United Nations Educational, Scientific and Cultural Organization
Organisation des Nations Unies pour l'éducation, la science et la culture

Centre du patrimoine mondial
World Heritage Centre

PROJECT PROPOSAL

Conservation of the milpa traditional agroecosystem and its related cultural values in Los Altos of Chiapas (Mexico) and Los Cuchumantanes of Huehuetenango (Guatemala)

To be submitted to the FAO GIAHS Steering Committee

SUMMARY INFORMATION

a. Country and Location

GUATEMALA, Los Cuchumantanes of Huehuetenango
MEXICO, Los Altos of Chiapas

b. Project title / name of the system

Conservation of the milpa traditional agroecosystem and its related cultural values in Los Altos of Chiapas (Mexico) and Los Cuchumantanes of Huehuetenango (Guatemala

c. Funding requesting

$ 250 000

d. Requesting Agency

World Heritage Centre, UNESCO

e. Governmental counterparts and other partners

The principal partners are: Ing. Mario Fuentes, Organización Integral de Desarrollo (OID), ciudad, Guatemala; and Dr. Hugo R. Perales, El Colegio de la Frontera Sur (Ecosur), San Cristóbal, Chiapas, Mexico.
Other expected partners are: Instituto de Ciencia y Tecnología Agrícolas (ICTA), Comisión de Áreas Protegidas, Ministerio de la Cultura, Asociación de Agricultores de la Meseta de los Cuchumantanes (Guatemala). Secretaría de los Pueblos Indígenas del Gobierno del Estado de Chiapas, Universidad Autónoma de Chiapas, (Mexico).

f. Project duration

24 months

g. Summary

Maize is, arguably, the central icon of the natural and cultural heritage that the ancient Mesoamericans have ledged to their descendants and to humanity. Mexican and Guatemalan indigenous populations, with farmer based selection and conservation of varieties, are the true guardians of maize landraces in its centres of origin. Threats affecting the traditional *milpa* agricultural system of small-scale farmers and their landraces of maize and associated species have highlighted the importance of the conservation in farmers' fields of maize diversity and concerns over its loss.
This project aims at being interdisciplinary, encompassing tangible and intangible values of maize culture. It intends to begin with two pilot projects in Los Cuchumantanes of Huehuetenango and Los Altos of Chiapas, which could be replicated and extended to other Mesoamerican sites. The highlands regions, with strong dominance of traditional maize varieties and mainly inhabited by diverse Mayan groups, are a repository of genetic resources of outstanding value and therefore, true representatives of their country's cultural and natural heritage. This project will:

- Improve the knowledge of recent changes in *milpa* cultivation and maize diversity, focusing in particular in changes in maize varieties and technology and how salary work and migrations might threaten *milpa* permanence.
- Document specific cultural practices and knowledge linked to *milpa* cultivation and maize diversity and changes these have undergone in the last decades. Research on cross-border relations of diverse nature will enforce understanding of these changes.
- Support mechanisms to reduce farmer's vulnerability and to reinforce sustainable development and poverty alleviation, including participatory plant breeding and soil improvement programs, "new literate" workshops, and linkage work to identify new market possibilities.
- Raise awareness regarding the universal value and importance of maize

culture in Mesoamerica by fostering cooperation among local, national and international government sectors and involving local key stakeholders through educational, scientific, and cultural activities.

- Preserve tangible and intangible aspects of the traditional maize agricultural system as an identity of Mesoamerica through this first phase, to be proposed as a bi-national Cultural Landscape for the World Heritage List, UNESCO.

DESCRIPTION OF THE SYSTEM

Mesoamerica is **one of the cradles of early civilization**, one of the six or seven independent areas in which plant domestication led to **the emergence of agriculture in the world** (Harlan 1995, Smith 1995). At least one-seventh of the most important plant species of the world that are used as food originated here, such as beans, chile peppers, avocado, vanilla, amaranth, squash, agave and, of course, maize. Mesoamerica, as originally proposed by Kirchhoff (1943), is a multicultural broad region that extends from central Mexico to the northwestern border of Costa Rica[1], characterized by more than 70 languages of pre-Columbian cultures that have shared language traits, religious beliefs, art and technology for three thousand years. Many cultural traits of pre-Columbian Mesoamerica continue to be present today, as is the case of the *milpa* in Mexico and Guatemala. **(see Map 1-Annex)**

Maize, the second most important crop in the world, has been and still is the prime crop of Mesoamerica. Since at least 6000 years ago (Piperno and Flannery 2001), its inhabitants had already included maize in their diets, although squashes were already domesticated by that time. Agriculture in Mesoamerica evolved along a distinct model from the rest of the world where grain agriculture was developed. Instead of broadcasting the seed or, in a later point in time, planting in lines, in Mesoamerica maize was sown in hills and tended individually, that is, planting three to four seeds each "mound" at approximately 1 m x 1 m from each other. Hill cultivation of maize made possible the inclusion of beans and squash in the same field, a polycrop commonly know as *milpa* and still in use among Guatemalan and Mexican farmers. The distribution of ancestors to maize, or wild relatives, is circumscribed to Mexico and to Guatemala.

The border states of Huehuetenango, Guatemala, and Chiapas, Mexico, posses the capacity to illustrate the essential and distinctive elements of

[1] The discussion on Mesoamerica's geographical limits and common cultural traits has long been argued. Nevertheless, it is a useful methodological tool, not a fixed nor static cultural area, as it was proposed by Kirchhoff (1943).

Mesoamerica's cultural and natural heritage. Huehuetenango is most possibly the richest department in maize biodiversity in Guatemala (Fuentes 1994, 2005, 2006), while **Chiapas is possibly the second** state in Mexico (Perales and Hernández 2005). **Both regions share a common and dynamic history since early human migrations coming from the north, advanced through the southeast into Central America, settling in highland Chiapas and Huehuetenango, and gradually composing one of Mesoamerica's prominent cultures: the Maya.** Archaeological findings have proven intensive commercial activity between the regions through exchange routes between the main Mayan cities of valuable objects like obsidian, jade, marine shells, feathers, genetic resources, and others. These routes were used through colonial times by merchants, friars and political corteges, as to later become the *camino real* departing from the Tehuantepec isthmus, and going all the way to Guatemala city, the ancient Kaminaljuyú (Navarrete 2001, Lee 2001). Spanish conquest and colonization generated a complex process in the region that provoked the emergence of new ethnic identities. Today's Mayan population is represented by eight linguistic subgroups of more than 20 main languages (depending on classification criteria) mainly in the south of Mexico and Guatemala.

Milpa has many other variants than those found in the highlands of Los Cuchumantanes and Los Altos. **A similar project could be proposed for many other sites in Guatemala and Mexico but surely it would be difficult to find two other that share so many common features. To raise awareness and appreciation of the value and importance of the *milpa* and its genetic resources as a natural and cultural world heritage is one of our main objectives.**

1. Description of the GIAHS

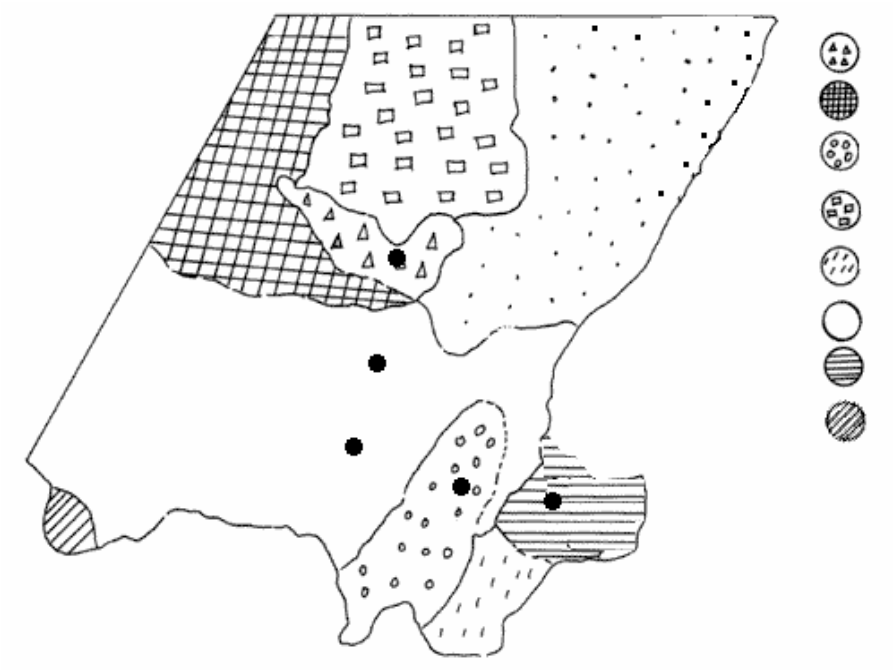
Description of the characteristics and functioning of the agricultural system: biodiversity, landscape, land and water resource management, indigenous and local knowledge systems, cultural and social aspects, overall ingenuity and remarkability of the human management.

