

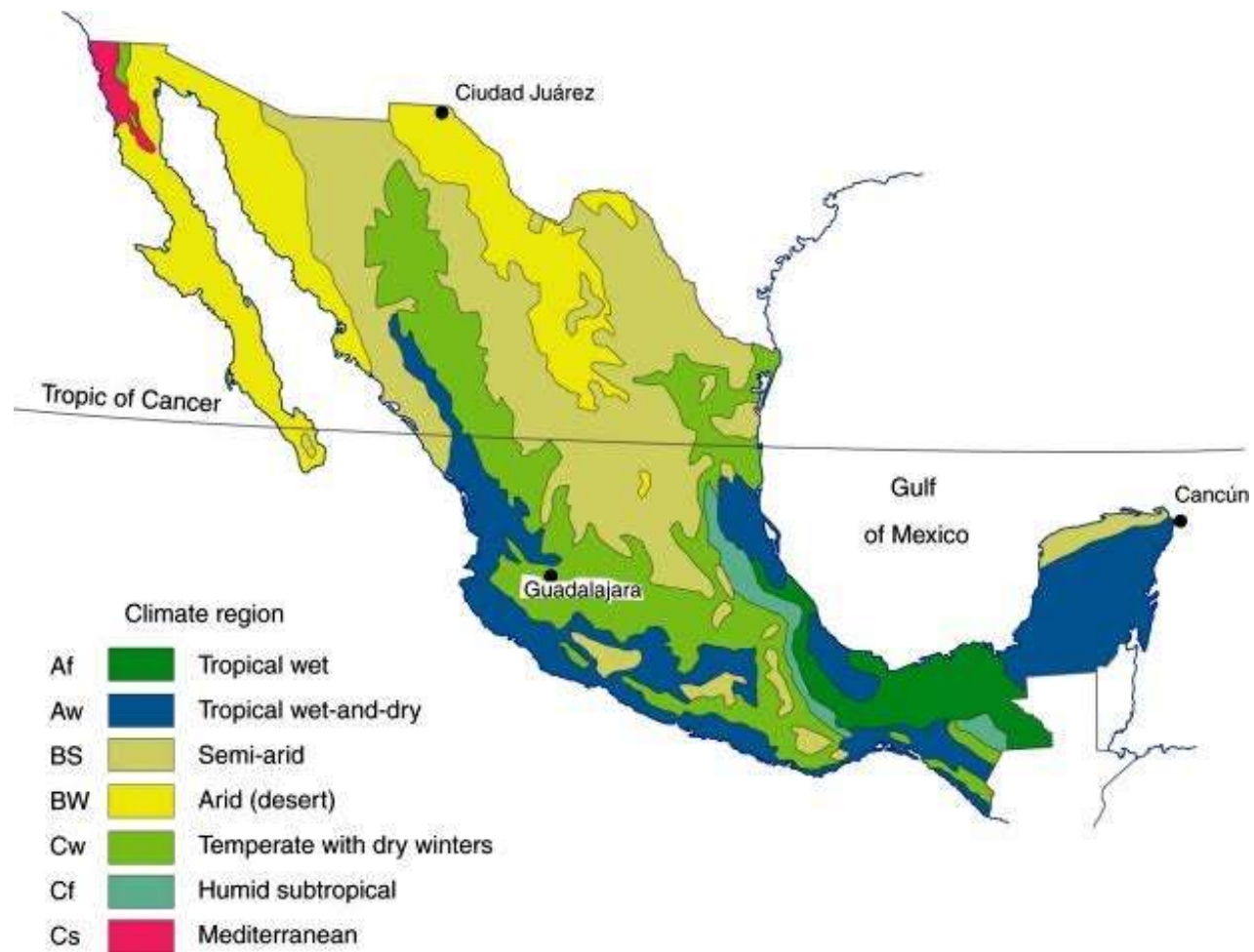
Silviculture in Mexico

Ryan Murrin



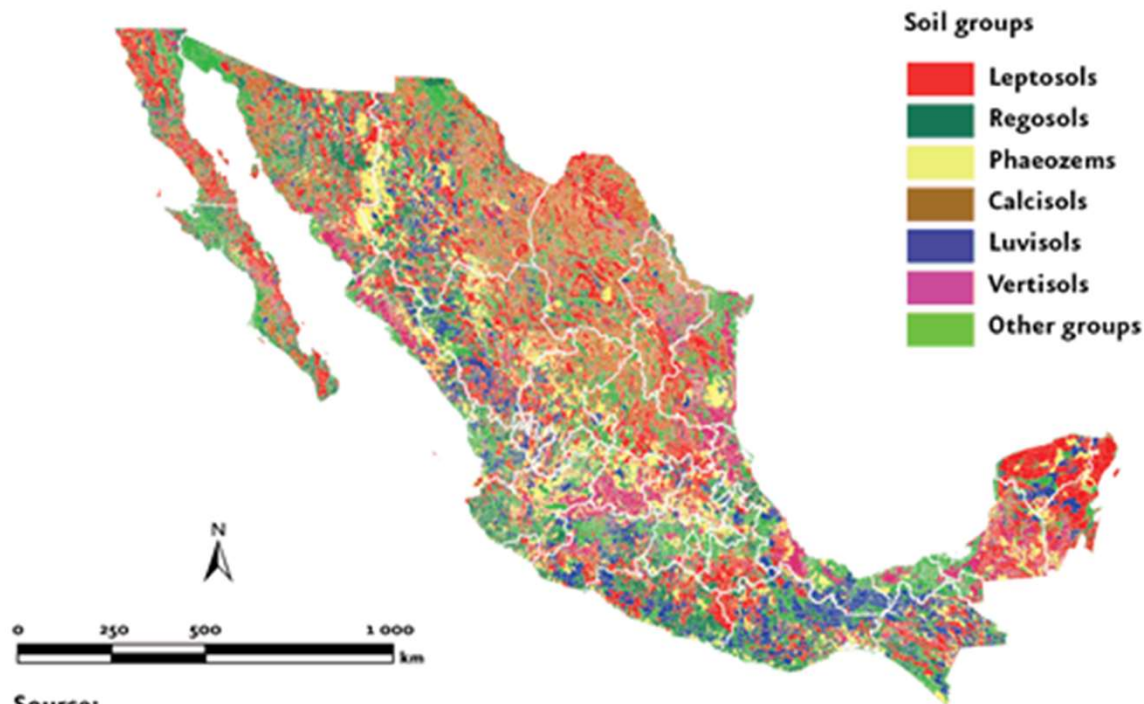






Map 3.1

