Global Forest Biodiversity Initiative

Conference & GFBI-FECS Joint Symposium 2017

Forest Research in the Big Data Era

Mexican network of permanent sample plots for monitoring forest growth and change: first results

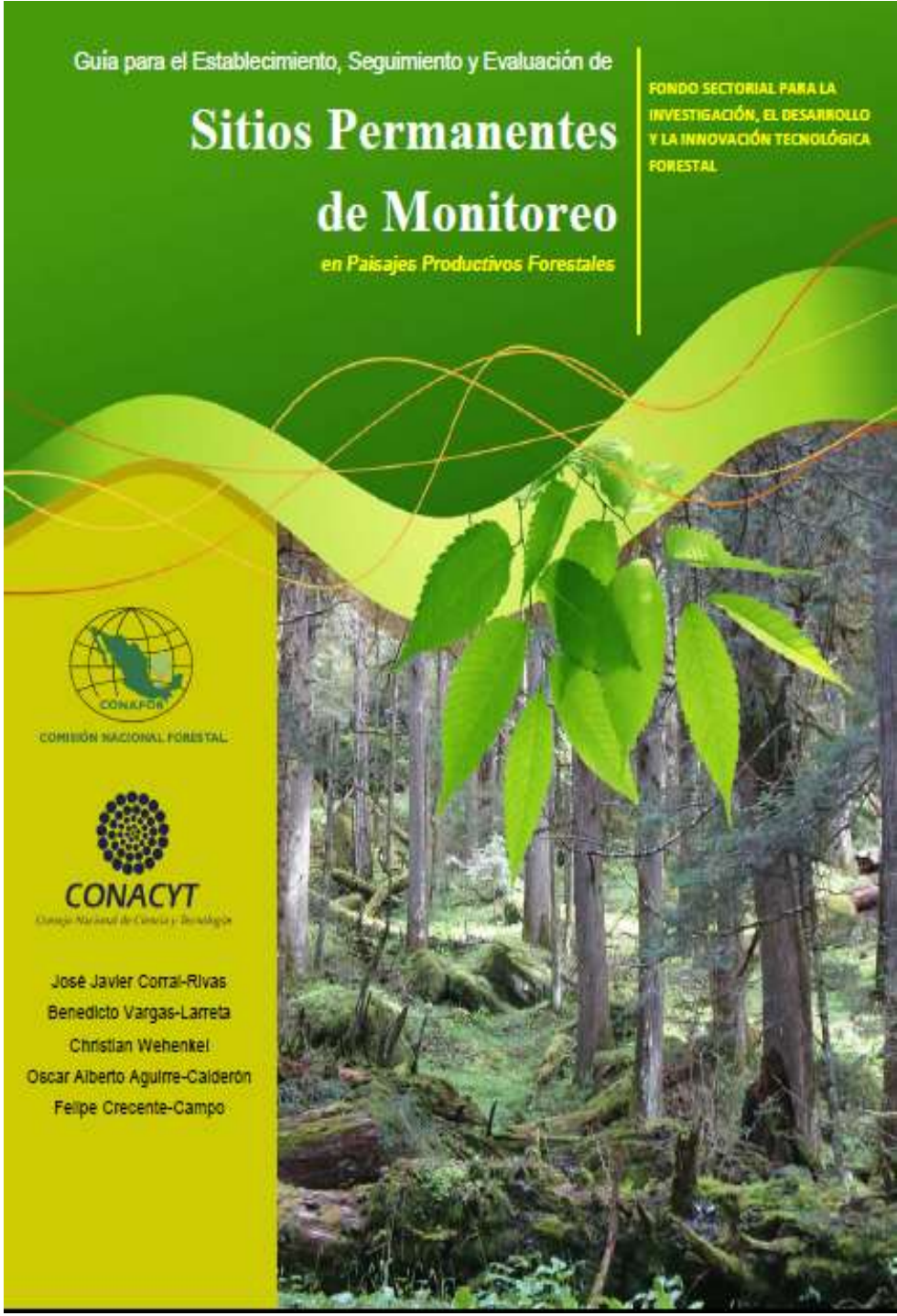



J. Javier Corral Rivas/Mexico

September 6-9, 2017 Beijing, China

Outline

- Overview of Mexican forests
- Objectives of plots
- Sampling design for plot establishment and remeasurement
- The Web-based Permanent Sample Plot Database (Monafor)
- Plot description
- First Results/publication
- Conclusions



Overview

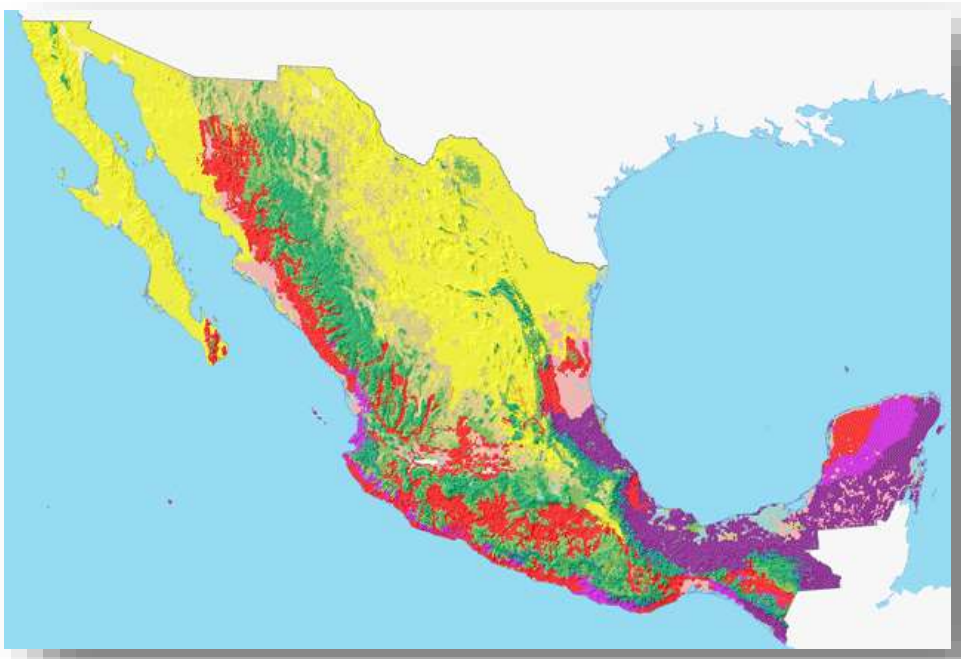
•141.7 Million hectares of Mexico is forest land (32% of the country).