The Cuchumantán highlands of Huehuetenango are constituted by heterogeneous ethnic groups and agro-ecological zones. The total population is

estimated of 189,529 inhabitants, where 89% live in rural areas with a population density average of 95 persons/km^2. The selected area corresponds to five municipalities of the Department of Huehuetenango with a high concentration of Mayan population: the highlands of Aguacatlán (Awacateko people), Chiantla, Todos Santos Cuchumantán, San Juan Atitlán (mestizo and Mam people), and San Rafael La Independencia (mestizo, Akateco, and Q'anjob'al people). Most of the *ladino* (spanish speaking people) population is established in the municipality of Chiantla. Ethnic groups recognize themselves as smaller subgroups depending on municipality headtown where minor communities go for their main fiestas. (**see Map 1 and Map 3-Annex)**

The highland altitudes range from 1500 masl and 3000 masl (meters above sea level). The annual rainfall is 2200 mm with an average temperature between 12.5 and 16 ºC. There is a clearly defined dry season (November-April) and a rainy season referred to as summer (verano). During the rainy season there are two notorious dry periods known as the canicules ("dog days of the summer"). The area corresponds mainly to the "low mountain humid forest", to the "dry sub-tropical forest" and to the "mountain humid forest" life zones. Natural vegetation is mostly of evergreen oak (Quercus spp.) and several types of « sad » pines (Pinus pseudostrobus,), ocote pine (Pinus montezumae) and other kinds of pines (P. occarpa, P. ayacahuite, P. rudis). It is characterized by a rich flora and fauna, some endemic and at risk of extinction (like "pavo de cacho" and quetzal).

Map 1. Selected area in Los Cuchumantanes, Department of Huehuetenango, Guatemala.



The Cuchumantán highlands lodge 60% of Guatemala's maize genetic biodiversity. Huehuetenango is the department where the greatest maize diversity has been reported (57% of races and 33% of sub-races). The cold agro-ecological zone that corresponds to the selected area, presents a greater number of races and sub-races than the sub-temperate zone. Even though maize is an interbreeding species, Maya farmers generally try to preserve morphological traits (Etten 2006). Preliminary studies have indicated that most of the maize collections gathered by the farmers have been conserved for an average of 15 years, and 25% of the people have kept them for more than 20 years (Fuentes et al., 2000) and imply beliefs that have not yet been studied. Mayan farmers classify maize according to criteria such as colour (white, yellow, black and red), period of growth, shape of grain, geographical origin and length of the growth cycle. According to Wellhausen et al. (1957) the landraces[2] of maize are **(see Picture 1-Annex)**:

Olotón	Both pure and crossed populations which are yellow and white in colour.
Quicheño	Pure and genetically crossed populations with the most genetic variety, with a great number of nodes in its chromosomes which indicates crossing with teosintle. Red-grained and Ramoso type which is

[2] One argument on the concept of landrace needs to be taken into account. As Berthaud and Gept (2004) suggested, the concept of landrace is not linked in the farmer's mind to a concept of genetic integrity. A landrace exists because it has been cultivated for a long time, enough to be locally adapted. Although landraces may appear to represent ancient varieties that are passed on from one generation of farmers to the next, it is in constant flux.

	an interesting genetic material whose cob is divided into various branches or appendices that has significant religious symbolism.
Tuxpeño	White grained landrace, semi-dent type. It is the landrace with the most environmental adaptation.
Serrano	White and yellow-grained landrace which presents both as pure and characteristics due to genetic-cross fertilisation.
Imbrincado	White-grain which is one of the most primitive landraces.
Comiteco	Yellow and white grain that has revealed an increasing adaptability rating, thus spreading to temperate areas.
Salpor	White-grained with big grains and few rows.

The *milpa* system is widely used among farmers in different parts of Guatemala. In the Cuchumantán highlands, it is estimated that 80% of the cultivated areas are based on this system. Depending on the locality, other products may compose the system such as different types of squashes, fava beans, wheat and oats (ICTA, 1996). Nevertheless, maize is the main component of the *milpa*, even though beans (pole and bush types) are intimately linked to maize for its vegetative development. This kind of sowing permits the sustainability of the system and the diversification of cultures based on maize.

Water management is based on soil humidity retention. Because of the types of soil and the cycle that maize agricultural system depends on, water management is based in traditional knowledge. This traditional management implies that between the months of December and February, humidity retention is based on fallow water storage. This modality allows the retention and accumulation of soil humidity through retrieval based on capillary action, and in March-April, the humidity contributes to the normal germination of the maize seed. This is a common practice in maize production systems in the Altiplano region in Guatemala (Fuentes, 2004). Slash and burn previous to breeding is not common, although it is sometimes practiced for pest control. The agricultural production cycle varies widely. In the cold zones, the cycle is longer and there is one harvest per year with an average of 34 quintals per hectare. The tasks related to the farming of maize reflect a combination of recently introduced techniques with ancestral practices.

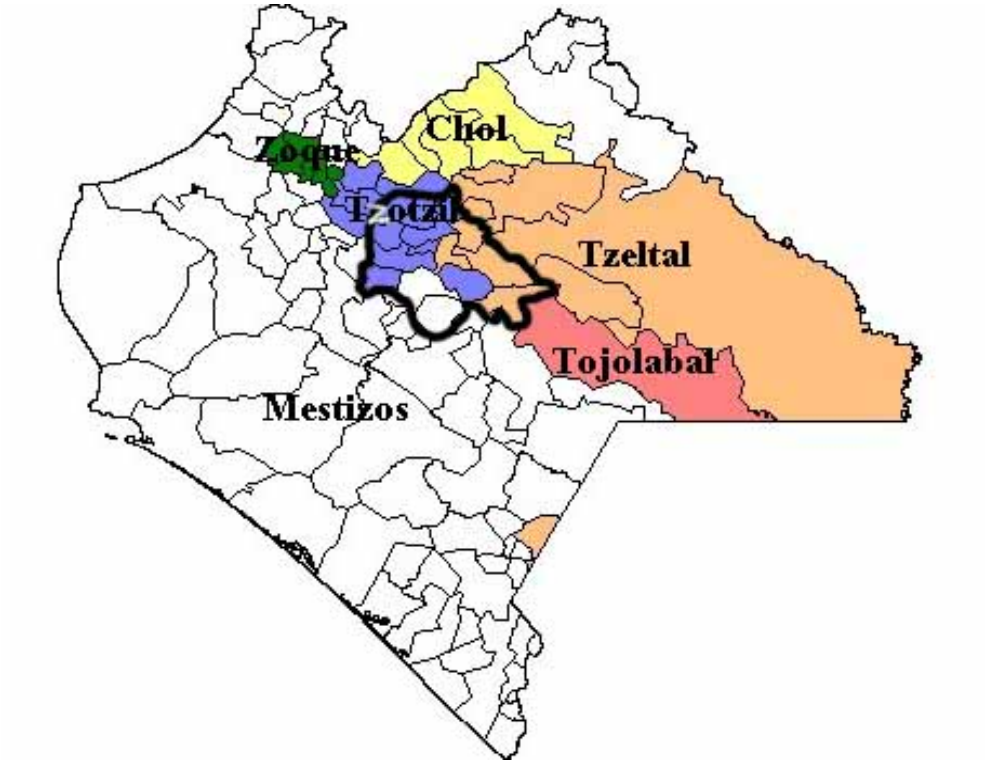
The predominant type of agriculture known as a “marginal and frontier type

production" corresponds to *fincas* (or farmhouses) with 0.46 ha of subsistence farming based on traditional techniques with maize as the main crop in association with other species and activities that include basic grains, native plants, vegetables, minor breeds and forest species (Fuentes 1994). This type of agriculture coexists with farmers shifting to culture diversification (*fincas* with 0.67 ha) and with specialized agriculture production systems (*fincas* with 10 ha), local and national market-oriented types, which coincides with conventional green revolution type production. Despite the introduction of improved varieties of maize in the area, local communities indicate that there was no massive adoption, thus with predomination of traditional varieties.

Based in the last national census of 1981 (INE), an average of 50% of the total land belonged to *fincas* between 0.7 and 7 ha, while more than 40% had *fincas* of less than 0.7 ha, and 1% had *fincas* of more than 10 ha. Actual land conditions reveal a complex situation where *fincas* are limited by size and by agricultural land availability. Agriculture, mainly for subsistence, is the main activity. Other important income is obtained from emigrated families, as well as from regional crafts like wool and cotton handicrafts, ceramics, leather and bronze products. The latter are either for domestic use or for selling in the main trading centres of Todos Santos and Chiantla.

