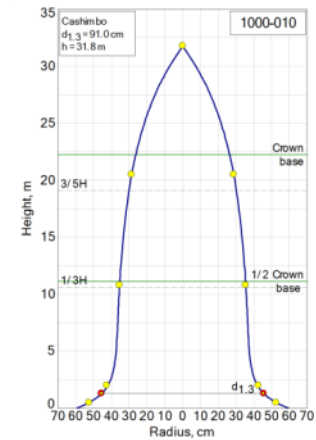
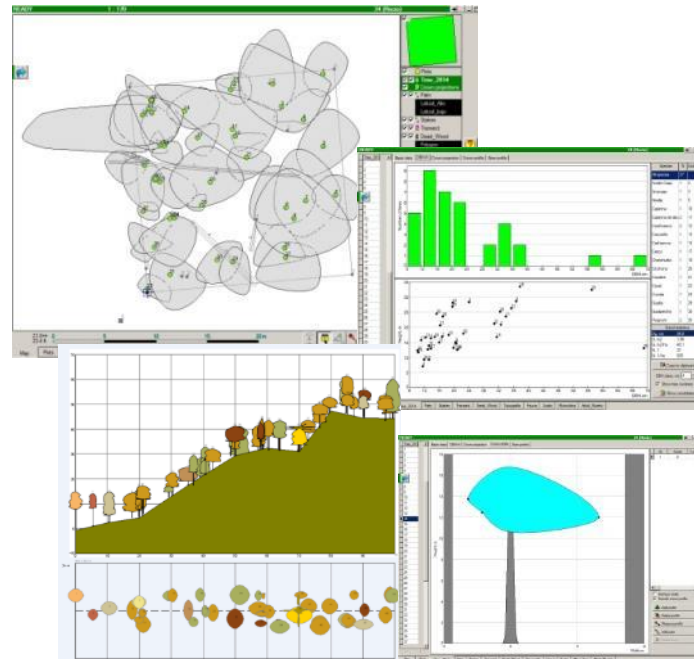


Permanent Monitoring Plots in productive systems: Forest, agroforestry, and agrosilvopastoral

Peru, México and Bolivia



Installation of Permanent Monitoring Plots (PPM) for the quantification of ecosystem services



Location of the permanent monitoring plots

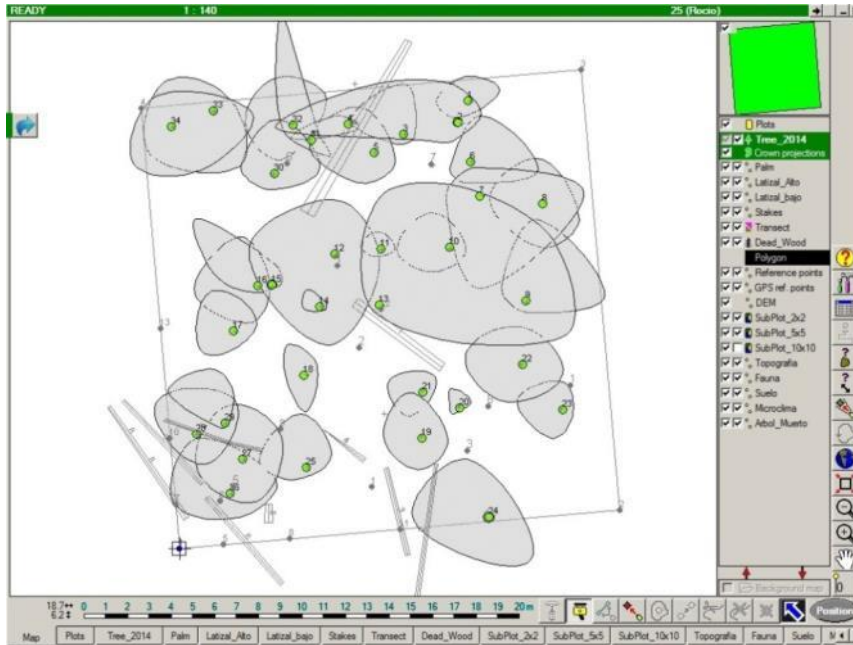


Region of Huánuco, Central Mountainous Rainforest in the forest reserve of the University of Tingo Maria, Bosque de Brunas: PMP in different forest types with ecosystem approach, monitoring since July 2014.

GITEC supported in the installation and development of the conceptual framework (ecosystem services, sustainable development and connectivity of habitats).



Database, measurement and evaluation



1. Stem profile
2. Crown projections
3. Crown profile
4. Branches
5. Tree inclination
6. Transects
7. Dead wood
8. Stumps
9. Ecologic variables
10. Topography, profiles.
11. Fauna
12. Soil
13. Microclima
14. Regeneration
15. Lianas
16. Medicinal plants



