http://www.fao.org/nr/giahs/candidate-system/candidate/milpa-solar-systems/milpa-solar-detailed/en/

Globally Important Agricultural Heritage Systems (GIAHS)
Milpa-Solar Systems (Mexico) - Detailed information

Outstanding Features

The traditional Mesoamerican farming system is referred to as ***milpa*** –defined as a field that is intercropped with three principal species –maize, beans and squash (*Zea mays, Phaseolus* spp*., and Cucurbita* spp.), often with other minor species (e.g. *Capsicum* spp*., Lycopersicon esculentum*)– and in which edible leafy weeds, locally called *quelites,* (e.g. *Chenopodium* spp.) are tolerated and harvested. A characteristic of *campesino* (word that describes scarce-resource farmer in Latin America) culture and agriculture is the existence of an area with high diversity of animal and vegetable species located next to the family house (and most times to the *milpa*) called *solar*. Both the *milpa* and the *solar* form the *milpa-solar* system.

The ***solar***, a type of homegarden, is a place of enjoyment, work, experimentation and a source of goods. Studies indicate the historic importance of the *solares*. They were a place for intensive work with irrigation and high productivity. Some of the plants grown in *solares* from highland areas include: amaranthus, beans, squash, chilli and medicinal and edible leafy weeds. In the lowland regions of central and southern Mexico the early gardens were mainly used for the production of cocoa, but nowadays in communities like Zongolica in the state of Veracruz, (ash, cutting and burning cultivation system) people cultivate several types of maize, broad beans (*Vicia faba*), peas (*Pisum sativum*), bananas (*Musa* spp.), avocado (*Persea* spp.), oats (*Avena fatua*), barley (*Ordeum vulgare*), potatoes (*Solanum* spp.), squash (*Cucurbita* spp.), mammee (*Mammea* sp.), coffee (*Coffea* sp.), beans (*Phaseoulus* spp.) and vanilla (*Vanilla planifolia*). The *milpa-solar* system was modified with the arrival of the Spaniards, who introduced new plant species, domestic animals (chicken, pigs, sheep and cattle) and tools.

Numerous social and biological elements of maize's crop evolutionary system are still present in the contemporary *milpa-solar.* Social elements include farmer selection and exchange of seed, post-harvest selection, intercropping of various species, movement of seed lots among fields according to field rotation and fallow cycles and production for home consumption (mostly subsistence). *Campesinos* pray and give thanks to God for their homegardens as their *solares* are a resource to make a living and part of peoples' identity.

Biological elements include gene flow from crop relatives such as *teosinte* and wild bean and squash relatives, and agro-climatic heterogeneity, and crops adaptation to different micro-climates.

Besides indigenous species, *campesinos* readily introduced temperate species into their cropping patterns, and which has enabled them to overcome some of the limitations of farming at high altitudes and low temperatures. Over time the *campesinos* have developed local landraces of these temperate crops.

Livestock serves as a savings system, is a source of cheap-high quality protein (e.g. poultry, eggs, milk), a valuable source of manure for crop production and a constant source of cash through the daily sale of milk. Cattle feeding is based on maize crop residues and associated plants such as weeds. The use of weeds as forage for livestock reduces the use of herbicides and transforms products of relatively low value into good quality protein. Furthermore, recent work by Castelán *et al*., (2002)[*)] suggest that some weed species like *Drymaria laxiflora* Benth promote favourable rumen conditions for an efficient fermentation of forages, reducing thus the emission of CO2 and methane –two of the most important green house effect gases produced by modern ruminant production systems.

Goods and Services Provided

The main advantages of the *milpa-solar* system compared to maize monoculture, are high production of rich and diverse food crops from small areas (less than 2 ha.), greater availability and variety of food, and better nutritional status of the household members, improved soil fertility through the use of legumes and manure, increased cash income through the sale of surplus food, efficient use of natural resources, nutrient recycling, sustainable and environmentally friendly livestock production and preservation and enhancement of biodiversity.

The *milpa-solar* system offers vital environmental services; it is the world's reservoir of maize genes including *Teosinte,* the ancient relative of maize. The reintroduction and preservation of the *milp-solara* system has the potential to revert the land degradation process that took place where maize monoculture is practiced and promote a model system that is more sustainable and environmentally friendly. Other environmental services of the predominately rain-fed *milpa-solar* system include: reduction of flood risk, improvement of water quality, soil conservation, erosion control and climate control.