The central highlands of Chiapas, known as Los Altos (366,033 ha), is an economic region organized in 16 municipalities, mostly inhabited by Mayan indigenous population represented by Tzotzil (*winik'oktil* "true men") and Tzeltal (*winik atel* "working men") peoples, surrounding the mestizo city and municipality of San Cristóbal de Las Casas (founded in 1528), main trading centre in the area. Similar subgroups, depending on municipal organization as in Huehuetenango are observed. Population density is greater than 100 persons/km^2 for 7 municipalities in Los Altos and five have more than 50 persons/km^2, when the national average is 53 persons/km^2. Notwithstanding, with the exception of San Cristóbal and Teopisca, the two mestizo cities in the region, no other community has more than 5000 habitants. **(see Map. 2 and Map 2-Annex)**

Map 2. Selected area in Los Altos, Chiapas, Mexico.



Los Altos is characterized by a mountainous mass with altitudes from 1000 to 2600 masl, subdivided in two subregions based on altitude and climate. On the north side altitudes are between 1000 and 1800 masl with a semi-warm humid climate with mean annual temperatures between 18 and 22 ºC and annual rainfall between 1200 and 1800 mm. Coffee and maize are the main agricultural products in this area. On the southern side of Los Altos altitudes go from 1800 to 2600 masl with a temperate humid climate with mean annual temperatures between 12 to 18 ºC and annual rainfall between 1100 and 1400 mm. This project will focus in the latter sub-region because it shares many attributes with the Cuchumantanes of Huehuetenango in Guatemala. Most of the land has medium to high slopes with relatively shallow soil, with depths between 30 to 40 cm and sometimes less than 10 cm, and of coarse textures that do not retain water well. Natural vegetation was basically oak forests (Quercus spp.), now oak-pine forests or only pine forests are more common. Deforestation has been high, mostly for fuel purposes including charcoal.

As in other regions of Mexico, in Chiapas the use of green revolution type packages, i.e., improved seed used in combination with increased plant densities, fertilizers, and herbicides, are only common in the warm areas where commercial maize production is done. Insect pests are only a problem in the warm areas so insecticides are not used for maize in the cooler regions. Most of the small maize holdings are made in

mountainous areas where it is not possible to use tractors, either because of slope or excessive amounts of stone. In the temperate and sub-temperate areas, improved seed has not had a big success (Perales et al 2003, Perales unpublished) and farmers still produce maize in much the same way as has been done for some hundreds of years. Two exceptions to the last statement are important. Slash and burn maize production is decreasing in importance because land is now scarce for this purpose and fallows are rarely long enough to support production without inputs. This fact, together with increasing cost of family labour and migration, has caused maize production to adopt some industrial inputs. Therefore, Los Altos of Chiapas is characterized by its maintenance of traditional characteristics with limited adoption of fertilizers and herbicides and only traditional varieties of maize are present.

Above 1800 masl of altitude and in the lands of the Tzeltal and Tzotzil, the two most common maize landraces are Olotón and Comiteco. In Mexico, Olotón is present only in the highlands of Chiapas. It grows above 2000 masl and is characterized by thick cobs, a bulky base with irregular rows, and large rounded, flinty grains. Wellhausen *et al* (1951) suggested that it was introduced from Guatemala, coming migrating from South America. Comiteco probably originated in Chiapas and is scantly found elsewhere in Mexico. It grows between 900 and 2000 masl and is characterized by very long ears (up to 35 cm) among other attributes. Colour (red, black, white, yellow) is the most important characteristic in Mayan farmer nomenclature, classification and selection of maize, although it is not important for racial classification. **(see Picture 2-Annex))**

Maize in Chiapas is planted from sea level to 2600 masl. Areas planted in maize are most commonly between 1 and 3 ha (65% of farmers). Commercial maize holdings are common in central Chiapas with 15% of farmers planting more than 5 ha of maize, and rarely few have more than 10 ha (<1% of farmers). This strong contrast between a large number of farmers with small areas planted in maize and a few large commercial farmers is common in Mexico (CEPAL 1994) and correlates with management characteristics.

Land tenure combines communal ownership with individual use rights. Maize is the predominant crop throughout the region and is grown primarily as a subsistence crop, although most household heads and family members are engaged in salary work outside the region, and few produce cabbage, potato, sheep, and textile handicrafts. Research on the maize systems of Mexico has shown that people might be open to

consistently acquiring new seed from neighbours and more distant sources; but are also conservative since there is ample evidence of the persistence of local maize types.

Indigenous and Local Knowledge Systems

The ability of early Mesoamericans to transform a wild grass into the world's largest crop permitted the emergence of the great ancient civilizations that depended on this basic food to supply their energetic needs. The long process of its domestication runs parallel to the history of its religious conceptions and the sophisticated ceremonialism that has accompanied its agricultural cycle. It is a cognitive model for Mesoamerican indigenous societies that goes back at least six thousand years, or as a Mam tale recalls "It is with the seed that it all starts..." (*Tchwinqel Ixin*:s.f.). **(see Image 2-Annex)**

Mesoamerican belief systems conceive nature and culture as a whole and same system. The Maya believe that plants, animals and some artefacts have a "soul" or "vital force". In order to reproduce itself, this force has to be fed. The predominant idea among the Maya is that of loan, restitution and pay. Every single thing taken from the Earth has to be given back. Offerings are one of the ways to compensate the Earth for the use of her belongings. This way, the circulation as a way to preserve the reproduction of the species is maintained.

The careful observation of the natural cycles has brought these societies to establish a sophisticated ritualism that permits them to affect the natural cycles through ritual action. Each community organizes rituals corresponding to their beliefs and the natural phenomena specific to the area. Every single phase of maize cycle, since selection of seed and field preparation until the first fruits and harvest, involve prayers, ceremonies, abstinences, fasting, incense, music, candles, offerings in sacred natural sites, and banquets that include maize diverse gastronomy and beverages shared among family and friends. **(see Picture 3-Annex & Image 1-Annex)**

Agriculture is intimately linked to astronomic knowledge, as to know the best times for seed and harvest. Among the Maya, the moon cycle plays an important role and every lunar phase has either a forceful or damaging effect on the milpa's breeding, associated to excessive fertility and growing, but also with madness, death and sickness. For instance, during the full moon, maize, beans and squash are cultivated or harvested and maize stems are folded, but during the first quarter it is considered dangerous to plant it because the stems would grow too high and break (Guiteras 1996:38). Among

the Tzotzil (as well as for many other Mayan groups), agricultural duties and ritual life are organized by the ancient Mayan moon calendar that correspond to a 260-day cycle (equivalent to 13 months of 20 days each). This ritual cycle is organized along three main ceremonies, or *mixá*, that address the prayers to the Holy Earth (Santa Tierra), Totik, (Sun Father), X'Ob (the Mother and Soul of Maize) and to the *Anjel*, the master of the animals and the mountains (Guiteras 1996, López Austin 1994). Among the Mam, prayers are addressed to the different deities that intervene in maize's growth, mainly to the Mother of Maize, B'ixin Pa'ach. The *chimán*, the mayor, the *regidor* or certain elders of the community participate, pronouncing the "call" to the Lords of the Hills to implore for rain. For this group, *Paxil* is conceived as the mythical origin of maize. Its geographical reference is thought to be in different hilltops in the Cuchumantán region.

Knowledge associated to maize is abundant in Mesoamerican languages. Stadelman (1940) elaborated a Mam glossary concerning maize terminology including 192 words on: instruments, activities, objects, vigesimal calendar system, numeration, agricultural chronological activities, etc. He registered 166 terms on maize varieties, classified in groups and sub-groups, with colour, appearance, grain and cob formation criteria. Through ethnographic work, farmers' conceptual knowledge and classification systems will contribute to a better understanding on how traditional knowledge systems sustain biological diversity.

Maize, the heritage of ancient societies of Mesoamerica, is a structural element that sustains today's indigenous societies of America. **Like a Mam tale recalls, "We are Maize Men, because Maize is in all our life: in our blood, in our flesh, in our bones, in our ceremonies, in our thirst"** (*Tchwinqel Ixin*: 20). This intimate relationship is reflected in the diversity of landraces and cultures that are bound and woven together.

Ingenuity and remarkability of human management

Maize landraces associated to the milpa agroecosystem are an outstanding bio-cultural artefact of Mesoamerica. No other place in the world has such an evolved farming system as the milpa. The highlands of Chiapas and Huehuetenango are representative of the inseparable interaction between natural and cultural characteristics that produce unique evolutionary forms as the milpa system and the maize landraces and other species associated. These coevolutionary interactions between the natural and

cultural world have been crucial for the conservation of an outstanding amount of maize genetic resources throughout history.