Major soil groups in Mexico, 2007

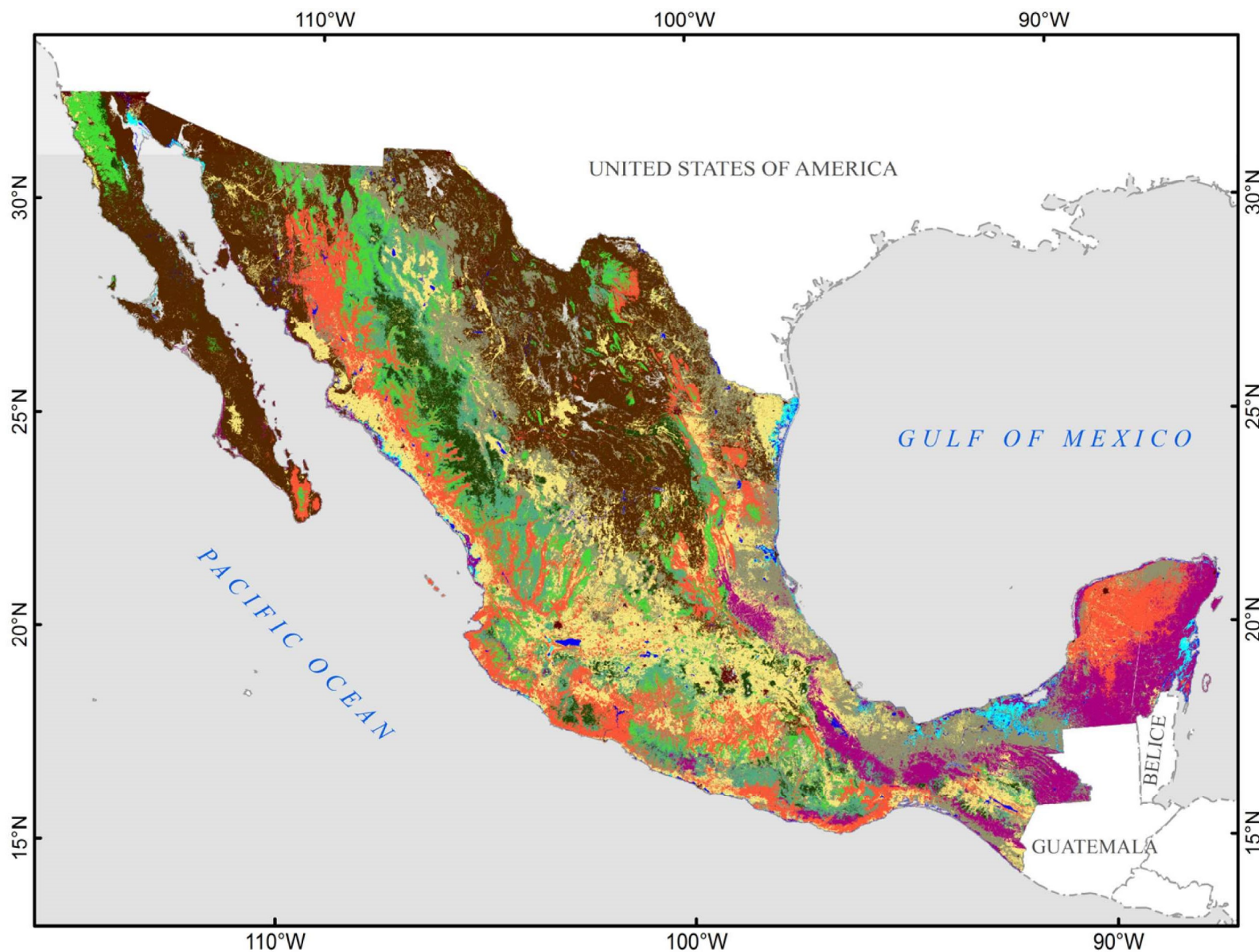
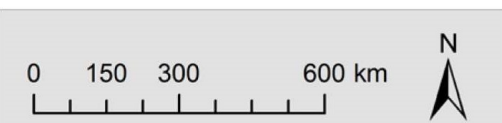
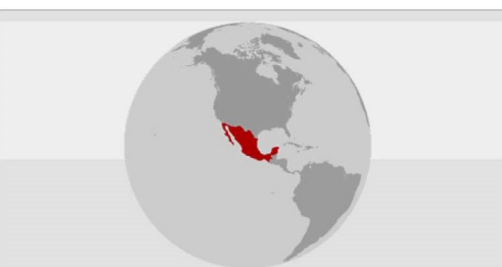