•38 Million ha are temperate forests (mixed and uneven-aged pine-oak forests)

•16 Million ha are tropical forests.

•87.7 Millio ha are arid areas.

• Forest land property: 80% community forests, 15% private forests, and 5% state forests.



Overview

México is considered one of the most mega-diverse countries of the world. With over 200,000 different species, Mexico is home of 10–12% of the world's biodiversity. It ranks:

- 1st in biodiversity in reptiles with 707 known species.
- 2nd in mammals with 438 species.
- 4th in amphibians with 290 species.
- 4th in flora, with 26,000 different species (71 species of pine and 135 of oak).

From our forest land

(41.3%)

Arid areas

(21.5%)

Temperate forests

(18.6%)

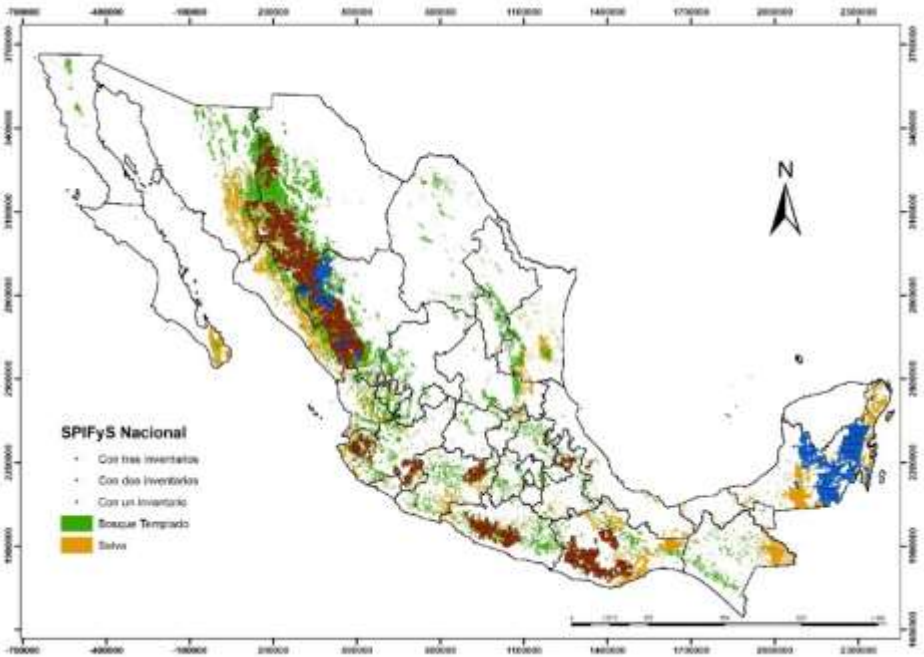
Tropical forests

Overview

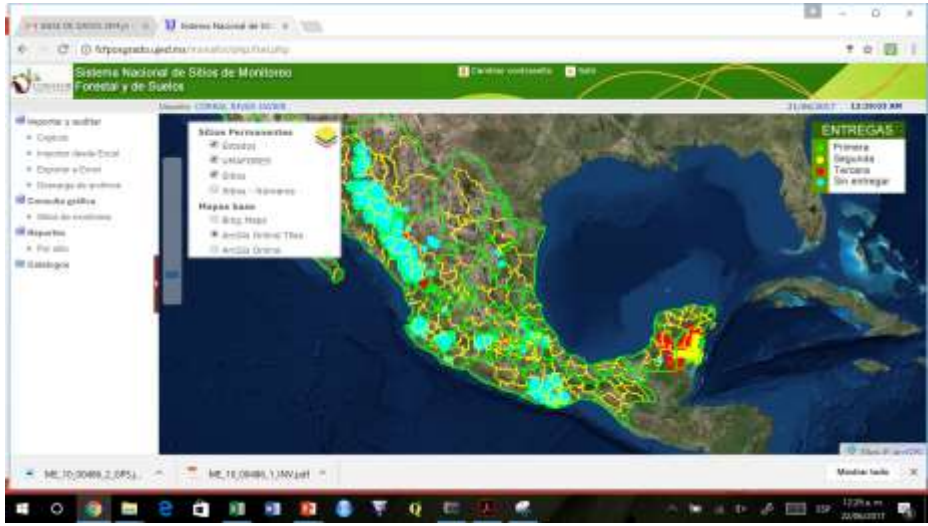
- Many people of Mexico live in or near the forested areas and depend on the forests for their livelihood (about 11 Million). Thus, these natural resources are very important for the social, economic and environmental development of the country.

Objetives of the plots

- Currently a total 3591 permanent sample plots, have been established between 2007 and 2014, on the temperate and tropical forests in Mexico.