In one hand, its remarkability has to do with the surprising continuity and importance of the agroecological system over time. Maize production in Mexico and Guatemala that resembles that of conventional input intensive production is present, including commercial maize hybrids as it is done in USA and Europe, but the greatest area planted to maize is still done in ways that are basically those developed by Mesoamerican ancestors. That is, maize is planted in mounds, with traditional seeds of maize and commonly intercropped with other species, fertilized by the natural vegetation, weeded, harvested and hulled by hand and tended individually and, nonetheless, prepared every day as tortilla, tamal or pozol in the ancestral way. Almost any other crop can be found in Mexico and Guatemala but it is extremely rare that any of these have displaced maize and milpa as the main agro-ecological system for peasants in Mesoamerica. Granted, adoption of specific modern techniques in maize production has been done by traditional and indigenous farmers, but the main Mesoamerican milpa characteristics persist. This speaks for the ingenuity of an agroecological system that has managed to adapt to new technical, social and environmental conditions. This is truly remarkable in view of the enormous changes of the last century and, possibly, suggests its permanence and importance for future generations.

On the other hand, despite the fact that improved varieties were introduced in Mexico more than 50 years ago, studies have shown that they were commonly incorporated in the farmer's repertoire instead of totally displacing the traditional ones (Bellon and Brush 1994, Perales et al. 2003). Farmers are interested in new maize germplasms but the process of management and selection of maize varieties is the same as for the landraces, sometimes being kept and sometimes discarded because their own traditional varieties were better. Perales et al. (2003) have pointed out the relative stability of high altitude maize populations, in contrast with the dynamic nature of low and mid-altitude populations. In the highlands of Guatemala, maize is also reported as being more heterogeneous than those in lower elevations, suggesting a greater degree of hybridization than in lower areas (Bretting et al. 1990, Etten, 2006)). Highlands are more conservative in terms of changes in populations of traditional varieties of maize but more diverse in the genetic structure of their populations, whereas lowlands are more dynamic in their changes of maize varieties but possibly

less diverse genetically. Ceccarelli (1994) has shown the superiority of traditional varieties of barley under low-yield conditions. There is evidence that in central Mexico this might be true (Perales 1998) and Perales et. al. (1998) have suggested that where traditional varieties are present these are competitive under farmers' conditions compared to modern varieties. The surprising persistence of local maize in the highlands of central Mexico, in spite of well-developed markets and research centres (Perales et al. 2003a), has highlighted that **in the highlands of Mesoamerica a strong coevolutionary process between farmers and maize genetic resources has produced traditional varieties that modern breeding programs have not surpassed. All descriptions of maize and milpa in Los Altos and Huehuetenango suggest this pattern is also present in these regions.**

Another remarkable aspect of the Mesoamerican milpa agroecosystem is that maize diversity has been shown to be linked to cultural diversity. Edgar Anderson (1947), a pioneer in the field study of Mesoamerican maize, observed long ago while working in Guatemala that "maize is a sensitive mirror of the people who grow it". Anderson suggested that maize diversity was associated not only to environmental adaptation but, also, to the association with different cultural groups. Hernandez X. (1985) has stated a similar view although evidence had been lacking until recently. Perales et al. (2005) have shown that despite the close proximity of two ethnic groups in Chiapas these had distinct maize diversity associated, which could not be completely explained by environmental adaptation of the maize varieties. Thus, conservation of maize diversity implies, in some way, conservation of cultural diversity, as will the conservation of cultural diversity imply conservation of maize diversity in Mesoamerica.

2. Goods and services provided by the system

Describe the important livelihood and environmental services provided by the system at local, national and global levels.

The maize agricultural system, present at both sites, do not only represent a remarkable example of dynamic adaptation, rich biodiversity, and a historic testimony of humanity's evolution, but it also represents a sustained provision of multiple goods and livelihood and environmental services.

Livelihood services

Food security

Mexico's population is nourished at striking low costs, representing only 1% of

the GDP. Half of the country's cultivated land is dedicated to maize but corresponds to only 18% of the market value of the total agricultural production. One fifth of Mexican population lives in rural areas with more than 2.5 million small-scale households planting between one and three hectares of maize per year. Mexico's total grain consumption fluctuates around 25 million tons/year, which in the last decade only 50 to 60% was supplied with national production (Leyva 2005). In Guatemala, maize production corresponds to 4% of the agricultural GDP and areas planted to maize correspond to 2/3 of the total cultivated land (Etten & Fuentes 2006).

In Huehuetenango, the main economic activity in the area is agriculture in which 78% of the population is engaged. In Chiapas, more than 250,000 households engage in maize production and represent 42% of the economically active population, mostly for home consumption though they may occasionally sell come surplus. Other important income is obtained from seasonal salary work and emigrated family members, as well as from regional crafts like wool and cotton textiles, ceramics, leather and bronze products. The crafts are either for domestic use or for selling in the main trading centres of Todos Santos and Chiantla, in Guatemala, and San Cristóbal, in Chiapas.

Eric Wolf has calculated that maize provides 75% of the Mexican caloric diet. Alone, tortilla consumption provides half of the calories (47%) that sustain more than one hundred million Mexicans. For most, the rest of the alimentary needs are fulfilled with complementary products from the *milpa*, and presently, with low-income temporary jobs outside of their communities. Depending on social stratum, it is estimated that the consumption per capita is of 110 kg/year. Maize and beans furnish 60% of proteins and 70% of carbohydrates of local inhabitants. The basic preparation of maize is an ancient Mesoamerican technique that produces "nixtamal" where maize is boiled with limestone or ash to remove the skin of the grain and that also raises its nutritional value. A similar situation is observed in Guatemala.

In Chiapas, 60 out of its 118 municipalities show *severe* under-nourishment (2nd place in Mexico). Children mortality rate is the highest in Mexico (32/1000 in 2000), and the main causes are attributed to respiratory, infectious, gastrointestinal, and nutritious deficiencies (SEPI, 2000). **In Huehuetenango, "chronic" under-nourishment (low height per age) is of 69.2% and "acute" under-nourishment (low weight per height) is of 33.4%, primarily present among indigenous populations** (ENSMI, 1998). This problem has severe implications in the nutrition-infectious complex that prevails as the principal cause for sickness and death in the country; the Cuchumantán region is not an exception, affecting the poorest and less protected

populations.

For most of Mexican and Guatemalan small-scale farmers living in poverty, with low educational level, lacking job and production opportunities outside their parcels, maize means, first of all, food. As expressed by Leyva, "to preserve production and consumption of maize is a compromise that stands beyond arguments of tradition and culture: in its ample reaches and with unquestionable use, maize remains as the base of food security, and therefore, as Mexico's (and Guatemala's) guarantee of social and political stability" (2005:141). Without food security, human development is void.

Maize is the basic food supply in Mexico, Central America, the Andean region, part of southern Asia, and some sub-saharan countries (Paliwal 2000). At global scale, maize culture –because of its remarkable capacity of environmental adaptation- represents an interesting alternative for world poverty alleviation.

Housing, fuel, health, related needs and economic services

Maize, besides being the basic staple in Mesoamerica, provides a number of goods that include regional gastronomy, beverages and medicinal uses, fuel, animal feed, and materials for crafts, a large number of industrial and some pharmaceutical products, and genetic resources of maize and associated crops in the milpa. It is even used to provide construction material for houses, but this use is not extremely rare.

The fact that despite growing pressure of various kinds, Mexican and Guatemalan farmers continue to cultivate traditional landraces and local varieties suggest that modern varieties that do eventually reach these farmers do not entirely meet their needs. Traits governing taste, cooking, nutritional value, yield stability rather than yield per se, and other attributes upraises the need for traditional varieties. For example, most modern varieties have tough stalks and leaves, making them unsuitable for farmers with the need to use maize plants as animal feed. In Guatemala, **maize from the cold regions is preferred for its taste, colour, development, growth cycles, resistance to pests and diseases, softness and because it produces tortillas of a better texture and keeps longer** (Etten 2006). The maize plant is used for several purposes. Among the Mam, to quote one example, the leaves are used to cover the *tamales* that are consumed by the family or sold at local markets, to regulate the heat while cooking, to feed the cattle, or to be sold. After shelling, the cobs are cooked in big casseroles and mixed with limestone ("nixtamalización") to feed the animals, or they are boiled in water with medicinal plants that is given as a drink to cure maladies provoked by fear or for children with eye problems.