Results in the field



Precise location of the trees



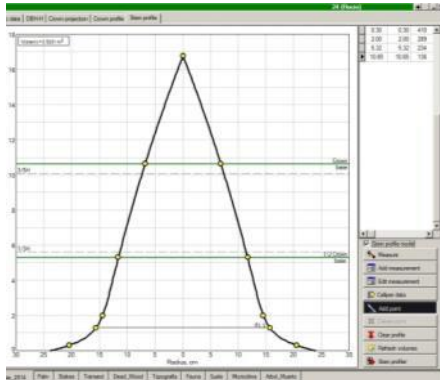
Precise heights



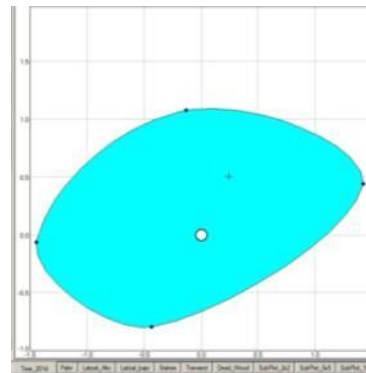
Ecological variables



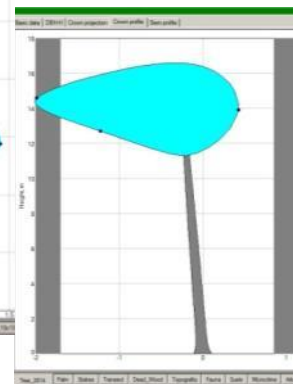
Measurement of stem profile



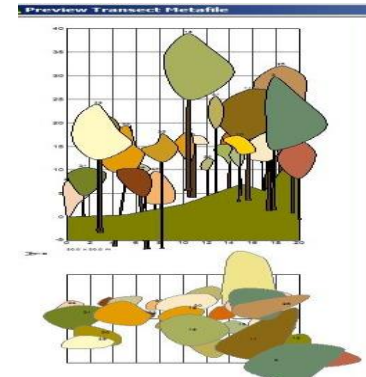
Equation of stem profile



Crown projection

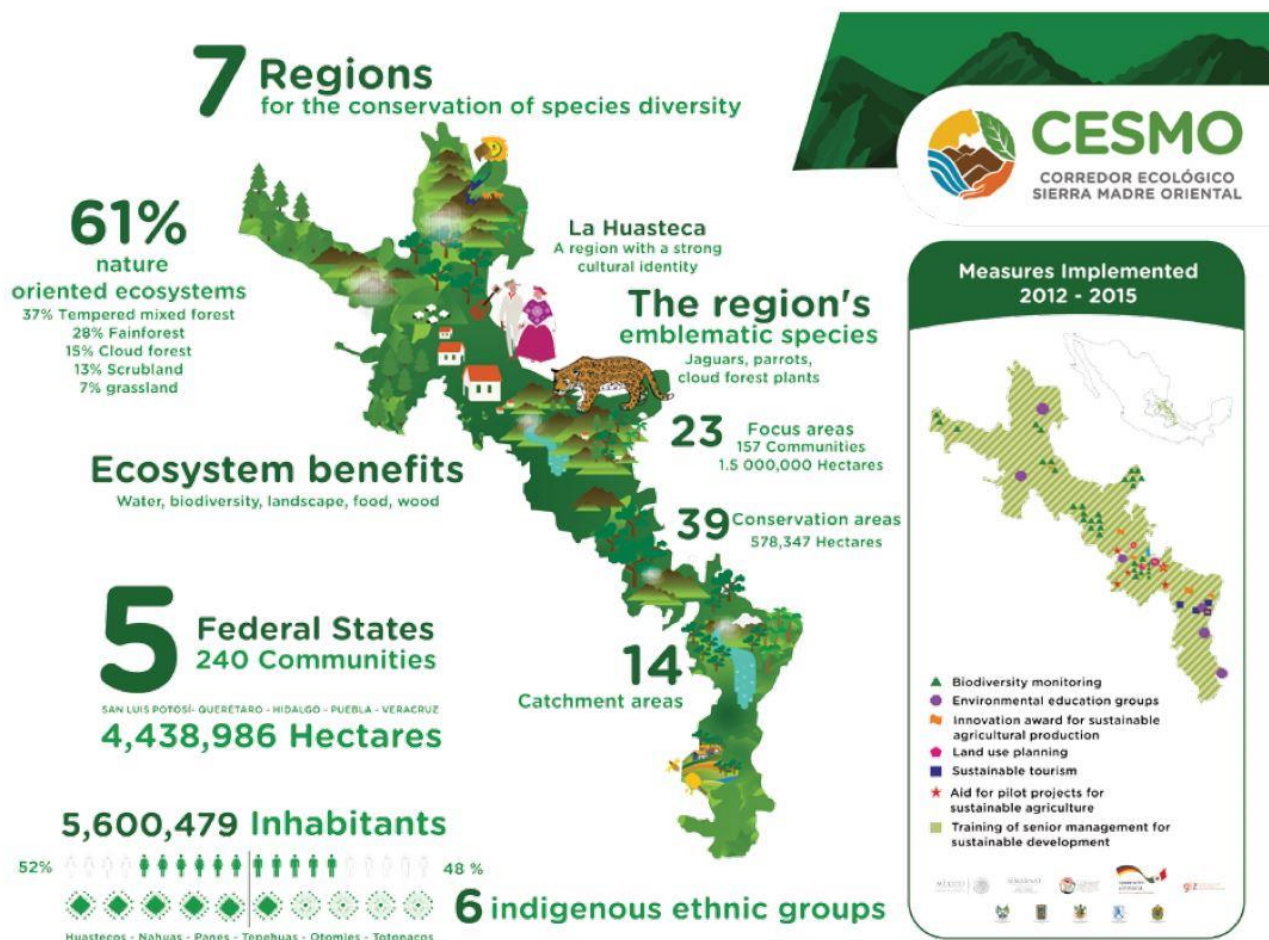


Crown profile and tree inclination



Forest structure

Permanent monitoring plots in forests, coffee and agrosilvopastoral in the Ecologic Corridor of the Sierra Madre Oriental - CESMO