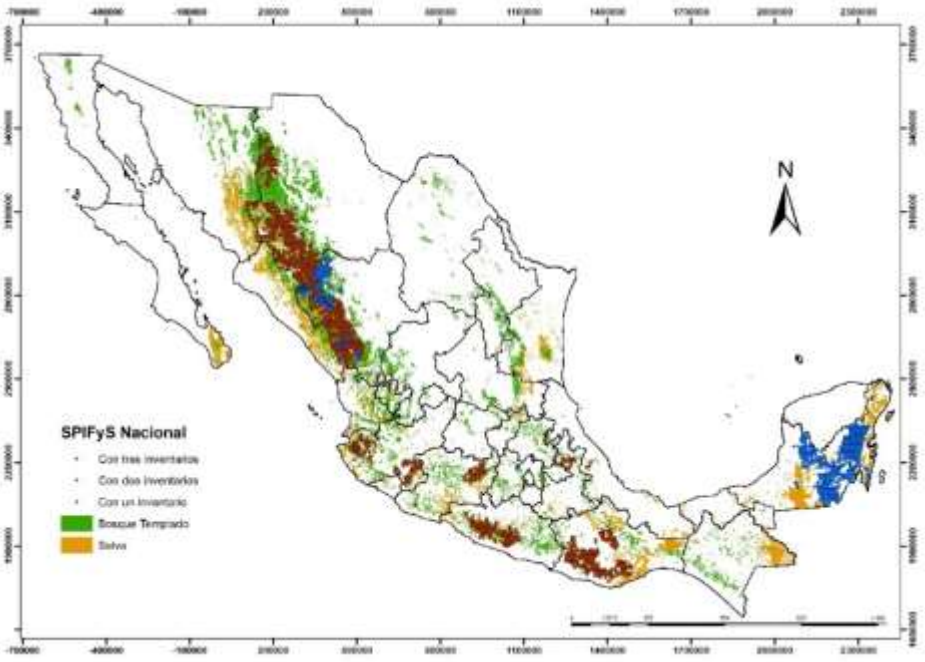


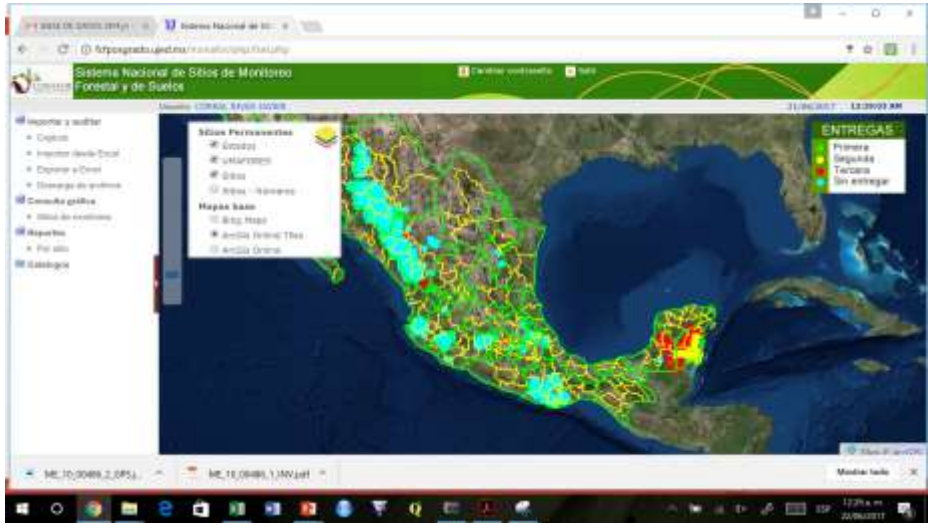
- Data from the PSPs can be used to define stand structures at specific points in time, develop or calibrate stand or individual tree growth models, and validate/invalidate projections made with such a models.



Objetives of the plots

- to provide data on the effect of specific silvicultural treatments on tree growth of commercial tree species, and on soil.
- to analyze changes on spatial forest structure and diversity.
- to develop key indicators for sustainable forest management in Mexico.
- to get the forest management certification .