Source:

Data source:

INEGI. Conjunto de Datos Vectorial Edafológico, Escala 1:250 000, Serie II (Continuo Nacional). México. 2007.

- Leptosols
 - Thin, weakly developed, hard rock close to surface
- Regosols
 - Weakly developed, lack significant horizon differentiation
- Phaeozems
 - High OM, high base saturation, dark color
- Calcisols
 - Accumulation of CaCO_3
- Luvisols
 - Downward movement & accumulation of clay
- Vertisols



Natural Disturbance Regime

- Hurricanes/tropical storms
 - Seasonal storms impact gulf coast, shapes tropical forests
- Wildfires
 - Temperate pine-oak forests experience periodic surface fires & high intensity fires
- Pests & diseases
 - Native insect/ pathogen outbreaks
- Flooding/drought cycle
 - Wet/dry season regulates hydrology



Pest & Diseases

- Pine bark beetle/ Ips beetle
 - Most destructive pest in Mexico's forest
 - *Dendroctonus mexicanus*, *D. frontalis*, and *Ips* wood borers
- Mistletoe
 - Dwarf & leafy mistletoe
 - Weakens host, makes them more susceptible to secondary attacks
- Defoliators
 - Various members of the Lepidoptera family target canopy structure



National Tree of Mexico

- Known as the ahuehuete or Montezuma cypress (*Taxodium mucronatum*)
- Ahuehuete translates to “old man of the water”
 - Native language
- Thrives near rivers and in riparian areas



El Árbol del Tule

- Located on church grounds in the city of Santa Maria del Tule
- DBH of 14.05 meters (around 46 feet)
- Around 116 feet tall





Species Composition- Pine

- Mexico has the most pine species of any country in the world
 - 46 native species
- **Montezuma Pine** (*Pinus montezumae*)
 - Dominant & tall pine tree (timber tree, similar function to lob)
- **Hartweg's Pine** (*Pinus hartwegii*)
 - Forms some of the highest tree lines in the world
- **Mexican White Pine** (*Pinus ayacahuite*)
 - Thrives in highlands