Mayan societies classify plants and food in hot, cold, and temperate categories. Maize is conceived as the perfect balanced food and it is attributed curative virtues by returning the balance between temperatures that is believed to be the cause for several

maladies. It also has preventive properties: it maintains a healthy set of teeth, it prevents problems in the stomach (such as cramps), the kidneys and urinary channels (for which red maize's boiled hair tea is taken), the heart, the intestines and measles (for which black maize with wheat, cinnamon and borraje herbs tea is taken). Local communities differentiate the nutritious properties of the different maize varieties. For example, in Huehuetenango, black maize is of special value as it produces the sweetest grain and is used for special occasions. In Chiapas, Tzotzil consume more red maize than Tzeltal for medicinal purposes. Tzeltal take sour *pozol* made of yellow, purple, or black maize during a sick person's diet, and grilled maize for nasal bleedings. In short, each community preserves special relationships with maize landraces.

Maize, with beans and chile pepper closely associated, is the basic ingredient in indigenous gastronomy. Maize has a wide number of gastronomic uses. Depending on grain quality, it can be used for tortilla (a flat bread of nixtamal), tamal (steamed nixtamal with extras), elote (corn on the cob), tostada or totopo (chips), pozol (a non-alcoholic beverage), atole (a gruel), pinole (toasted maize flour) and regional snacks. Among the different forms in which maize is prepared, tortilla prevails as the basic staple and it accompanies almost every meal. Substitutability between maize varieties for tortilla use is prevalent (Perales et al. 2005). Some kinds of maize food imply a sophisticated way of preparing it and have specific religious significance when consumed in ritual ceremonies. For example, among Tzeltal, *k'wab'j Sqa* ("atol blanco", maize dough mixed with bean dough and seasoned with chili) is taken by family and friends who helped in the field during the first and last days, while among Tzotzil, the first day's meal is called *bokix* (boiled and crushed maize mixed with chili, coriander and onion, servd with atole and a boiled egg), and is only taken by the men.

In Huehuetenango, collected samples of maize have shown that white-grained maize is appropriate for industrial flours and coloured-grained maize is appropriate for traditional atoles, tortillas and snacks. Maize varieties have been valued mostly in terms of their agronomic yield, but recently new research on "grains of enhanced value" has identified maize varieties with characteristics that present technological and economical advantages in certain processes and products. For example, red maize types are valued for their usage as natural tints for food industry and as an antioxidant (Figueroa & Fuentes 2006). It is important to consider that the milpa system provides other products besides maize. Another element is that in Mexico city and other urban areas, demand for consumption goods made from locally grown varieties of maize and

other peasantry products has augmented in recent years. Such is the case of traditional nixtamal hand-made tortillas of prices as high as three times more the prevailing price for industrial style tortillas (Barkin 2002). Totopos made from Zapalote maize in the Tehuantepec region in Oaxaca, and tostadas from Teopisca in Los Altos are other examples of this trend. Peasant and indigenous sellers in metropolitan areas have gained spaces to promote their own products. New market possibilities could be identified through this project as to contribute to local struggle for self-sufficiency through linkage work.

Social and cultural services and quality of life (equity, cohesion, ethics, identity, art, values)

Maize Mayan myths and rites stresses out the necessity to reproduce it because it is the result of man's hard work that granted him with freedom and food security. From maize agriculture were derived work techniques, gender division of work and the human management of natural resources. It has played an essential role in conceptions of personhood, life cycles and group identity, and has established rules of sociability as well as those towards the natural world. Maize marks the passage from nature to culture. It points out the human quality of men, but at the same time, establishes its own limitations and a rigid system over its own nature. Through maize, men transcended the natural world by obtaining freedom, at the same time that it revealed its dependency condition towards work, social relations and nature (Rojas Lima 1988). **(see Literature-Annex)**

Collective labour needed to fulfil the agricultural activities, plays an essential role in community and family bonds that reinforce social cohesion. Maize cultivation is a family responsibility and as such it involves all members of the family as a unit. Regarding political organization, when the Tzotzil traditional authorities are elected, one of their first obligations is to prepare the "Earth mass" so the earth deities testify the beginning of the new political order and the new agricultural season. The authorities consider their work done when the harvest season is ready.

Indigenous' Mayan communities in Chiapas and Huehuetenango strive to reproduce their own and unique ways of life. Nonetheless, they have changed dramatically in recent years due to demographic growth, lack of land and employment, the agricultural crisis, migration, diversification of economic activities and natural catastrophes that have generated frequent migratory movements, and strong territory disputes and conflicts. The northern area of Huehuetenango has been the most affected

by the armed conflict, generating migration movements and the return of refugees, thus suffering from a strong social fragmentation. In Chiapas, many Tzotzil have dispersed, converted to other religions, or migrated to cities in the state and the United States, while some Tzeltal groups have been displaced into the Lacandón rainforest (Gómez 1982). Political conflicts have affected the region as well. These factors that have not yet been thoroughly studied in relation to the milpa adaptability and the conservation of maize varieties, are thought to have a negative effect on planting materials and the conservation of genetic resources, thus highlighting its uncertain future. In situ conservation implies working on farmers' social conditions on which the viability of the system depends.

In both Mexican and Guatemala societies maize is rooted in plastic art, sculpture, literature and music. It has been central in the development of national culture and is considered as a national identity symbol. The phrase "we are people of maize" that is frequently used in both countries, is much more than a rhetorical figure of speech. Without maize, local cultural identity throughout Mesoamerica would be compromised with consequences and effects much wider than the loss of the particular genetic resources of maize. Identity, culture, welfare, and maize are inextricably linked for the peoples of Mesoamerica.

Environmental services

Biodiversity and ecosystem services, soil and water conservation and restoration, climate regulation and carbon sequestration

Milpa cultivation in Mesoamerica was structured as a production system known as slash and burn agriculture. Slash and burn agriculture is also practiced in other parts of the world and its principle is the recovery of soil fertility and reduction of weed competition by secondary vegetation growth. This agricultural system is very effective as long as the rest period is lengthy enough and there is enough land for the cycle to be repeated throughout the area for each farmer. As land becomes scarce and farmers let their land rest for only a couple of years or so, soil fertility is not recovered nor the weeds controlled effectively. Presently Mayan farmers have had to cope with extremely short fallows or none at all and their adjustment to these new conditions has not been as effective as desirable. Nonetheless, the structure of the slash and burn

milpa system is still prevalent in the agricultural environment and within it maize genetic resources have evolved in the Mayan area.

These new conditions have provoked a negative relationship between maize as part of the milpa and soil conservation. Even though maize production is not the only cause for soil erosion a large amount has been associated with the need to plant maize in hillside areas. It is not that Mayan farmers prefer hillsides for maize, as population has increased they have had no other option but to cultivate land with steep slopes. Soils have degraded in association with maize and are now in the need of an intensive and systematic effort of restoration. Associating soil conservation and restoration efforts to milpa production is of great importance because it could imply improving the soil of large areas. In recent years, besides some efforts by the Secretaría de Pueblos Indios of Chiapas, there have been relatively isolated efforts by farmers in these regions on soil conservation projects. For example, in Chamula, Chiapanecan farmers accumulate all maize stubble in lines against the slope to help stop or slow rainfall and thus soil erosion. These and other possibilities are in great need to be supported and extended.

In contrast to the United States and the high productivity areas in the north of Mexico where irrigation for maize is customary, milpa cultivation in the Mayan area is in almost all accounts a rainfed production system. In the highlands of Chiapas, water is scarce and in the rare cases it is available for agriculture, it is used for vegetables, flowers or other cash crops. Maize is sometimes irrigated but in these cases it is to be sold as vegetable corn (corn in the cob) in off-season production. The wide adaptation of maize for rainfall and temperature, ranging from 500 to over 2500 mm per year and annual mean of 14 to 30 °C, allows milpa production over all the Mexican and Guatemalan countryside. In all Mesoamerica there is no other crop that can be grown in such wide environmental conditions.

In Los Cuchumantanes, 55% of the area is estimated as a forestry zone where 30% is dedicated to agriculture and 15% as protected areas (INAB, 2000). Even though forestry land is predominant, deforestation is one of the main causes of loss of forest mass to be opened for cultivation. This zone constitutes one of the principal areas in water retrieval because it lodges a great number of water sources that are the origin of several streams and rivers that

flow into the Atlantic or Pacific Oceans. Different projects such as "El Proyecto de Desarrollo de Los Cuchumatanes", together with local organizations such as ASOCUCH (Asociación de Organizaciones de Los Cuchamatanes), have collaborated to implement soil conservation projects to dispose of areas dedicated to agriculture against soil erosion. The region is particularly rich in water but the efficiency of its usage is very weak. A critical element is the lack of legal regulation at municipal and national levels. This situation has provoked conflicts between the communities and could affect social stability. Through actual projects in the area, an inventory of water sources has been started, as well as their geographic location, community gatherings and consensus over water use at community and municipal levels. The Guatemalan government has started the second phase of the Cuchumantán Project. It is intended to focus on natural resources' conservation and its main function is to minimize deforestation problems as to define protected areas, and to promote the rational and proper usage of water. It is important to mention that this area could constitute the principal water supplier of the city of Guatemala **that is only at 280 km. (Cifuentes 2006, Figueroa & Tomas, personal communication).**

Maize and milpa are not strong activities for climate regulation and carbon sequestration. Nonetheless, it has been showed that maize as part of the milpa system promotes soil restoration through nitrogen fixation by the use of several species. It is important to mention that one possibility that has been explored elsewhere in Chiapas is milpa cultivation as an agroforestry system. In this instance tree crops are planted in the edges of the fields, or are even planted in rows or dispersed throughout the milpa. If schemes as such are extended, milpa could make a significant contribution towards carbon sequestration. In Guatemala, experiences on carbon sequestration have focused in the lowlands, in areas under reforestation process. An exchange of experiences between both sites could be held through this project. That is to share soil improvement programs experiences from Huehuetenango, and of carbon sequestration related to agroforestry systems experiences from Chiapas, to enforce sustainable development.