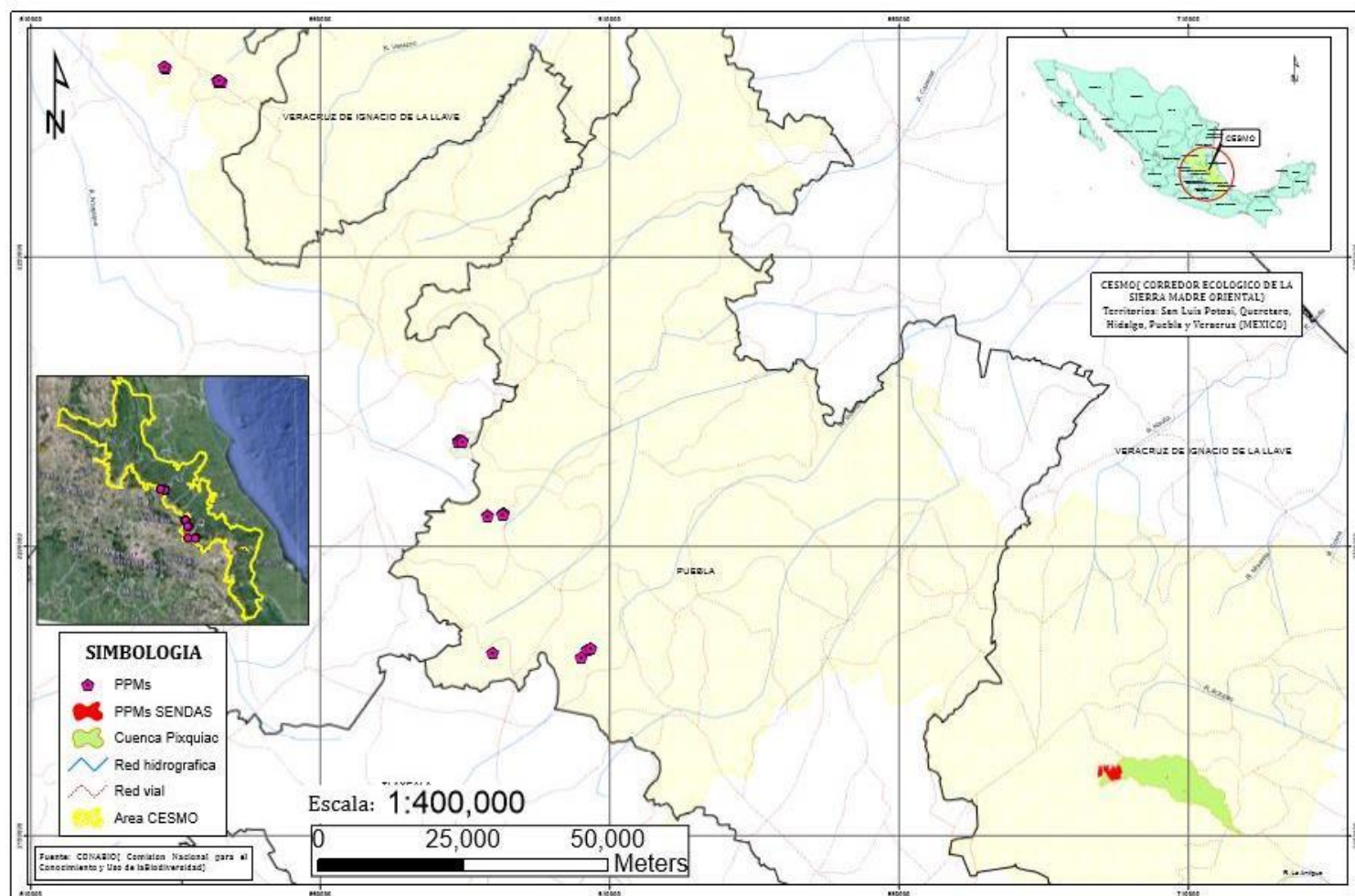
Objective of the PPM in the CESMO

Improve the productivity and sustainability of value chains in productive systems of forests, coffee and agrosilvopastoral systems with investigation and technological innovation, on the basis of the measurement of the PPM with focus on ecosystem services and best practices.

The installation of the PPM in the Ecological Corridor of the Sierra Madre Oriental (CESMO) has been an initiative of GITEC Consult GmbH for GIZ.



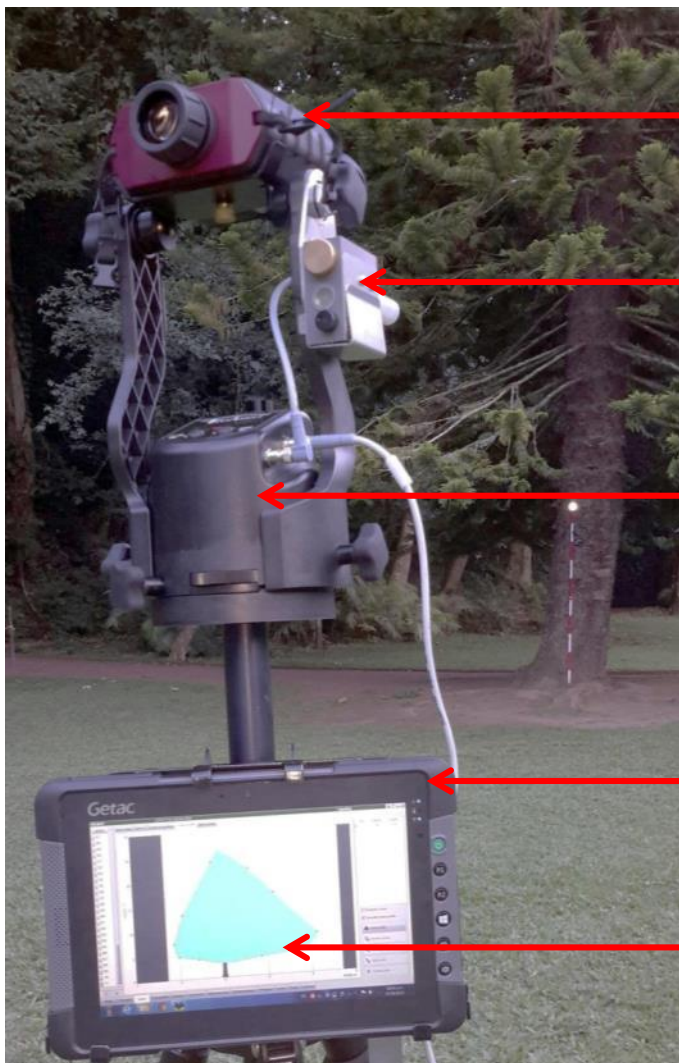
Location of the installed PMP in productive systems of coffee, agrosilvopastoral and forests



Installed permanent monitoring plots in the CESMO

	Categories	Quant. PMP	Evaluated Variables	Trained people	Location
SENDAS – Universidad Veracruzana	Conservation Forests	21	85 18	20	Basin of Pixquiac- Veracruz
SENDAS	Agrosilvopastoril	6	180	7	Private model producers in the basin of Piztquik - Veracruz
Winner of the Forest Innovation Prize in 5 EJIDOS	Productive forests	30	50 - 70	32	Producers Cooperatives in Ejidos forestales in Puebla and Hidalgo
Winner of the Agriculture Innovation Prize AGROXICOTEPEC	Coffee	8	70	7	Including Project on carbon footprint and sustainable forestry, Puebla
Technical University of Xicotepec	Coffee	1	75	2	Installation of model demonstration plots for training of producers and investigation, Puebla
Cafecol	Coffee	8	90	5	Work with coffee cooperatives in Veracruz

