mexican organic agriculture reproduces existing social inequalities between large and small producers in conventional Mexican agriculture. This is due to high demands for certification (staff and documentation requirements and high costs especially in the conversion period) which exclude non-supported small-scale farmers.

The Mexican organic sector could increase the benefit of the potential of organic agriculture through local processing and marketing. Since most organic produce is exported as raw produce the value is added in the import countries. The national capacity for processing could be further developed and international trade and tax regulations on processed goods discussed and changed. Domestic sales could open up the market for processed organic products and furthermore include very intensive cultivated crops such as organic vegetables that are not suitable for export. Intensive organic vegetable production would besides increase the impact of organic agriculture on the national environment and health situation.

Chinampas and Organic Agriculture

The chinampas as they were described earlier are a man-made agro-eco-system that is managed intensively using specific farming methods developed through centuries. These farming methods include many characteristics of organic farming like soil fertility management, high biodiversity, organic fertilization, crop rotations etc. Therefore it indicates that nature-sound agriculture can be achieved in a most intensive manner. However, the use of non-organic agricultural inputs and current threats to the chinampas agriculture (change in the water regime and polluted sewage water) harm the ecological nature and the sustainability.

The local non-governmental and non-profit initiative DANA A.C. is following the aim to rehabilitate the chinampas through organic agricultural techniques cooperating with the governmental authorities. In this process they have started in Xochimilco to support organic

production by providing training and markets. Organic crops are sold in the organic shop of the NGO and transported to organic markets in Mexico City.

So far the chinampas' sub-urban agricultural production is for the conventional markets in Mexico City. Production for the organic markets could be a promising option increasing prices through the value addition on the one hand and ensuring the sustainability of the agro-eco-system on the other hand. Furthermore, organic production in the chinampas could increase the public attention and pressure politicians to ensure the safety of the agro-eco-systems due to the economic value of the organic markets.

The organic export market is much developed in Mexico, but crops exported do not fit into the intensive chinampas agricultural system due to their perennial and rather extensive nature e.g. coffee, fruits, cocoa etc. For the intensive, difficult-to-export crops like vegetables that are grown in the chinampas, domestic sales could therefore be more promising. The demand for vegetables in organic quality rises more and more in Mexico City as described earlier. To achieve organic production for local markets, the current cultivation practices in the chinampas can be continued in terms of soil conservation and crop rotations etc. but have to follow the requirements of organic pest control, fertilization and traceability measures. The alternatives to polluted irrigation water have to be checked and regulations developed following a simplistic approach. Here, the PGS certification scheme could be adequate and cost efficient ensuring the organic quality with little documentation requirements.

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List of participants

No.	Family Name	Given Name	E-mail	Study Programme University
1	Araujo Enciso	Sergio Rene	saraujo@gwdg.de	International Agriculture GOE
2	Beckschäfer	Philip	philip.beckschaefer@googlemail.com	Forestry GOE
3	Brand	Hendrik	hendrikbrand@student.uni-kassel.de	Organic Agriculture WIZ
4	Cruz Uribe	Fabian	jaime.cruz@uan.edu.co	Intern. Organic Agriculture WIZ
5	Gonzalez Monge	Sandra	sandragm28@hotmail.com	International Agribusiness GOE
6	Hagmann	Jonas	jonashagmann@web.de	Organic Agriculture WIZ
7	Hohls	Charlotte	ch.hohls@student.uni-kassel.de	Organic Agriculture WIZ
8	Honsdorf	Nora	n_honsdorf@hotmail.com	Agricultural Sciences GOE
9	Klaiss	Matthias	matthias.klaiss@student.uni-kassel.de	Organic Agriculture WIZ
10	Khathir	Rita	ukhti79@yahoo.com	Tropical & International Agriculture GOE
11	Leupolt	Sabrina	s.leupolt@web.de	Organic Agriculture WIZ
12	Pannwitt	Heike	h_pannwitt@web.de	Agricultural Sciences GOE
13	Plagemann	Julian	pgtpanama@web.de	Agricultural Sciences GOE
14	Rakow	Nina	lottarie@yahoo.com	Pädagogik / Agrarwiss. (NF) GOE
15	Reckling	Moritz	morireckling@web.de	Organic Agriculture WIZ
16	Rivera Aedo	Edinson	edinsonrivera@googlemail.com	International Agribusiness GOE
17	Roberts	Alison	nosilamarie@yahoo.ca	Ethnology and English GOE
18	Stout	Daniel	djstout1@gmail.com	Agroecology (Exch. Stud. Norway) WIZ
19	Tigges	Verena	verenatigges@web.de	Organic Agriculture WIZ
20	Zschocke	Arnd	arzschocke@yahoo.com	Intern. Organic Agriculture WIZ
21	Buerkert	Andreas	buerkert@uni-kassel.de	Tropical Crop Production WIZ
22	Schlecht	Eva	schlecht@uni-kassel.de	Tropical Livestock WIZ / GOE
23	Hülsebusch	Christian	huelse@uni-kassel.de	Tropical Livestock DITSL
24	Dohrenbusch	Achim	adohren@gwdg.de	Tropical Silviculture, Forestry GOE