Mexican white pine



Hartweg's pine



Montezuma pine

Species Composition- Oak

- Over 140 oak species present in mountain ranges
- **Netleaf oak** (*Quercus rugosa*)
 - Widespread evergreen white oak found at high elevations
- **Mexican white oak** (*Quercus polymorpha*)
 - Native to central & NE Mexico, has smooth grey colored bark
- **Mexican red oak** (*Quercus castanea*)
 - Common in mountain pine-oak forests





Mexican red oak



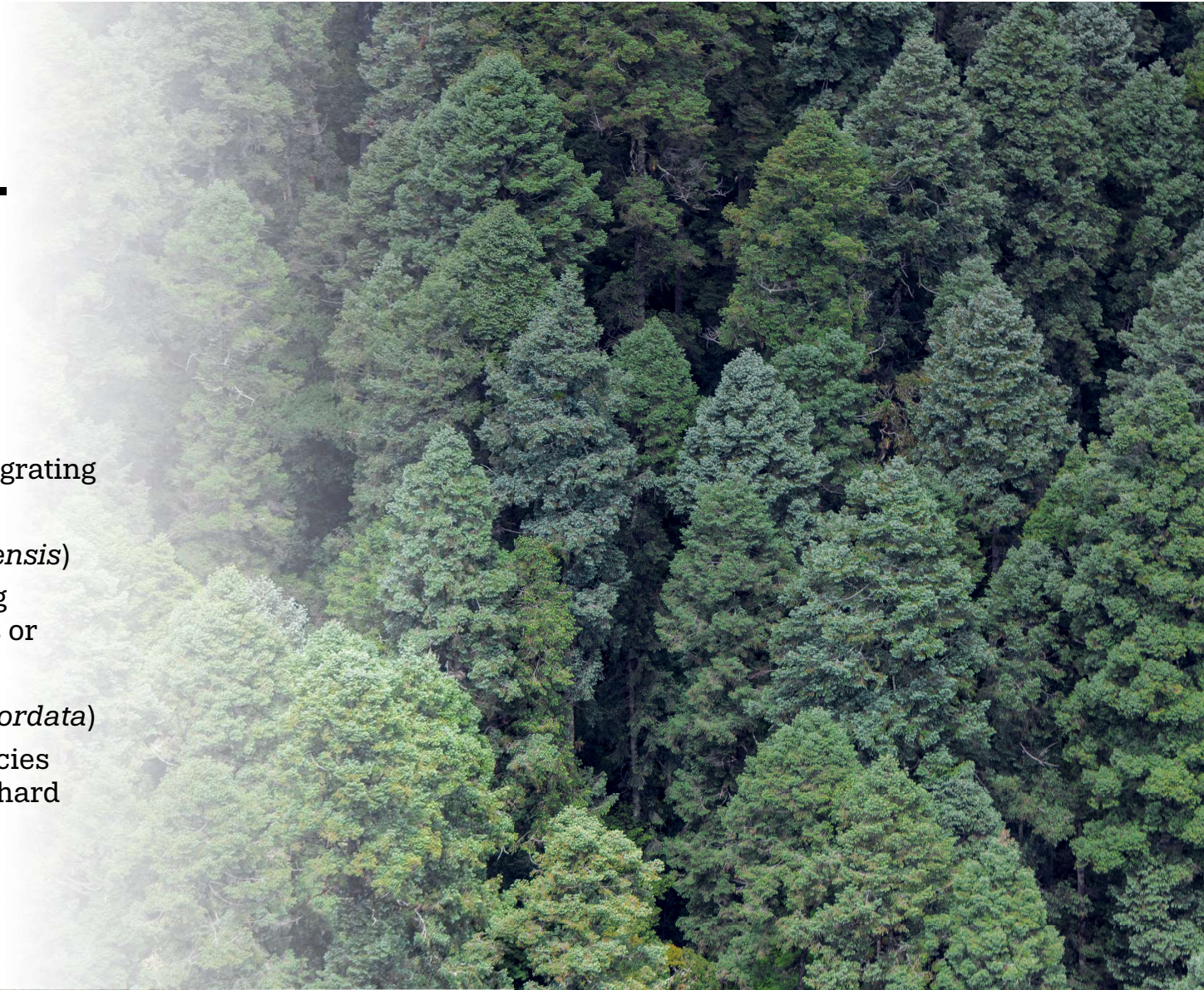
Mexican white oak



Netleaf oak

Species Composition- Other

- **Oyamel fir** (*Abies religiosa*)
 - Exclusive habitat for migrating monarch butterflies
- **Mexican alder** (*Alnus jorullensis*)
 - Typically found growing around pines in ravines or riparian areas
- **Tepozán blanco** (*Buddleja cordata*)
 - Early-successional species that prefers to grow on hard edges