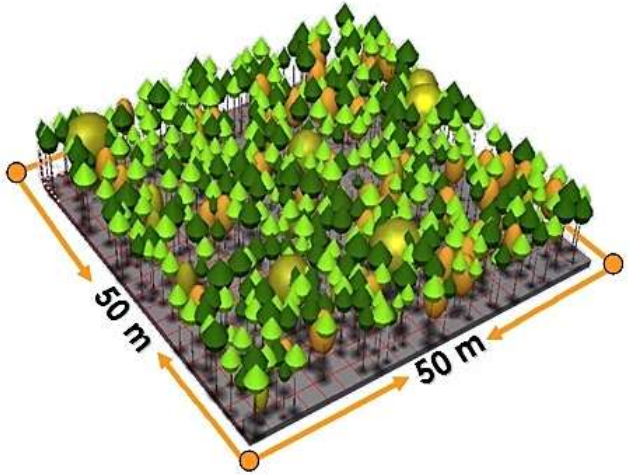


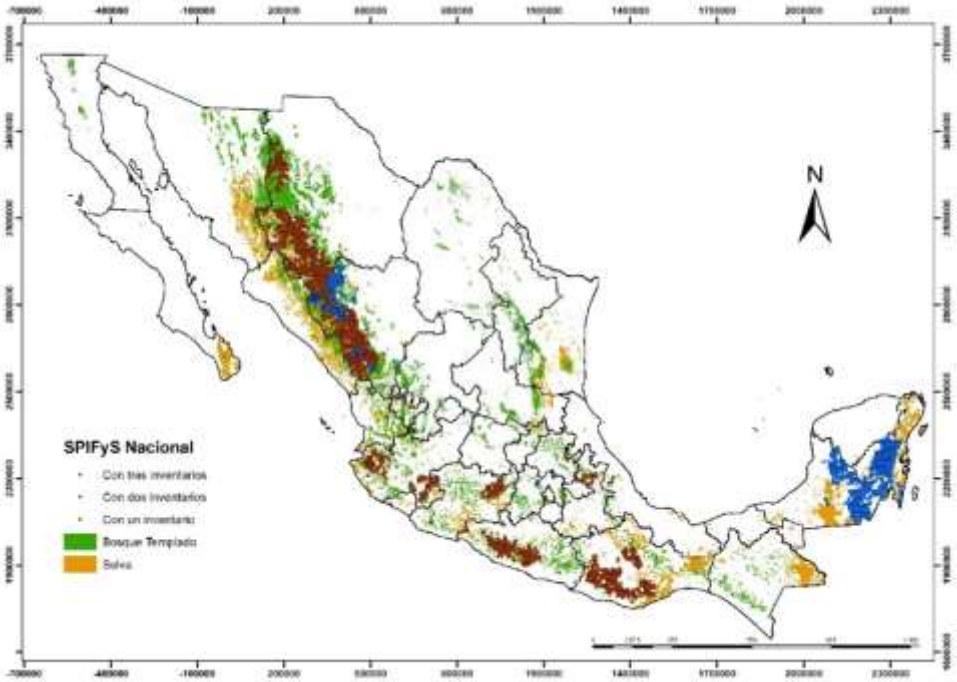


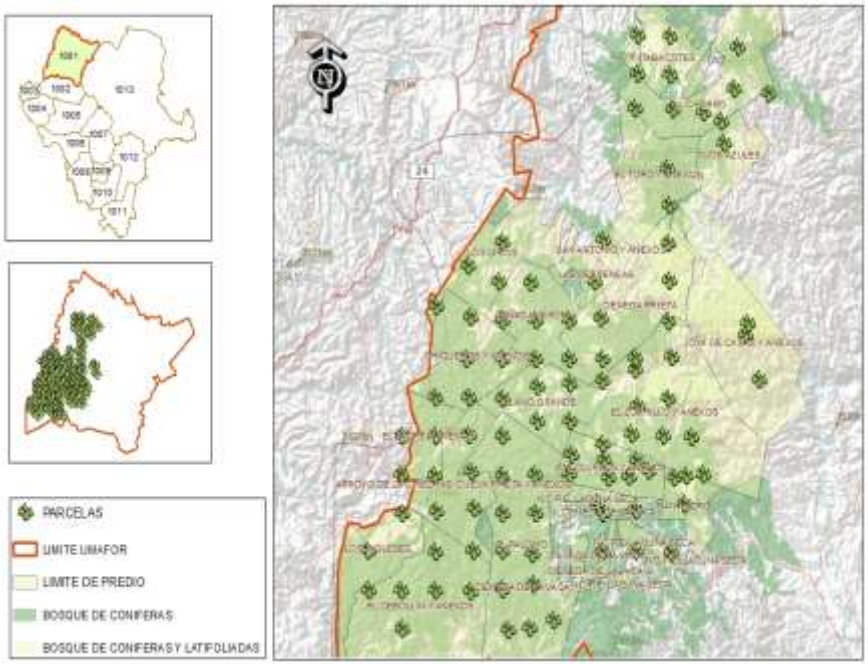
Sampling design for plot establishment and remeasurement

- Each of the permanent field plots covers 2500 m^2 .

- They are distributed systematically (with some exceptions), with a variable grid ranging from 3 to 5 kilometers







Sampling design for plot establishment and remeasurement

- The Permanent Sample Plot Procedure Manual uses 4 forms for establishing and remeasuring the plots:

1. Form F-01: Plot and site information (44 records)

Apéndices

F-01: INFORMACIÓN DE CONTROL Y ECOLOGICA DEL SITIO

1 Fecha: _____ (Día Mes Año) 2 Brigada: _____

3 Nombre y firma del responsable: _____

4 Estado: _____ 5 Municipio: _____

6 Predio: _____ 7 Paraje: _____

8. Hora de Inicio: _____ 9. Hora de Termino: _____

10 Sitio	11 T-Sitio (m^2)	12 ASNM	13 Zona UTM	14 Datum	15 Error de precisión	Coordenadas UTM	
						16 Norte	17 Este
				WGS84	m_____		

Variables ecológicas

18 Exposición: Z [1] N [2] S [3] E [4] O [5] NE [6] SE [7] NO [8] SO [9]

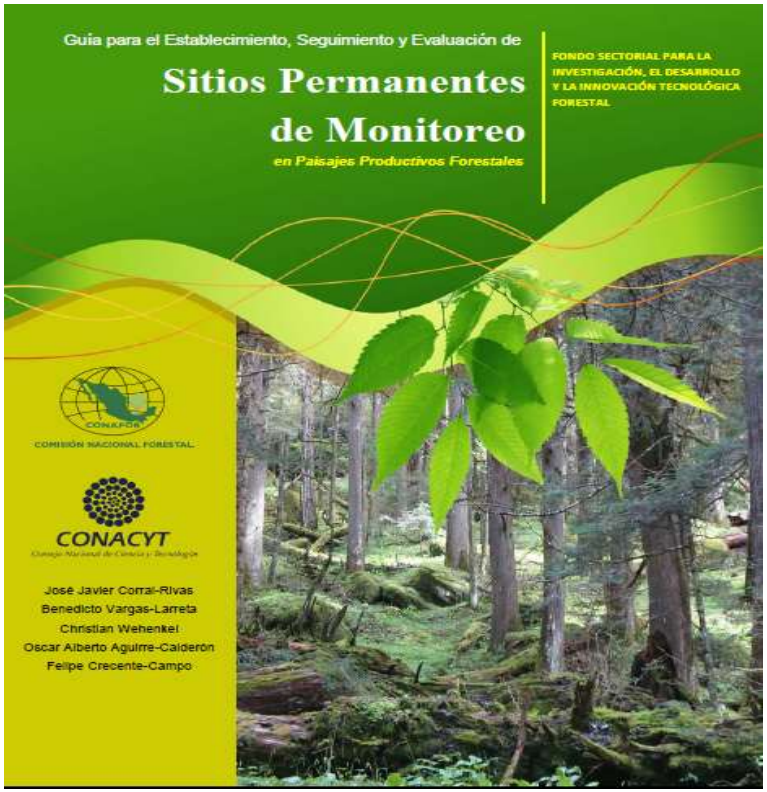
19 Fisiografía: Valle [1] Meseta [5] Terraza [2] Ladera [6] Planicie [3] Lomerío [7] Barranca [4] Bajo [8]

20	21	22	23	24	25	26	27	28	29	30	31	32	33
Co	Te	Mp	Mo (cm)	Oc (cm)	Uac	Up	El (%)	Ec (%)	Er (%)	Ea (%)	Per	Pen (%)	CA %