Hardware procured by GIZ-GITEC for the producers



Laser + electronic dendroscope +
electronic clinometer

Bluetooth

True Angle

Field Computer-
Tablet

Software Field-Map

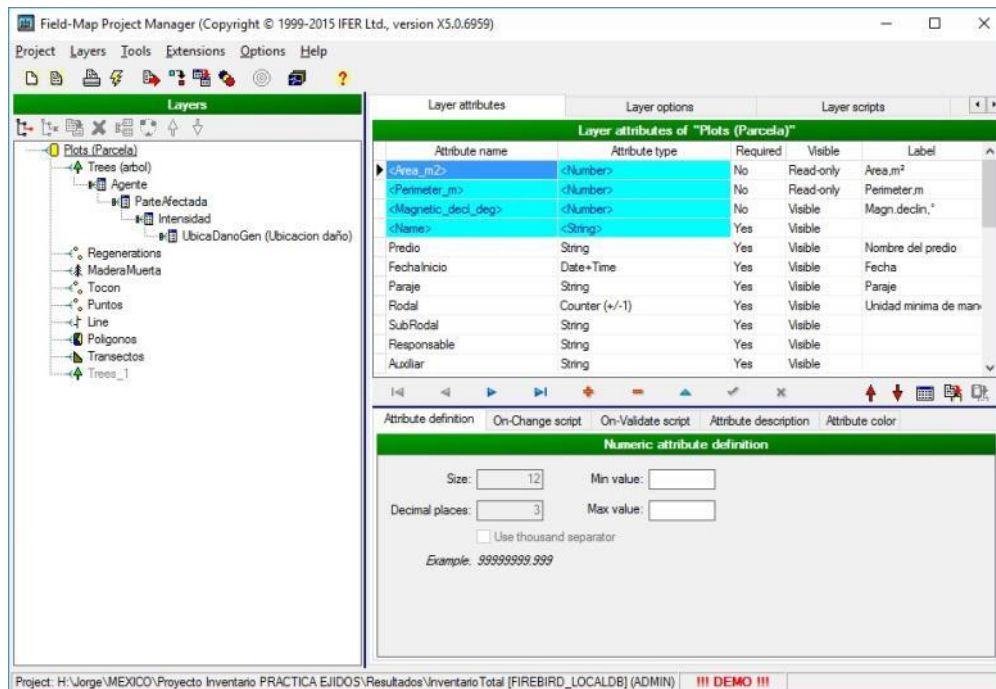
- Precision**
1. Laser: 4 cm to 1000 meter
 2. True Angle: 0.05°
 3. Electronic Clinometer: 0.1°

Installation of permanent monitoring plots for the control of activities in sustainable forestry



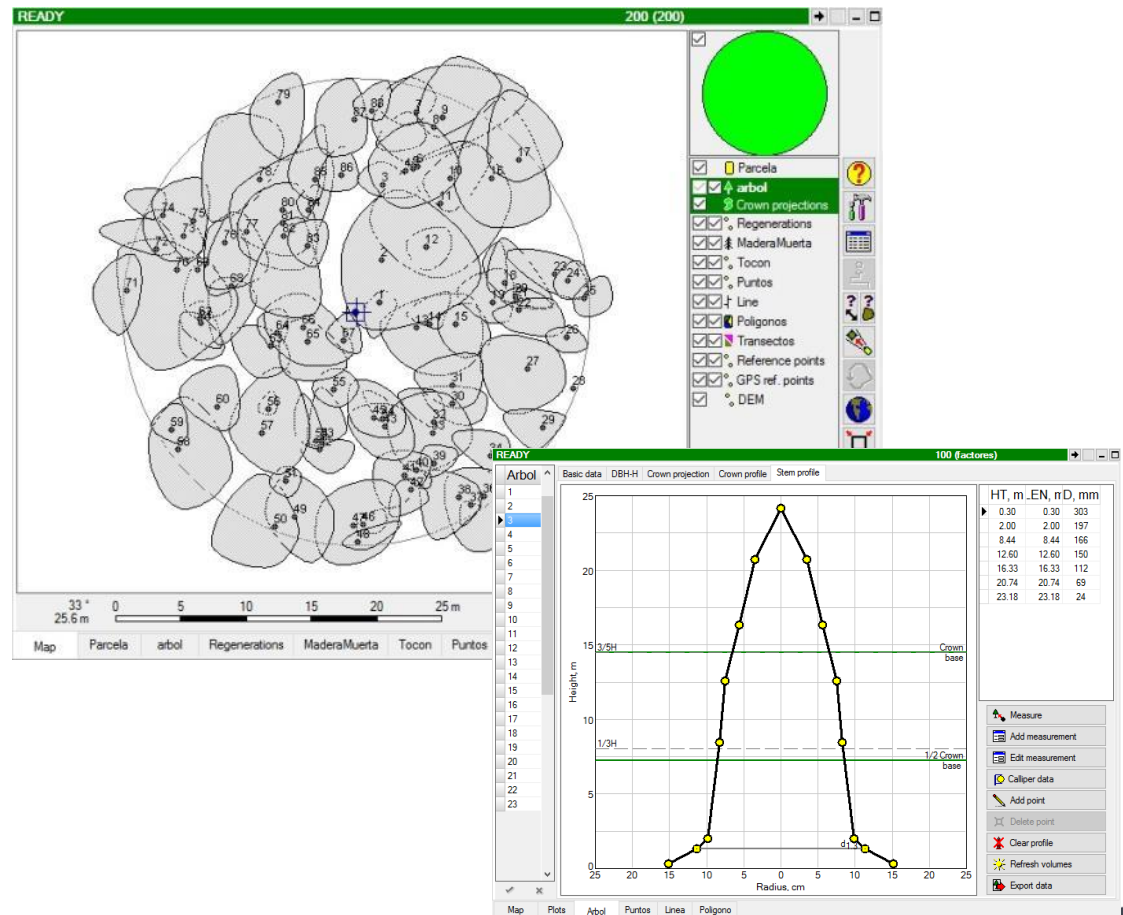
Permanent monitoring plots for sustainable forest management with the winners of the Forest Innovation Prize

- Forest producers in Ejidos (Federal State of Puebla), CONAFOR and Universities (Hidalgo)
- Number of PMP: 30
- Number of variables: between 40 and 90



Data collection in the field

- Creation of stem profiles for volume calculations
- Volume analysis in the field
- Detailed mapping of the trees



Monitoring of conservation forests



Biodiversity monitoring in conservation forests

- **Cluster for the forest monitoring**
 - University of Veracruz
 - NGO SENDAS
 - Producers of the basin of Pizquiat
- **Total quantity of PPM to be installed:**
90
- **Variables to evaluate:** + 85
- **Covered areas:** Xico, Xalapa, subbasins of río Pixquiac (more than 10k has), subbasins of Texolo and Huhueyapan.