Threats and Challenges

At **national level** the most important threat to the existence of the *milpa-solar* system comes from the active promotion of the Mexican government of policies to stimulate maize mono-culture, a policy followed during the last thirty years.

- Promotion of maize monoculture was backed by the introduction of green revolution technologies, such as the use of chemical fertilizers, herbicides and the use of "improved" maize varieties. Currently the scarce subsidies for agriculture (PROCAMPO) are conditioned to farmers who cultivate maize monoculture.
- Excessive use of chemical fertilizers has led to soil acidification, contamination of subsoil water, and increased production cost
- Herbicides use was incompatible with the *milpa* cultivation system, beans and squash land races were the most affected and some have disappeared or are difficult to find seeds of
- Herbicides kill edible weeds
- Pesticides kill edible insects such as the maguey worm, fish and river shrimps once very abundant

At **local level** the effects of maize monoculture on human well-being were dramatic; low maize yields, increased cost of production, low revenues, reduction in the maize price, reduction in subsidies and loss of crop biodiversity, all together increased poverty in rural areas Of the 12 million indigenous people in rural Mexico, 93% are estimated to live in poverty. When farmers moved from a very diverse, rich and nutritionally balanced diet provided by the *milpa-solar* system, under nutrition became endemic in most Mesoamerican regions, the new diet is mostly based on maize and junk food. Other problems include

- cultivation technologies developed for other parts of the world (usually developed countries) were imposed on *campesino* farmers with disastrous consequences, risk levels increased due to the use of only one crop of maize varieties that are poorly adapted to smallholder farmers conditions, the *Plan Puebla* is a good example of this.
- food security was seriously affected
- crop yield reduction associated to less crop diversity also led to less food products that could be sold to complement household income,

- men had to emigrate in search for off-farm work, and perhaps most importantly millions of rural Mexicans had to emigrate to the United States in search for better living conditions, rural communities are left behind inhabited by women, children and old people, who now are in charge of cultivating the land.

Changes to the *milpa-solar* system and the shift towards part-time farming as farm families are pressured to earn off-farm income, provoke loss of knowledge about traditional technology and about the usefulness of plants and varieties associated with this cropping system.

At **global level** the *milpa-solar* system is threatened by the introduction of transgenic maize. Mexico is not self sufficient in maize production so it has to import large amount of maize from the USA (sometimes beyond the needs).

Policy and Development Relevance

The *milpa-solar* system offers a system model with great possibilities of replication in other parts of the world with similar conditions.

A lesson for governments can be drawn from the *milpa-solar* system where new technologies and policies have to be based on a deep knowledge of current farming systems and the benefits they provide at local, national and global levels. Agroclimatic and socio-economic heterogeneity, prevailing in developing countries, require technology to be highly tailored to local conditions if it is to be useful. This requires taking advantage of local crop adaptation conferred by native landraces.

The overall lesson drawn from the *milpa-solar* system is that only if locally adapted technologies can be developed, will these farmers have the incentive to continue farming, and only then will the crop genetic diversity residing in landrace varieties remain available in the future, to ensure continued productivity of the food crops upon which we all depend. It is necessary to develop and to establish the legal and policy environments and instruments which are conducive to the continued functioning and preserving of agricultural heritage systems and the wide use and adoption of sustainable agricultural practices.

Global Importance

The *milpa-solar* system is the world's reservoir of maize genes including *Teosinte,* the ancient relative of maize. Mexico has both the world's greatest amount of racial diversity and allelic diversity among races, a world's heritage preserved through centuries by *campesino* farmers in the *milpa-solar* system. Preservation of this system ensures future maize improvement programs and guarantees food supply for a large proportion of the world's population for whom maize is staple food.

Native beans and squash relatives are endangered species, and represent a very important source of genetic diversity for both crops. The *milpa-solar* system has preserved this valuable genetic resource for the world.

*) Castelán O., González C., Arriaga J.C., Estrada J., Flores S. Albarran B. & Chávez C (2002). Development of Sustainable Models of Campesino Agrodiversity Management in the Highlands of the State of Mexico and Michoacán-Final Report. PEOPLE, LAND MANAGEMENT AND ENVIRONMENTAL CHANGE Project (UNU / PLEC). Toluca, México.