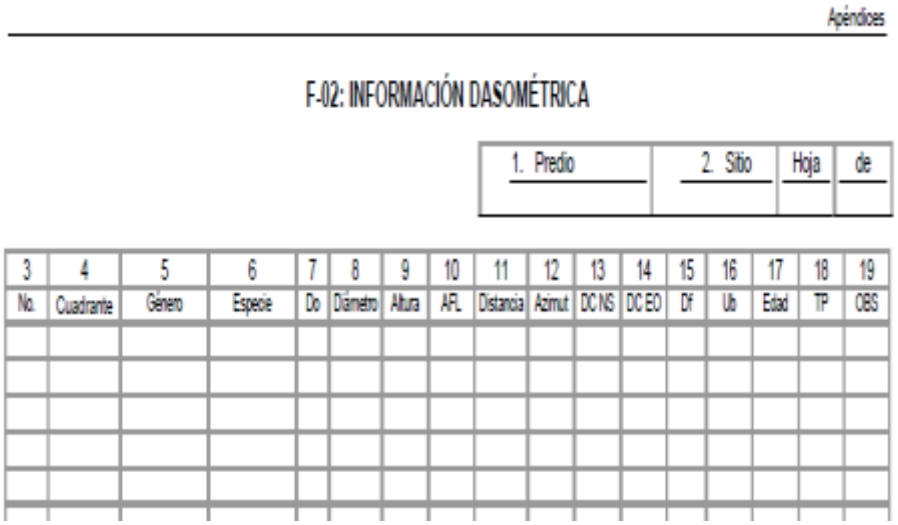
34	35	36	37	38	39	40	41	42
CH %	CP %	COC %	Plagas y Enf.	Ni	Ts	Rec. Mo.	Accesibilidad	Tipo de acceso

43 Croquis de ubicación

44 Observaciones



Sampling design for plot establishment and remeasurement



Apéndices

F-02: INFORMACIÓN DASOMÉTRICA

1. Predio	2. Sitio	Hoja	de

3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
No.	Cuadrante	Género	Especie	Do	Diámetro	Altura	AFL	Distancia	Azimut	DC NS	DC EO	Df	Ub	Edad	TP	OBS

- The Permanent Sample Plot Procedure Manual uses four forms for establishing and remeasuring the plots:

2. Form F-02: Tree measurements (16 records of each tree)

Sampling design for plot establishment and remeasurement

3. Form F-03: Understory subplots (12 records)

4. Form F-04: Soil information (8 records + lab results)

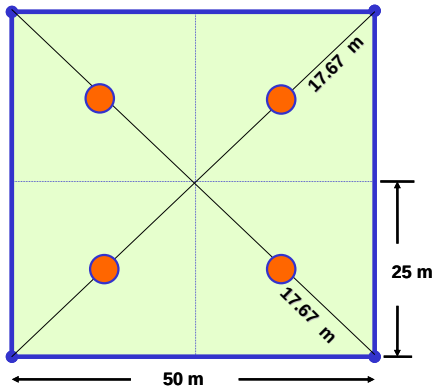
F-03: INFORMACIÓN DE LA REGENERACIÓN NATURAL (árboles con diámetro normal < 7.5 cm y altura >= 25cm)

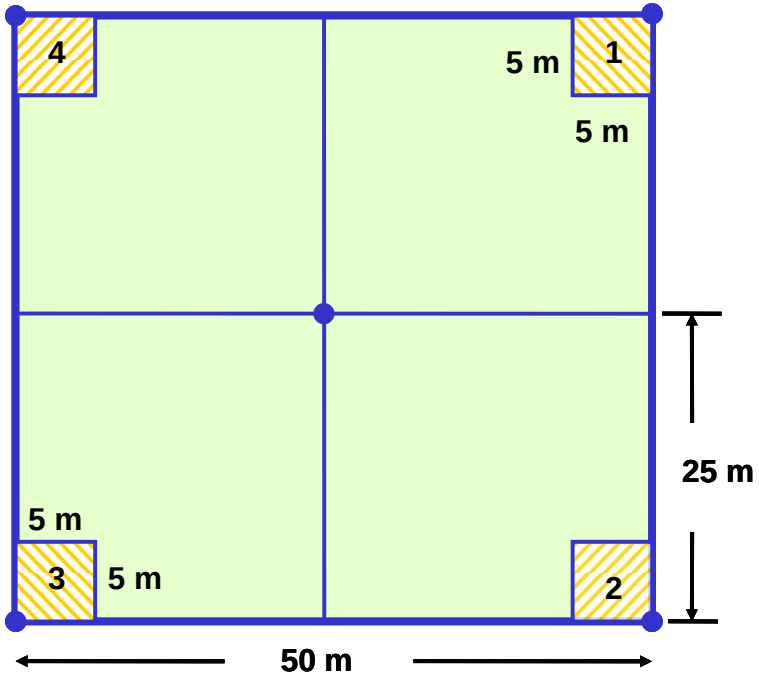
1. Predio	2. Sitio	3. T. subparcela (m^2)	4. Distribución	Hoja	De

5. Sub	6. Género	7. Especie	8. Clase de altura								
			0.25-1.50 m			1.51-2.75 m			Mayor que 2.75 m		
			9. Frec.	10. EM	11. DM	9. Frec.	10. EM	11. DM	9. Frec.	10. EM	11. DM

F-04: INFORMACIÓN DEL RECURSO SUELO

1. Predio:		
2. No. Sitio:		
Factor	Características (marcar con X)	
3. Profundidad efectiva	1. Menor a 15 cm	
	2. Entre 15 y 30 cm	
	3. Entre 30 y 60 cm	
	4. Entre 60 y 90	
	5. Mayor de 90	





Sampling design for plot establishment and remeasurement

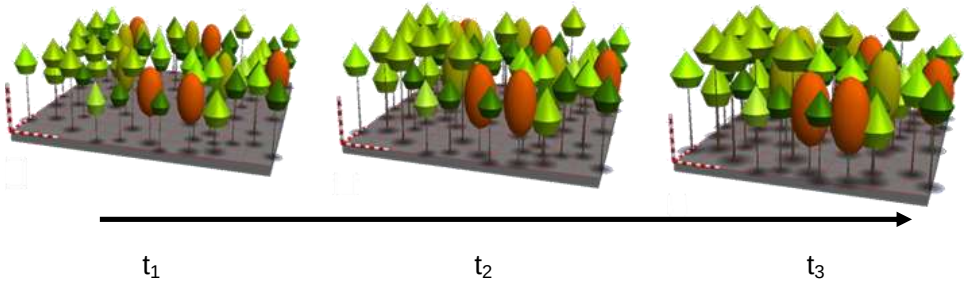
- Among other variables, tag number, species code, breast height diameter (d, cm), total tree height (h, m), height to the live crown (m), azimuth (º) and radius (m) from the centre of the plot of all trees equal or larger than 7.5 cm in diameter are recorded. Currently, the database includes such measurements for more than 710,539 records of trees on 3591 sample plots.