Design, collection, processes and analysis

Parcela Circular, R=12.5 m.

Field-Map Project Manager (Copyright © 1999-2014 IFER Ltd., version X4.1.6071)

Project Layers Tools Extensions Synchronization Options Help

Layers

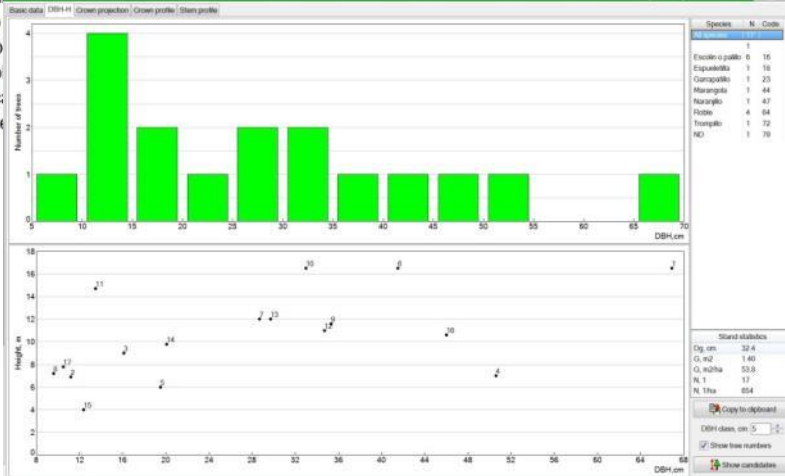
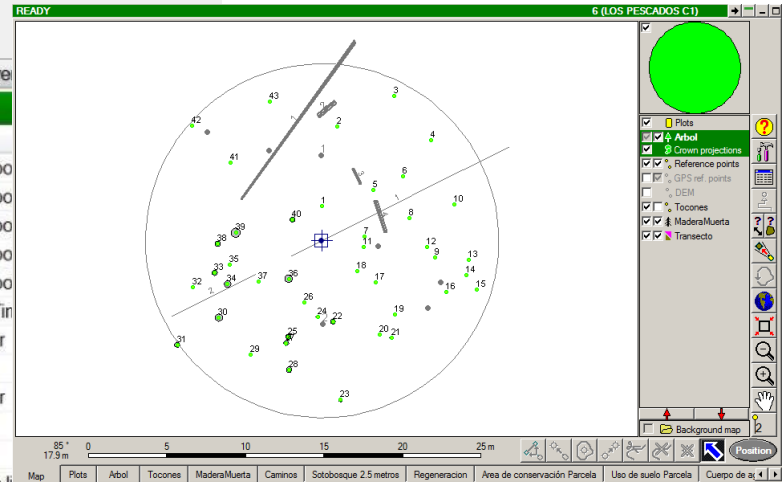
- Plots
 - Tree (Arbol)
 - Multifurcado
 - Tiposepif (Tipo de epifitas)
 - Tocones
 - MaderaMuerta
 - SotoBosque (2.5x2 SotoBsque)
 - Regeneracion (1x1 Regeneracion)
 - Tipodecobertura
 - Areadeconservacon (Area de conservación)
 - Usodesuelo (Uso de suelo Parcela)
 - Potrero
 - Reforestacion
 - Bosque
 - Agricultura
 - Tala
 - Cultivo

Layer attributes

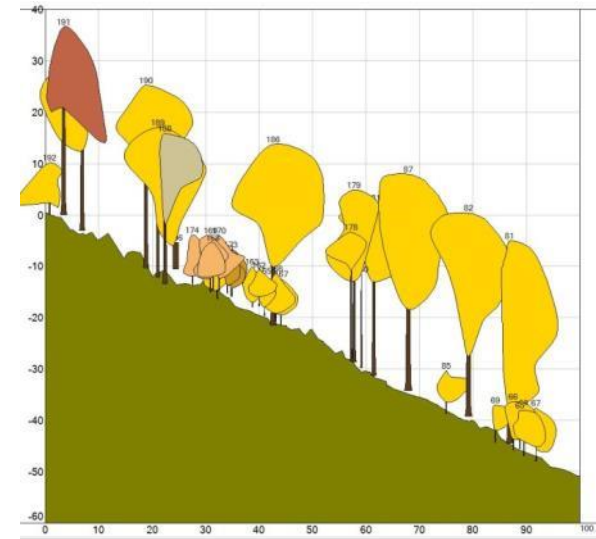
Attribute name	
NombrePropietario	Cond. loo
Municipio	Cond. loo
Tenencia	Cond. loo
SuperficieParcela	Cond. loo
Superficie de Cons	Cond. loo
Fecha	Date+Tim
Telefono	Number
Domicilio	String
Brigada	Number
Informante	String
Responsable	String
Temporada	Lookup list
GPS	Lookup list (numeric ID)
Camara	Lookup list (numeric ID)

Species

Species	N.	Code
Encino o paltán	0	16
Esqueleto	1	16
Comapalá	1	23
Mangrila	1	44
Naragila	1	47
Papel	4	64
Tronchillo	1	72
ND	1	76



- ip list (numeric ID)
- ip list (numeric ID)
- ip list (numeric ID)
- er
- er
- ip list (numeric ID)