3. Threats and challenges

Identify and analyse threats and challenges to the continued existence of the systems and/or to its sustainability and viability. Identify and analyse the local, national and/or global nature of these threats, paying particular attention to occurrences and trends of economic, social, environmental or political nature. Illustrate the changes in the human and ecological dynamics of the system and their effects on ecosystem health, resource endowments and human well-being.

As stated above, **maize diversity and in situ conservation will most possibly be viable as long as Mesoamerican indigenous communities have conditions for survival as cultural groups. Maize, milpa and indigenous cultural groups of Mesoamerica have such a strong coevolutionary relation that they might as well imply one another**. But this is not to say that simple continuity is expected, there are also threats concerning the economic, social and cultural viability of maize and the milpa agroecosystem for indigenous populations. There are local, national and global conditions and policies that illustrate these.

On the local level it is striking to see that **Chiapas is the second Mexican state with largest natural and cultural diversity, has 30% of the country's water resource, and is as characterized by one of the highest degrees of social marginalisation and poverty** with extremely elevated rates of under-nourishment, illiteracy, human rights violation, migration and mortality, mostly among its indigenous populations[3] (SEPI, 2000). A similar situation is observed in **Huehuetenango, which lodges Guatemala's most natural and cultural diversity but concentrates 85.9% of poverty rate, and 43.67% of extreme poverty, i.e. the lowest human development report (HDR) in Guatemala[4]**. It has the highest mortality, illiteracy, chronic under-nourishment rates, mostly among its indigenous populations (SEGEPLAN, 2001). Huehuetenango was the department that was the most brutally affected by the armed conflict that formerly ended in 1996 and caused the death of around 132,000 persons and the displacement of around 80% of the population in the affected areas (Comisión para el Esclarecimiento Histórico 1999).

The latter must take into account what seems to be the greatest change into region. That is the incorporation into a monetarized economy and the subsequent migration it has produced. In Los Altos, Cancian (1972, 1976, 1992) and others (Breedlove and Laughlin 1993) have shown how the proportion of the economically active population engaged in agriculture for the state of

[3] 93.16% of the state's total municipalities were considered as of "high" and "very high· degree of marginalisation, where 20 municipalities are mostly indigenous.
[4] 0.49 compared to o.70 in metropolitan areas.

Chiapas has diminished from 93.5% in 1950 to 76.5% in 1980 and 47% in 2000. Maize productivity and economic return is recognized as too low to justify business-like entrepreneurship and peasant households associated with milpa are among the poorest people. Maize production in Chiapas is accounted for 42% of the economically active population and only 12% of the gross domestic product of the State. This great disparity between the number of people involved and the value of the production clearly indicate the problem for Chiapanecos living from maize production and suggests the reason for the change in the population associated with agriculture. This change has been accompanied by seasonal and permanent massive migration of household members. In Huehuetenango, 60% of the active population is engaged in agriculture, which indicates a significant decrease if it is compared to the 80's and 90's (INE, 2003). As an example, preliminary data estimates that in Todos Santos Cuchumantán, 10 000 persons have immigrated in the last five years (Figueroa, 2006, personal communication). Fragmentation of social networks has decreased the transmission of knowledge between farmers and to the younger generations that find it difficult to continue to reside in their communities when even their parents have a difficult time surviving as farmers. In Huehuetenango, farmer population has an average of 45 years old. This abandon of maize agriculture, and agriculture in general, and the permanent migration of the newer generations is a very strong risk to the conservation of milpa agriculture and maize genetic resources.

Abandon of maize agriculture has also been increased due to social problems regarding land access and asymmetrical conditions with landowners that have pushed indigenous communities into less fertile areas throughout their history, thus generating a great amount of social conflicts that are far from being resolved, as well as intensive human pressure over land that have caused alarming land erosion. The latter highlights the need to support land stabilization and reversing degradation programs, which is one of our challenges.

Threats on the Mexican national level are related to governmental efforts in the last two decades to move peasant production to more lucrative activities. Support for maize agriculture is limited to small subsidies directed more towards consumption than

production. Extension services have been cancelled and agricultural research, although present, is too limited for the needs of the more than 2.5 million households.

> The above is linked to a global problem. As stated, maize agriculture both in Mexico and Guatemala is divided in two categories: small-scale and large-scale maize production. Since Mexico's signing in 1994 of the North American Free Trade (NAFTA), governmental policies concerning agriculture have been strongly designed with a competitive principle as their main or only criteria. While large-scale maize production has benefited from government support programs, market prices, and the adoption of new technologies, small-scale farmers have been profoundly affected. With NAFTA, Mexican farmers compete directly with large scale US maize producers in supplying the large Mexican market for purchased grain. Even though present economic policy demands global competition, it is difficult to see how Mayan farmers with one to three hectares of hillside land can compete directly with American maize farmers with hundreds or even thousands of hectares, highly subsidised, and with capital and technology intensive production. With the recent signing of the Dominican Republic and Central American Free Trade Agreement (DR-CAFTA) in Guatemala, a similar situation is being observed, although the Guatemalan government negotiated more moderate policies regarding protection of national basic grains, but nonetheless, puts at risk national production because of low international market prices. Since the 1990's, both countries have experienced an increment of impoverishment, threats on food security, health problems, and mortality and malnourishment rates, therefore, an increment on human rights violation. Maize market prices competition has promoted the transformation of the agricultural system in ways that do not point towards the welfare of rural households.

Another global factor that threats maize diversity is the inadvertent introduction of transgenes into the local gene pools. Industry has been pushing strongly towards the use of transgenic maize in Mexico, a seed company has even threatened to leave the country if transgenic maize is not authorized. Because of the lack of research onto the possible effects of transgenes if introduced in traditional varieties of maize, Mexico had a moratorium -presently partially lifted- on experimentation and commercial production of transgenic maize. But even with the moratorium in place the importation of transgenic maize for food purposes was authorized with no provisions to control its presence in the countryside. The presence of transgenes in Mexican traditional varieties has been reported, although controversy surrounds the issue (Quist and Chapela 2002, Ortiz et al. 2005). Introduction of maize transgenes, either by migrants in the USA, from maize destined for food, or by seed programs, might have unknown consequences that could be detrimental to local populations. Exposing local populations to uncontrolled contamination of transgenes could contribute to genetic erosion in unexpected ways. Knowledge of how to establish a reversible system is very limited. Transgenes generate considerable uncertainty for local farmers and may create situations that have never been considered in the biosafety assessments and management protocols used to regulate transgenic varieties in industrialized countries. These concerns merit careful consideration because they not only threaten diversity but may include the

abandonment of maize cultivation as farmers migrate or shift to other crops, or as the aging of the farming populations and the lack of interest in agriculture among young people continue (Bellon and Berthaud 2004). Thus, considering the very little knowledge on how to manage transgenes once they enter the traditional Mexican and Guatemalan maize system and the survival importance of maize to so many poverty-stricken livelihoods the precautory principle should be dominant as policy. This raises the importance of research on farmers' behaviour and of farmers' education and information about transgenic and non transgenic varieties and the implications for their agricultural systems.

Since maize diversity and milpa agroecosystem's permanence in Los Altos and Los Cuchumantanes –as in the rest of Mesoamerica- depends on the social stability of the Mayan communities that reproduce it, it is imperative to pursue research on the specificity and dynamics of the social factors affecting it. Maize production is in the hands of farmers without the strong support that such an important crop in its native land deserves. An essential need of maize farming in general is its revaluation in terms of its economic, social and cultural importance at the national and local levels. This revaluation should, eventually, give way to changes in policy at the national level. **If society values the maize and its diversity in Mexico and Guatemala's traditional agricultural systems and is committed to its conservation, it should be willing to invest in small-scale farmers' efforts to maintain that diversity.**

4. Policy and development relevance

Describe possible lessons to be learned and benchmark management strategies and principle practices provided by the system, which are relevant for formulating national and international policies for sustainable agricultural development, as well as their potential contribution to global concerns of food security and poverty alleviation, biodiversity conservation and others.