- We have developed an app for mobile devices that work under the android environment and collects the data in accordance with our manual

The Permanent Sample Plot Database (Monafor)

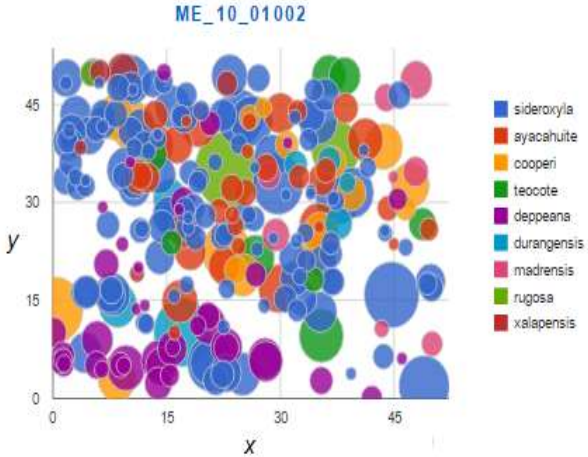
http://fcfposgrado.ujed.mx/monafor

- A web-based system was created for data management and reporting. Online tools are used to facilitate access and transform the raw data into information using meaningful, built-in calculations and a flexible graphical user interface. Monafor is updated annually with new measurement data from the PSPs and can be use easily via the Internet.

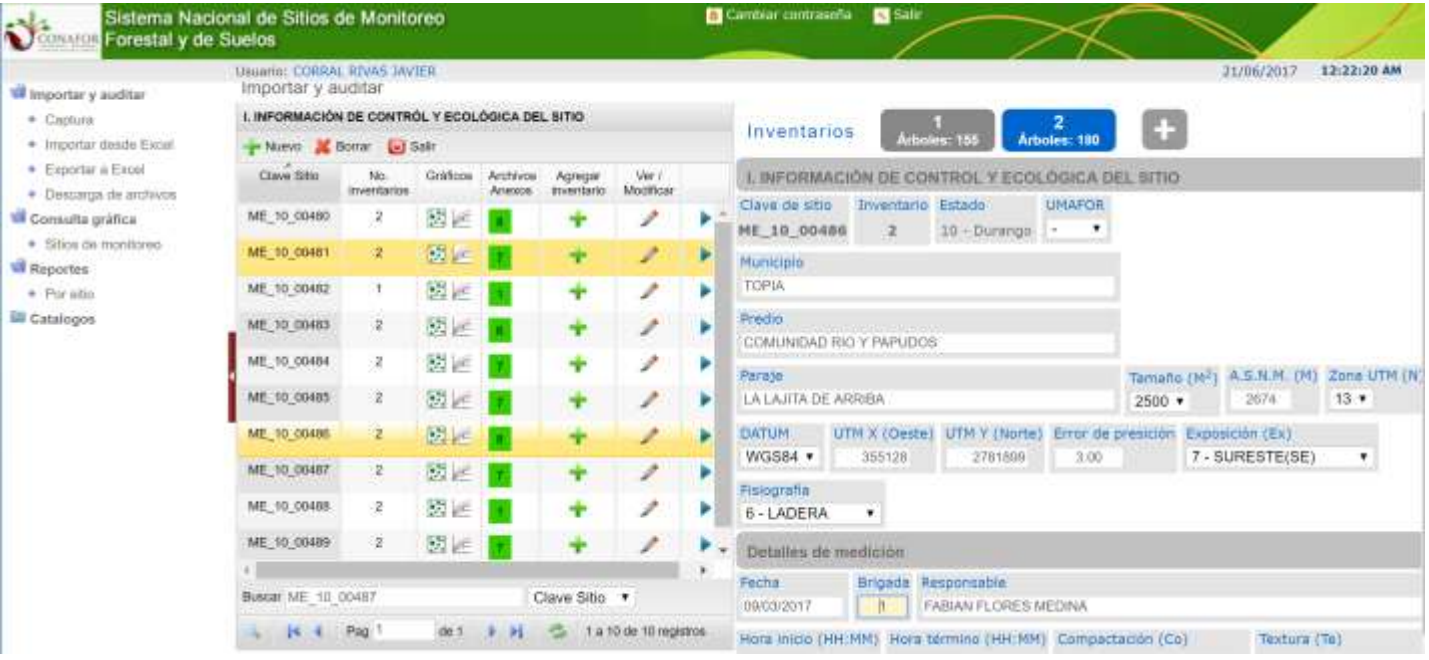


The Permanent Sample Plot Database (Monafor)

- Monafor has proved to be very useful for data validation. But also for generating reports that presents an overview of the PSPs. Outputs from the system include estimation of stand variables like volume, basal area periodic annual increment, calculation of some diversity indices by plot.



The Permanent Sample Plot Database (Monafor)



The Permanent Sample Plot Database (Monafor)

F-01: INFORMACIÓN DE CONTROL Y ECOLOGICA DEL SITIO

1 Fecha: 08/03/17 (Día Mes Año) 2 Brigada: 3

3 Nombre y firma del responsable: Favian Flores Medina

4 Estado: Durango 5 Municipio: Tepehuanes

6 Predio: EP. Zaloas 7 Paraje:

8 Hora de Inicio: 9:30 9. Hora de Termino: 18:48

10 Sitio	11 T-Sitio (m²)	12 ASNM	13 Zona UTM	14 Datum	15 Error de precisión	Coordenadas UTM 16 Este	17 Norte
10037480	2500	2,590	13	WGS84	m 4.2	201192	2285707