Permanent monitoring plots in Agrosilvopastoral systems

México



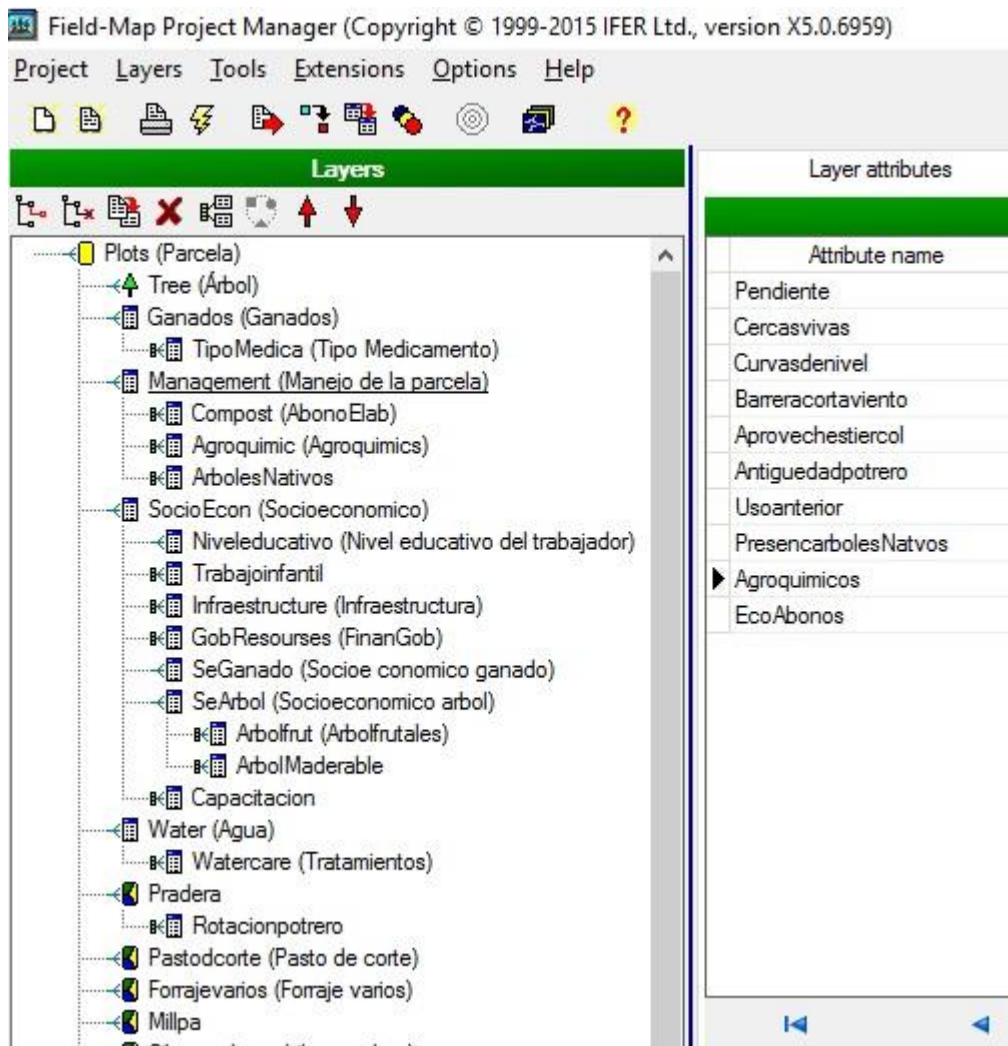
Permanent Monitoring Demonstration Estates for Agrosilvopastoral Systems

México



- Cluster for the monitoring of the **Agrosilvopastoral systems**
 - SENDAS
 - Producers
 - University of Veracruz
- **Total Quantity of PMP: 16**
- **Evaluated Variables: +180**
- **Covered area: Xico, Xalapa**, subbasins of the río Pixquiac (more than 10 k has), subbasins of Texolo and Huhueyapan.

Design of the database and validation in the field

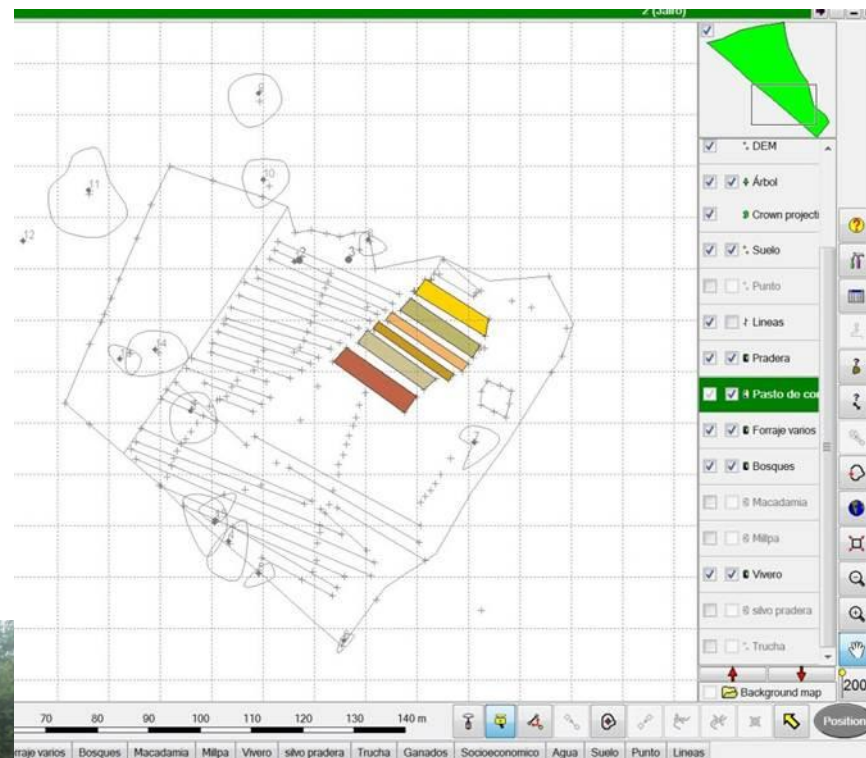


- Ecological
- Production
- **Socio economic**
- Management of the estates
- Water
- Soils



Mapping in agrosilvopastoral estates

- Topography
- Delimitation
- Mapping of infrastructure
- Zoning of paddocks
- Contour trenches
- Waterholes



Network of permanent monitoring plots in coffee



Installation of Permanent Monitoring Plots “Electronic Estates”

México

- **Cluster for the monitoring of the coffee estates**
 - Technical University of Xicotepec: Demonstrative plot for producers and students
 - Foundation Produce: 15 k producers
 - Local producers / winners of the Innovation Prize.
- **Total quantity of electronic estates: 10**
- **Number of variables: +70**



Model electronic plots for education and investigation – México

Technical University of Xicotepec

- Detailed measurement of the demonstrative plot for the productive management of coffee with the support of producers and Fundación Produce
- Generation of projects of applied investigation
- Integration of the demonstrative plot into the subject area of sustainable agriculture
- Strengthening of capacities of professors and producers



Design of database and measurement of coffee under shade

- Mapping of trees and coffee plants
- Crown projections of trees: for the management and control of shade

The screenshot displays the Field-Map Project Manager interface. The left pane shows a hierarchical project structure under 'Plots (Parcela)', including 'Tree (Arbol)' and 'Coffee'. The 'Tree (Arbol)' category lists various species like 'Usomaderable', 'Usocombustibles', 'Cactacea1', and 'Epifitas1'. The 'Coffee' category lists 'Robusta1', 'Arabica1', and 'Injerto1'. Below these are various management and control options like 'ManejoAgronomicoCafe', 'Manejodeplagas', and 'Manejodesombra'.