Comisión Nacional Forestal (CONAFOR)

- Created on April 4, 2001
- Under the Secretariat of the Environment and Natural Resources
- Develop, support, and promote the the conservation, restoration, and sustainable development of Mexico's forests
- Operates cost-share programs for conservation





Illegal Logging

- Has become a serious issue in recent years
- Stolen timber accounts for around 50% of all timber circulating the market
 - Estimated that a 10-person crew can clear up to 250 trees in a night
- 95% of all deforestation in Mexico occurs illegally
- Occurs mainly in Chihuahua, Michoacán, and Jalisco
- Has transformed into a highly violent and organized crime community
 - Has become highly profitable for the Sinaloa & Juárez cartels

Temperate Pine-Oak Silviculture

- Communities harvest pine and oak using “selective cutting” and sustained-yield management
- Use two main methods MMOBI & MDS
- Differing levels of shade tolerance cause issues during regeneration



Temperate Pine-Oak Silviculture

- Chihuahua, Durango, Michoacán, and Oaxaca
 - This region produces the vast majority of Mexico's timber
- Local ejidos often run the logging operations
 - Ejido: an area of communal land used mainly for agriculture, community/government makes decisions on land management



Método Mexicano de Ordenación de Bosques Irregulares (MMOBI)

- Mexican Method of Irregular Forest Management
- Uneven-aged management system
- Based on natural regeneration and gap dynamics
 - Tree falls and creates a gap in the canopy



Método Mexicano de Ordenación de Bosques Irregulares (MMOBI)

- Individual trees or small groups for harvest (single tree selection/ group selection)
- Main goal is to maintain a balanced diameter class distribution across stands
- Allows the original vertical structure with diverse regeneration



Método de Desarrollo Silvícola (MDS)

- Silvicultural Development Method
- Even-aged management system
 - Very similar to our seed-tree system
- Main goal is to make stand age-classes uniform



Método de Desarrollo Silvícola (MDS)

- Main goal is to leave a few high-value pines after first cut
- Used in higher productivity areas for timber
- Preparatory, seed, and removal cuts
 - Sparse overstory protects the seedlings



Tropical Hardwood Silviculture

- Foresters maintain natural tropical forests for high-value species such as big-leaf mahogany (*Swietenia macrophylla*) & tropical cedar (*Cedrela odorata*)
 - Tropical cedar not a true cedar, technically in the mahogany family
 - Secondary hardwoods such as chechén (*Metopium brownei*) & chacá (*Bursera simaruba*) are also managed for





Tropical Hardwood Silviculture

- Controlled canopy clearings to improve mahogany seedling growth
- Harvesting timber and then relying on natural regeneration
- Yucatán peninsula, Quintana Roo, and Campeche



Tropical Hardwood Silviculture

- Commercial-size tropical hardwood stands very rare
- Traditional logging only creates small canopy openings
- Desirable species often occur in tight, localized clumps
 - Often embedded within 100s of non-desirable species



Tropical Hardwood Silviculture

- Historically these species would regenerate via natural disasters (large disturbances)
 - Aim to “mimic” these disturbances by establishing 5000 sq meter clearings
- Mexican forestry regulations mandate replanting in harvested areas, as well as enforcing diameter limit restrictions on loggers



Milpa Intercalada con Árboles Frutales (MIAF)

- Milpa Interspersed with Fruit Trees
- Milpa: the “three sisters” corn, beans, and squash grown together
- Organized rows of fruiting trees with milpa underneath
 - Citrus, peach, avocado

..., Mexico Jan 2020



Milpa Intercalada con Árboles Frutales (MIAF)

- Each February seeds are collected from mature trees and planted in nurseries
 - Seedlings are then planted on harvested land
- Central, south, and SE Mexico
 - Mostly in the mountainous hillsides
- Trees and crops provide resilience to drought in the area
 - Improves rainwater interception and reduce downslope erosion