The Mexican and Guatemalan highlands have a strong dominance of traditional varieties, therefore, they are an important repository of genetic resources. Traditional varieties' advantages in marginal environmental, production, and economic conditions are to lower risk of food deficits or economic losses and to satisfy goals of consumption and other uses. That at the beginning of the XXI century farmers in Chiapas and Guatemala continue to solve food security through their millenarian milpa systems should be considered as a lesson and as an outstanding example for peasants and marginal conditions in other parts of the world.

Mexico and Guatemala have an alarming void in legal regulation in the

conservation, production and innovation of genetic resources, even though Guatemala has marked the first steps for normative establishment through the signing of international biological conservation treaties. National policy toward maize production needs to take into account that our maize farmers need special policies and that their contribution to society should not be viewed only in terms of economic efficiency. It should also reconsider the huge gap between international economic market policies and national social conditions at maize's centres of origin. The revaluation of maize and the milpa system could be an important contributing factor towards policy change, as to understand that maize, the milpa and its guardians make part of a whole and unique system. Policies should be designed to insure the essential contribution that maize does toward food security of our most vulnerable population and should seek to strengthen this role. Policies should assure the continuing evolution of maize in farmer's fields and, concurrently, improve the livelihood of the indigenous populations that are maize's custodians. Therefore, policies concerned with sustainable development of maize and milpa should be appropriate to the special nature of maize in its centre of origin. A policy change in the sense described for maize could contribute toward a more sensible management of other crops in their centre of origin.

5. Global importance

Summarise the outstanding features of the system in terms of their relevance to global concerns in agricultural development and ecosystems management and their cultural and heritage value.The outstanding value of maize for Mexico and Guatemala is unquestionable, as it is for the rest of the world. Maize has been diffused to virtually every agricultural environment in the world, thus becoming the second most important crop in the world. Despite the radically different agricultural regimes and techniques of subsistence it has been adapted to, maize is an interesting alternative to supply the 8000 million inhabitants expected for the year 2030 (Paliwal 2001).

Chiapanecan and Guatemalan farmers depend completely on maize and the milpa system for their subsistence. Nevertheless, the permanence of the milpa is uncertain under the present economic systems that purport globalized competition in all areas of the economy. Disparities between rural and urban areas in Mexico and Guatemala seem to be growing apart. Agricultural research can potentially improve rural livelihoods by addressing farmer's problems and generating cost effective technology. **Therefore, this project attends global concerns by focusing on marginal regions such as the highlands of Mexico and Guatemala where traditional varieties have proven to be superior in performance than improved varieties. It has been showed that *in situ* conservation of traditional varieties depends on small-scale farmers and that it is imperative to support them.** In this sense, focusing on the

farmers' role in supplying seeds, given the limitations of seed supply by the formal sector in poor areas, is imperative. Community focused activities proposed though this project will empower local communities assuring sustainable use of a considerable amount of maize's genetic resources.

The fact that **the milpa agroecosystem is the basis of food security in Mexico and Guatemala means that all actions supporting this system engage in the United Nations Millennium Declaration on "Development and poverty eradication" (point III).** At the sites here proposed, poverty and extreme poverty rates (i.e. child and maternal mortality rates) are alarming, and therefore, a human rights violation. This proposal will support The Millennium Development Goals 1 "Eradicate extreme poverty and hunger", Goal 4 "Reduce child mortality" (see rates above) and Goal 7 "Ensure environmental sustainability" by preserving world's biodiversity of maize among communities whose day-to-day subsistence is directly linked to the natural resources around them. Parallel activities such as the "New literate workshops" proposed through this project will enforce Goal 2 "Achieve universal primary education" among children and adult women and men as to create long-term benefits to the indigenous communities.

The conservation of agricultural biodiversity is an international compromise since the Convention on Biological Diversity. International consensus has stated the importance of seed storage in germplasm banks that should be complemented with *in situ* conservation. Guatemala, as one of the signing parties of the International Treaty on Plant Genetic Resources for Food and Agriculture (2001) has been nominated as a country where the genetic erosion of maize is severe (Steinberg and Taylor 2002). However, the assessment of maize biodiversity loss in Guatemala has not been done with the intensity and detail required and can still is of a preliminary character (Etten, 2006). To focus on policy decisions, more insight into the severity of genetic erosion in and its causes is necessary both for Los Altos and Los Cuchumantanes.

The evaluation of threats affecting milpa viability by focusing on the traditional knowledge that sustains biological diversity among the Maya will contribute to have a more precise picture of the future of this ingenious agricultural heritage system. Some efforts by the Smithsonian Institute have enforced shade grown coffee for its key role in the conservation of migratory birds both in the highlands of Huehuetenango and Chiapas. **This project is an opportunity to complement this conservation initiative by strengthening the region's primary food source and an economic activity that**

compromises the majority of the households at both sites. In this sense, another factor needs to be mentioned. International conservation efforts have focused on the preservation of the natural heritage of the tropical forests through the Maya Biosphere Reserve in Guatemala, Belize and Mexico. **The Mayan culture is also alive in the marginal highlands of Chiapas and Huehuetenango**, reason for which both sites are proposed as a trans-frontier Cultural Landscape, as to enforce the preservation of the Mayan biological corridor.

Based on the Operational Guidelines of the Convention for the Protection of the World Heritage, the Maize Agricultural Landscape is of adequate criteria to be included in the cultural landscape category[5], which is one of our objectives. The sites here proposed, constitute a tangible and living evidence of the encounter between human and nature. It is a singular material evidence of how societies –*los hijos del maíz*- have used, transformed and conserved their natural surroundings. **Cultural Landscapes in Latin America are intimately linked to sustainability, development and identity. They represent not only achievements of the past but also real possibilities for the sustainable development of the indigenous communities of today** (Mujica 2003).

Like other crops in their cradles of domestication and evolution, genetic diversity of maize in Mesoamerica is faced with an uncertain future. The loss of genetic variability, long-term evolution and diversity is problematic because it represents genetic erosion of valuable traits in ancient genetic pools, but most importantly because it threats a millenary and still existing agricultural system. **This project is a challenge for bi-national cooperation in one hand, and concerns international cooperation on the other. To lose a variety of maize in Mexico or Guatemala is to lose it throughout the planet.**

6. Outline of activities during the project

This project will have an interdisciplinary approach based in several scientific fields such as biology, agronomy, anthropology and history, encompassing tangible and intangible values of maize culture. Two site-specific regions with dominance of traditional varieties of maize, Los Altos of Chiapas (Mexico) and Los Cuchumantanes of Huehuetenango (Guatemala), have been chosen. This work could be replicated in other Mesoamerican sites. Mam, Awacateko, Q'anjob'al, Tzeltal and Tzotzil farmer

[5] According to the Convention, it is of adequate criteria following articles 1, 7, 9, and 10 (ii), (iii).

communities will benefit from this project. This proposal is built upon three pillars: research work, implementation of conservation programs and community activities, which will be executed through already existing networks.

Workplan

Objective 1: Pursue scientific research on maize and milpa conservation in farmers' fields to have a more precise picture of the evolution and of the future of this agroecological system. Even though the remarkable continuity and adaptation of the milpa has been highlighted, threats concerning its permanence are increasing. General information on this issue has been retrieved, but local specificity is lacking for the selected areas.			
Research activities	Calendar	Activities	Expected Results
Socioeconomic study at both sites	April-June 2007	-Study of the migration's impact on the communities -Study of the impact of the armed conflicts in the milpa system -Study of remittances and their relation to the milpa system -Study of diversification of labours and salary work	Improve our knowledge of recent changes in milpa cultivation and maize varieties.
Ethnographic fieldwork at both sites	April-October 2007	-Ethnography of the maize ritual cycle -Collect information on religious conceptions concerning each type of maize -Ethnography gastronomic uses of each maize type -Publication of the gastronomic diversity of maize in the Mayan highlands of Chiapas and Huehuetenango -Collect information on	Characterization of cultural values related to the milpa agroecosystem and understanding of changes these have gone in the last decades. Understand long-term change in intraspecific crop diversity. Analyze the possibilities to propose a Maize Cultural Route.