The middle pane shows 'Layer attributes' for a selected layer. It lists attributes such as 'Especie' (Lookup list), 'Altura' (Height), 'ProyeccionA' (Number), 'ProyeccionB' (Number), 'Diametro' (Tree diameter), 'Edad' (Number), 'Temperaturapromedio' (Lookup list), 'Sanidad' (Lookup list), and 'Plagas' (Lookup list). Below this is an 'Attribute definition' section with an 'On-Change script' and a 'Lookup list' table.

The 'Lookup list' table is as follows:

ID	Value
1	Robusta
2	Arabica
3	Injerto

The right pane shows a map titled '8 (E3 Mirador 2)' with a scale bar from 0 to 20 meters. The map displays a complex arrangement of coffee plots, each with a tree crown projection overlaid. The crown projections are represented by green circles of varying sizes. A legend on the right side of the map shows various layers and their symbols, including 'Parcela' (yellow square), 'Reference points' (red dot), 'GPS ref. points' (blue dot), 'DEM' (green square), 'Arbol' (green circle), 'Crown projections' (green circle), 'Madera muerta' (brown square), 'Hierbas' (green square), 'Trans' (red square), 'Finca' (blue square), 'SueloPol' (green square), 'Suelo punto' (blue square), and 'Agua' (blue square). The map also includes a scale bar and a 'Position' button.

Electronic monitoring of diseases “Roya”