Variables ecológicas

18 Exposición: Z [1] N [2] S [3] E [4] O [X] NE [6] SE [7] NO [8] SO [9]

19 Fisiografía: Valle [1] Terraza [2] Planicie [3] Barranca [4] Meseta [5] Ladera [X] Lomerío [7] Bajo [8]

20	21	22	23	24	25	26	27	28	29	30	31	32	33
Cu	Ta	Mp	Mo (cm)	Oc (cm)	Uac	Up	El (%)	Eo (%)	Er (%)	Ea (%)	Per	Pen (%)	CA %
2	4	1	2.1	2.7	3	2	1	1	1	1	10	3	2

34	35	36	37	38	39	40	41	42
CH %	CP %	COC %	Plagas y Enf.	NI	Ts	Rec. Mjo.	Accesibilidad	Tipo de acceso
2	3	9	2	1	4	03/15	1	2

43 Croquis de ubicación

44 Observaciones

The Permanent Sample Plot Database (Monafor)

Sistema Nacional de Sitios de Monitoreo Forestal y de Suelos

Cambiar contraseña | Salir

Usuario: CORRAL RIVAS JAVIER

- Importar y auditar
  - Captura
  - Importar desde Excel
  - Exportar a Excel
  - Descarga de archivos
- Consulta gráfica
- Reportes
- Catalogos

Importar y auditar

Exportar a Excel

Seleccione el estado e inventario a exportar

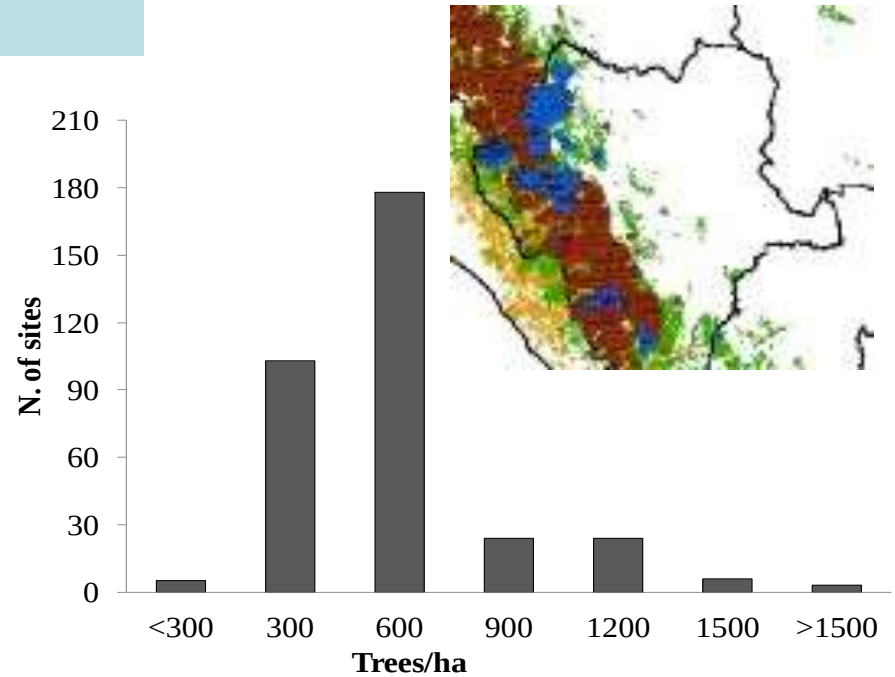
	Estado	Inventario 1				Inventario 2			
		F01	F02	F03	F04	F01	F02	F03	F04
○	4 Campeche	233	63804	4492	233	102	14750	1199	67
○	8 Chihuahua	847	109453						
○	9 Distrito Federal	4	471	40	4				
●	10 Durango	1219	170405	2890	307	385	53805	3022	331
○	12 Guerrero	205	17656	1482	137				
○	14 Jalisco	164	20244	582	163	5	743	50	5
○	15 México	10	1567	35	10				
○	16 Michoacán de Ocampo	96	3374	93	50				
○	19 Nuevo León	6	639	32	5				
○	20 Oaxaca	377	49296	2793	342				
○	21 Puebla	29	3572	191	29				
○	23 Quintana Roo	488	116410	10531	478	318	68507	8727	256
○	30 Veracruz de Ignacio de la Llave	11	1629	59	11				
○	32 Zacatecas	2	294	9	1				