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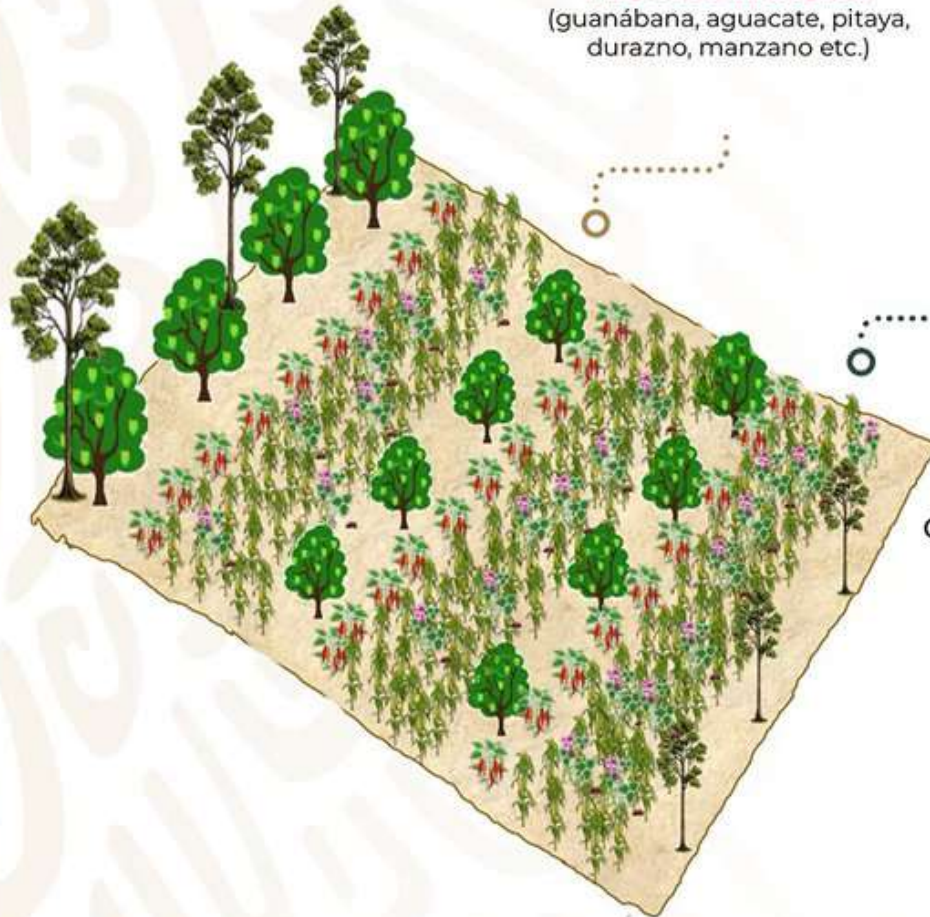




(Sistemas Agroforestales)

Árboles frutales

(guanábana, aguacate, pitaya, durazno, manzano etc.)



Se instrumentará la producción de maíz y frijol bajo el sistema **MIAF**. Este sistema contribuirá con la **seguridad alimentaria a corto plazo**.

Milpa

Cultivos de autoconsumo (maíz, frijol, calabaza, avena, ajonjolí, trigo, arroz, etc.)



Silvopastures

- Northern and interior regions extremely arid, need forage for livestock when grasses die off
- Farmers manage natural stands of mesquite (*Prosopis* spp.) & huisache (*Vachellia farnesiana*) due to their nitrogen fixing capabilities
 - Pods act as forage for livestock
- Also act as “living fences”
 - Dense lines of living trees that act as both fences and windbreaks



Chewing Gum & Forest Protection

- Sapodilla tree (*Manilkara zapota*)
- Rainforests of Chiapas and southern Yucatán
- Produces a milky-white latex sap, called chicle
- First harvested by Mayan and Incan civilizations
 - Used to clean teeth and fight starvation
- Late 19th century became the base for chewing gum
 - Shifted to synthetic products in the late 20th century



Chewing Gum & Forest Protection

- Recently many manufactures have shifted to using a natural base for chewing gum
- “Tappers” are known as chicleros
- Use machetes to make zig-zag cuts in the bark
 - Use ropes to climb
- Sap slowly runs down trunk into collection bags
 - Tree will “bleed” for around 20 hours
- Chicleros wait 3-4 years before tapping a tree again





Chewing Gum & Forest Protection

- Highly unique non-timber silviculture
- Millions of acres of diverse rainforest are protected because the trees must stay alive to yield chicle
 - Communities protect these forests from deforestation
- In this case, high value forest management does not require any timber harvests





Conclusion

- Silviculture in Mexico is both similar and completely different than silviculture in the southern U.S.
- Majority (70-80%) of land is communally owned
 - Complex communal property rights



Conclusion

- Majority of timber is illegally harvested
 - Foresters who attempt to stand up to cartels are intimidated or killed
- Recent severe budget cuts to National Forestry Commission
- This makes any kind of silvicultural management very complex and difficult





Thank You for Your Time

Questions?