México

- Total number of plots: 8
- Number of variables: +90

Field-Map Project Manager (Copyright © 1999-2015 IFER Ltd., version

Project Layers Tools Extensions Options Help

Layers

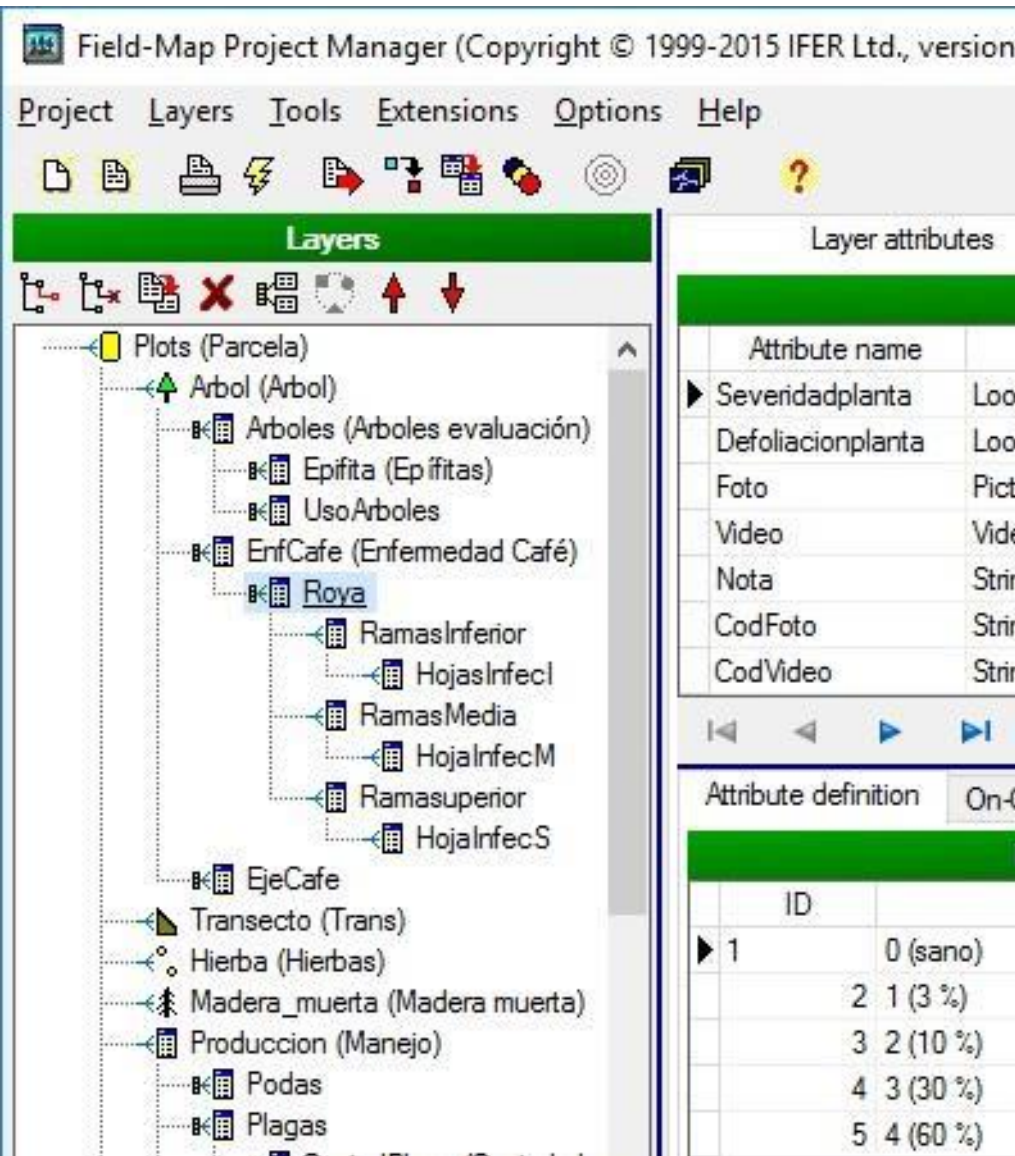
Layer attributes

Attribute name

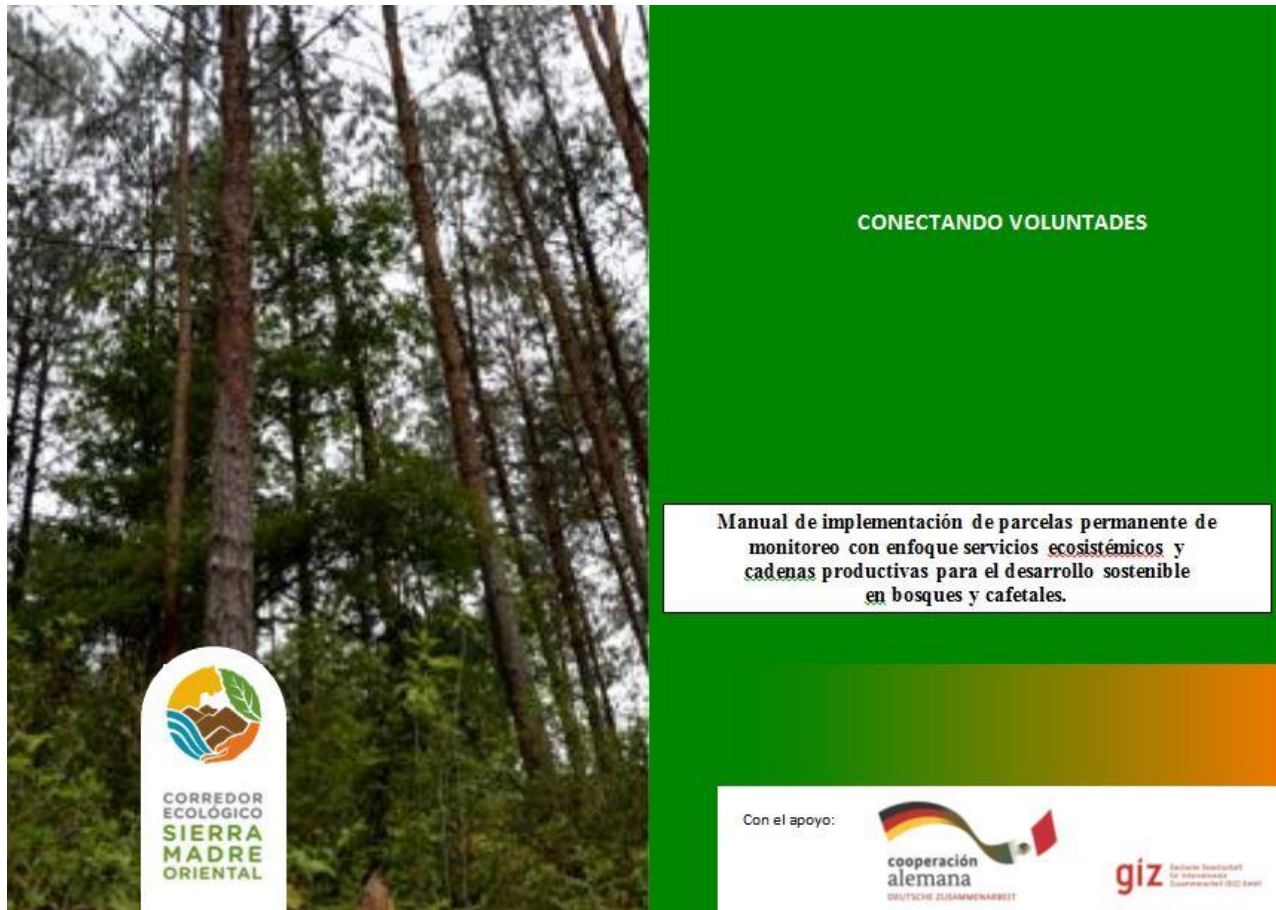
Severidadplanta	Lool
Defoliacionplanta	Lool
Foto	Picti
Video	Vide
Nota	Strir
CodFoto	Strir
CodVideo	Strir

Attribute definition On-C

ID	
1	0 (sano)
2	1 (3 %)
3	2 (10 %)
4	3 (30 %)
5	4 (60 %)



Manual for installation of PPM with Field-Map technology in productive value chains



Development of a sustainable model for agrosilvopastoral systems in Santa Cruz, on the basis of permanent monitoring plots

Members:

- GITEC Bolivia
- Autonomous University of Gabriel René Moreno
- Engineers of the National Bolivian Authority for Forest Control



Location of
PMP

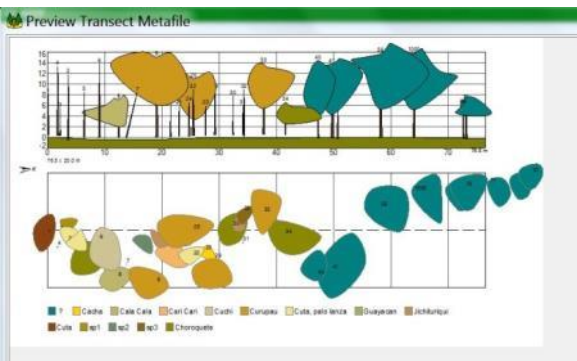
Installation of the PMP



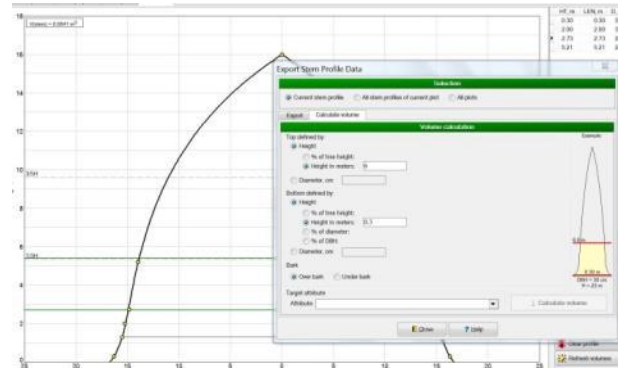
Detailed measurement of the trees



Evaluation of the forest biodiversity – Field-Map Technology



Ecosystem structure



Stem profile equation for the forest harvesting