		specific indigenous conceptual classification and know-how in seed selection criteria (c.f. methodology applied by Van Etten 2001, 2006 in Jacaltenango, Huehuetenango). -Research archaeological and historical sources to study cross-border relations -Research in germplasm banks to study changes in crop diversity -Comparative work with previous ethnographies to establish changes and permanence on maize cultural values and diversity	
Results' final analysis	Autumn 2008	-Analysis of the research data by Fuentes and Perales	Research publications in the academic sectors.
Objective 2: Support mechanisms to reduce farmer's vulnerability by enforcing local development strategies in Los Altos and Los Cuchumantanes as part of the communities' search for alternatives and as to contribute to genetic resources conservation by bridging indigenous knowledge and formal theory for conservation and sustainable use.			
Conservation programs	Calendar	Activities	Expected results
Participatory breeding	Two years	-Validation of PB methodology -Results' systematization -Diffusion and elaboration of didactic materials -Diffusion of the results -Professionals and technicians capacity training -Elaboration of	Collaborate with conservation programs destined to conserve maize agrodiversity and improve its productivity by working closely with farmers' interests in conserving genetic resources.

		local germplasm banks -Elaboration of a catalogue of local varieties -Establish one *in situ* conservation area	
Land stabilization	Two years	-Description of the maize production systems (milpa) -Characterization of the “abonera” (mulch) systems (i.e. Chamula and Santa Martha projects in collaboration with Ecosur Chiapas) -Application of hillside (“ladera”) agricultural practices -Training on soil conservation	Support and reinforce processes that permit soil conservation.
Create new markets	Last semester of the project	-Agrodiversity characterization in terms of potential uses for traditional or conventional industry. (c.f. Figueroa and Fuentes research methodology 2006). -Define two potential markets for each site (i.e. “Teopisca tostada” project for Chiapas or the “Grains of enhanced value” in Huehuetenango) to be financed. -Linkage work through new alternative markets (i.e. “green markets”, Hispanic markets in USA,	Develop linkage work in the framework of equitable commerce to promote local markets as to create economic income and contribute to poverty alleviation.

		IFOAM, Slow Food, Commission for Environmental Cooperation of North America, etc.)	
Objective 3: Realization of "New Literate" workshops based upon local issues as a parallel activity to create long-term benefits and strengthen the communities. To develop this objective, we will build upon an ongoing program by UNESCO/Education sector and AlSol (Alternativa Solidaria) NGO among Chiapaneco women, mainly Tzotzil, that has taken place since march 2005 in the framework of the "Microfinance and Literacy for Chiapas Women". Workshops will be given in three levels and include reading, writing and arithmetic courses.			
New literate workshops	Calendar	Activities	Expected Results
Preparation of didactic materials	First phase of the program concerning the preparation of didactic materials will be developed during the first semester of the project.	-Establish didactic materials themes ("The Maya", "Women textiles", "Maize and biodiversity", "The armed conflict"). -Compose and edit the contents by building upon potential partners already working on these issues (COMAR for refugees issue, Rigoberta Menchú for indigenous human rights, etc.) -Translate in indigenous languages (Mam, Awacateko, Q'anjob'al, Tzeltal and Tzotzil) -Publication of materials -Regroup professors	
Realization	The workshops will be given for 12 months in three levels	-3 workshops in a Mam, Awakateco and Q'anjob'al community -2 workshops in a Tzeltal and Tzotzil community.	Strengthen local communities according to their social and economic context. (i.e. Development Millennium Goals)

<table>
<tr><td colspan="4">Objective 4: Raise awareness regarding the universal value of maize culture by fostering cooperation among local, national and international government sectors and involving other key stakeholders.</td></tr>
<tr><td>Promotion and workshops</td><td>Calendar</td><td>Activities</td><td>Expected Results</td></tr>
<tr><td>Formal sector and indigenous knowledge fair (2)</td><td>End of first semester</td><td>-Bridge scientific and traditional knowledge in site-specific problems and challenges.</td><td rowspan="4">Promote participatory agrodiversity recognition and value among farmers.

Through these activities and experiences, a methodology to be applied to further Mesoamerican sites will be developed.</td></tr>
<tr><td>Gastronomic fair (2)</td><td>End of second semester</td><td>-Gastronomic samples from each community</td></tr>
<tr><td>Agronomic fair (2)</td><td>End of third semester</td><td>-Agrodiversity recognition and value
-Seed exchange among communities</td></tr>
<tr><td>Final regional workshop (1)</td><td>End of fourth semester</td><td>-Final workshop as a platform for sharing experiences of issues affecting local systems and local projects’ achievements.
-Information and seed exchange between Mayan communities.</td></tr>
<tr><td colspan="4">Objective 5: As the first phase in the preservation of the tangible and intangible aspects of the traditional maize agricultural system as an identity of Mesoamerica, both sites will be proposed as a trans-frontier Cultural Landscape for the World Heritage List, UNESCO. Conservation of both sites will enforce biological corridors in Mesoamerica of planetary relevance.</td></tr>
</table>

National agencies and counterparts

This project will be built upon local research programs and institutions and its main purpose is to fill areas of research that are lacking for the full implementation of conservation programs led by the two main institutions that will lead the project at both sites.

In Los Altos, Chiapas (Mexico):

a. Colegio de la Frontera Sur (Ecosur): This institution will lead the project in the area.
b. Secretaría de Pueblos Indios del Gobierno de Chiapas: The project will build upon participatory improvement programs led by this institution since 2002 and existing networks.
c. Universidad Autónoma de Chiapas: Ethnographic fieldwork will be led by local anthropologists working in the area. Students will participate in supervised field practices during the project activities to foster cooperation with the academic sector.

In Los Cuchumantanes, Huehuetenango (Guatemala):

a. Organización Integral de Desarrollo (OID): NGO, related to the implementation of development processes and technological innovation, property rights regarding vegetable species germplasm, etc. This organization will lead the project in Huehuetenango.
b. Instituto de Ciencia y Tecnología Agrícolas (ICTA): decentralized institution that as part of the Ministry of Agriculture, Cattle and Food, will act as a partner for specific implementation activities.
c. Asociación de Agricultores de la Meseta de los Cuchumatanes, Huehuetenango: Community association located in the area of study that practices subsistence agriculture. This group will participate and benefit from the project.
d. Universities and Superior Educational Centres located in the area: Students in the area will participate in supervised field practices during the project activities to foster cooperation with the academic sector.

Potential partners

Intersectoral cooperation at UNESCO: Education and Science sectors.
Local and Indigenous Knowledge Systems Intersectoral Program for Poverty Erradication (LINKS).
Microfinancing and literacy for Chiapas women program, UNESCO/Education sector/AlSol (Alternativa Solidaria, Chiapas) NGO.
Fundación Rigoberta Menchú.
Iberoamerican Intergovernmental Network (RIEJA) for youth and adult education.
UNHCR- UN Refugee Agency / SIPAZ / REDPAZ/ COMAR for armed conflicts and refugee issues.
Commission for Environmental Cooperation of North America: as a partner for linkage work to incorporate conservation initiatives as to create new market opportunities, mostly through "green markets" (i.e. Slow Food, IFOAM), and Hispanic market in USA.

Other potential co-financing partners

CONACULTA-SEP, Consejo de Ciencia y Tecnología de Chiapas, Secretarías del Gobierno de Chiapas and CONABIO (Mexico), Ministerio de Cultura, INGUAT (Guatemala): for publications of didactic materials, workshop memoirs and further publications, as well as for the proposed cultural and scientific activities.

Budget

Salaries	
1 coordinator (24 months)	$ 30 000
2 project directors (24 months)	$ 46 000
Miscellaneous costs	$ 6 000
Total	**$ 82 000**
Research activities	
2 ethnographers (7 months)	$ 14 000
2 economists (3 months)	$ 6 000
Total	**$20 000**
Agricultural Workshops	
6 workshops of 3000 each	$ 18 000
1 final workshop	$ 5 000
Total	**$ 23 000**
New literate workshops	
Didactic materials	$ 5 000
5 workshops	$ 40 000
Total	**$ 45 000**
New market financed projects	
Huehuetenango project	$ 10 000
Chiapas project	$ 10 000
Total	**$ 20 000**
Conservation Programs	
Participatory breeding	$ 30 000
Land stabilization	$ 30 000
Total	**$ 60 000**
Total project funding	**$ 250 000**

Final comment

The highlands of Chiapas and Huehuetenango are exemplary representatives of Mesoamerica's cultural and natural heritage. Mayan world vision reproduced though myths and rituals still reminds us that nature is a cognitive model to which culture should be attentive. This is a primary lesson that the international conservation community has learned through the nature and culture conservation strategy. The Maize Agricultural Landscape represented by both sites is an outstanding example of how traditional knowledge regarding natural management sustains biological diversity. Mam, Awacateko, Q'anjob'al, Tzeltal and Tzotzil peoples and the scientific community can come together to preserve a bi-national world heritage that concerns

humanity. This project is a challenge for multicultural dialogue, for Mexican and Guatemalan cooperation and for international engagement in the preservation of a Globally-important Ingenious Agricultural Heritage System to be proposed as a trans-frontier Cultural Landscape.

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