Prof. Dr. Eva Schlecht
University of Kassel / Göttingen

Prof. Dr. Andreas Buerkert
University of Kassel

Dr. Christian Hülsebusch
DITSL - Witzenhausen

Prof. Dr. Achim Dohrenbusch
University of Göttingen

Partners and partner institutions

Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) - El Batan

Km 45 Carretera Mexico-Veracruz
El Batan, Texcoco, Edo. de Mexico, D.F.
Tel.: +52-5804-2004
Fax: +52-5804-7558

CIMMYT headquarters is located at Km.45 of the Mexico-Veracruz highway. It is 3 kilometers past the town of Texcoco, State of Mexico, or approximately 45 minutes from the airport

Petr Kosina
CIMMYT - El Batan

Manager - Knowledge, Information & Training CIMMYT

Tel.: +52 (55) 5804 7536 or +52 (55) 58042004 ext 2112

Mobile: +525520435154 if used from abroad to be dialed as +5215520435154

Fax: +52 (55) 5804 7558/59
Skype: clobrda
Email: p.kosina@cgiar.org
Web: www.cimmyt.org

Alejandro Ramírez López
CIMMYT - Oaxaca

Email: oaxcimmyt@yahoo.com.mx
Tel.: 044-595108024
Mobile: +(52-1) 5514474536

Universidad Autónoma de Chapingo
Alejandro Hernandez

Email: ahtapia@gmail.com
Mobile: +(52-1)55-1141 5281

Universidad Autónoma de Mexico
Hermenegildo Losada Custardoy

Email: hrlc@xanum.izt.uam.mx

Universidad Autónoma de Yucatán
Dr. Andrés Aluja Schunemann

Coordinador General de Relaciones Interinstitucionales Secretaria General

Km. 1 Carretera Mèrida-Tizimin Tramo Cholul, Mèrida, Yucatàn México CP 97305

Tel.: + 52(999)9282711 ext. 1351 o 1352
Tel.: + 52 (999) 924-05-76 Ext. 1308-1326
Email: ciri@uady.mx
Web: www.uady.mx

Universidad Autónoma de Yucatán
Wilbert Trejo Lizama

Email: wtlizama@uady.mx

FIECH - Federación Indígena Ecológica de Chiapas
Hugo Roblero

Carretera Tuxtla Gutiérrez - Chiapa de Corzo km. 10.5, 2ª Sección de Riveras de Nandambua, Chiapa de Corzo, C.P. 29160, Chiapas, México

Tel.: 0052 961 60 06017 (international)
Tel.: 01 961 60 06017 (from Oaxaca)
Tel.: 60 06017 (from Tuxtla)
Fax: 0052 961 60 06017
Email: cafefiech@prodigy.net.mx
Web: www.cafebiomaya.com
Mobile: 045-961-1778585 (from Oaxaca)
Mobile: 044-961-1778585 (from Tuxtla)

Naturland
Asociación para Agricultura Orgánica
Mr. Peter Gänz

A.P. 331, Cuernavaca, Morelos, C.P. 62001, México
Tel.: +52 (01) 777- 1029392
Fax: +52 (01) 777- 1029392
Eamil: mexico@naturland.de
Web: www.naturland.de/bienvenido.html

"Café Museo Café"

Calle María Adelina Flores No. 10, Centro Histórico, San Cristóbal de las Casas, Chiapas

Martha Sol Hérnandez (encargarda)
Tel.: 0052- 967- 678 78 76
Email: cafe@prodigy.net.mx

Asociación Veracruzana de Acuicultores
Mr. Nemesio Alvarez

Tel.: 01 2727245690
Tel.: 01 2727246077
Mobile: 0452721030352

Email: nemesioalvarez@hotmail.com