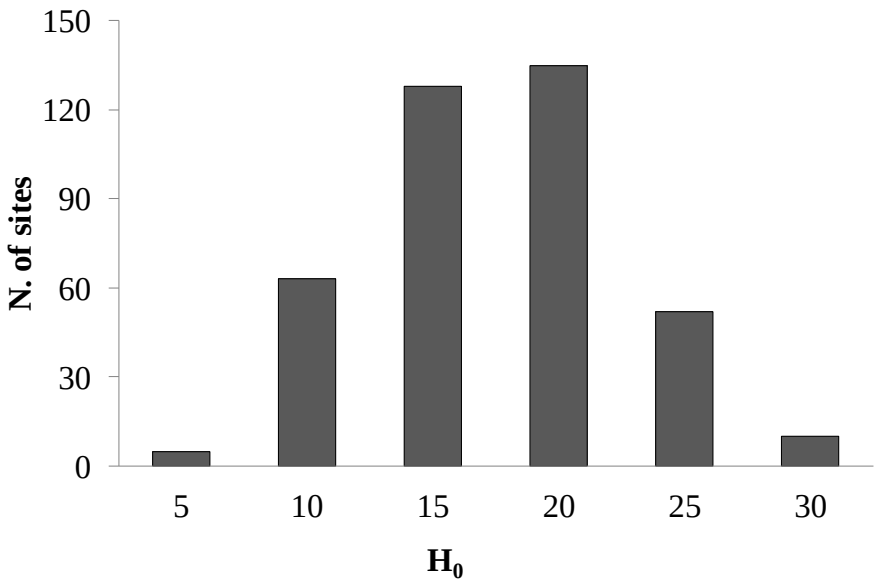
Exportar >>

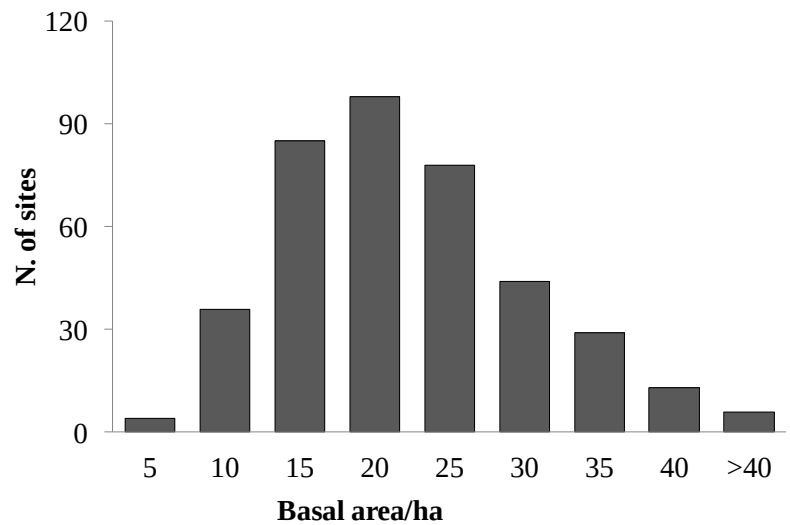
Plot description/stand variables

a) In the temperate forests more 90 tree species are being studied within the plots, including the genera Pinus, *Juniperus*, *Abies*, *Pseudotsuga*, *Cupresus*, *Picea*, and *Quercus*.

Durango



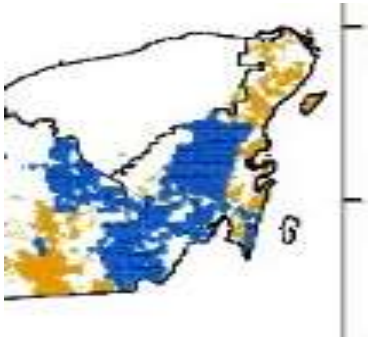


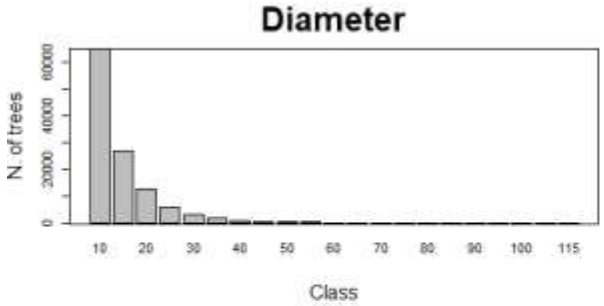


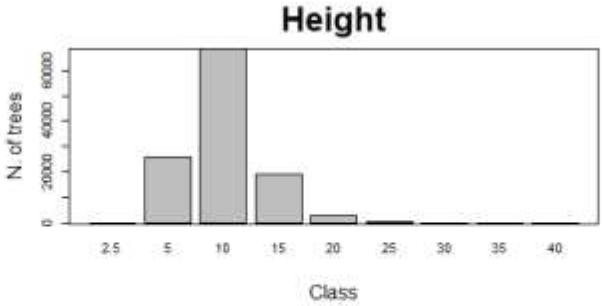
Plot description/stand variables

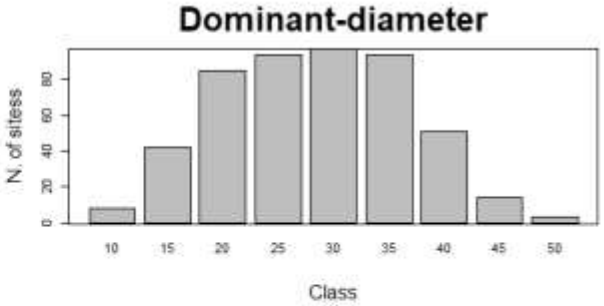
b) An example from tropical forest.

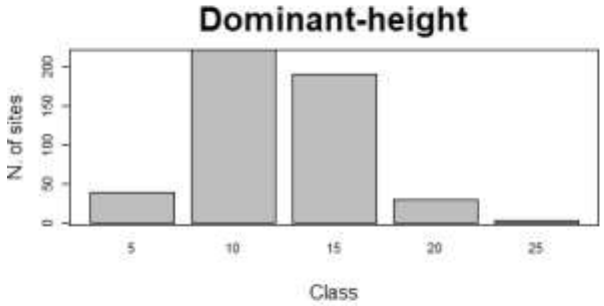
Quintana Roo

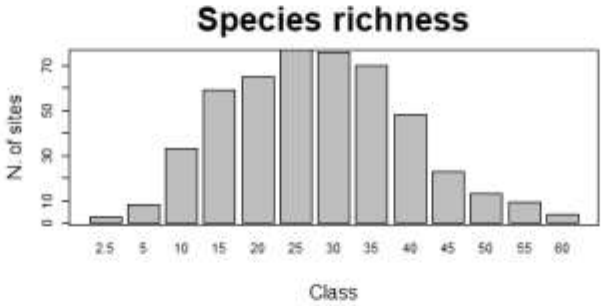


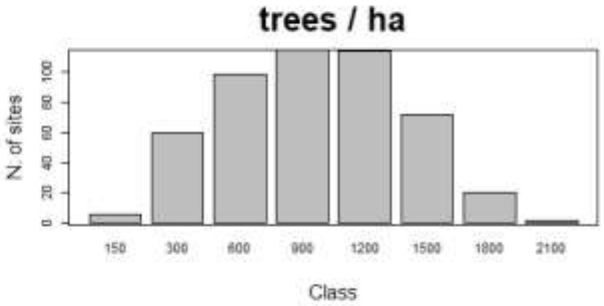


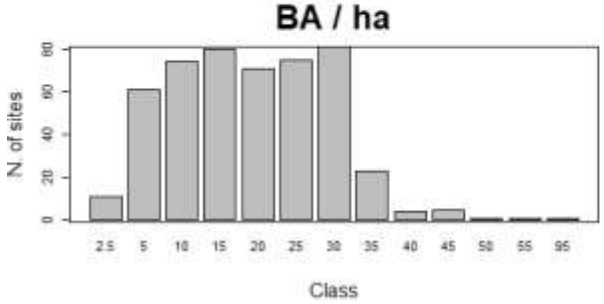


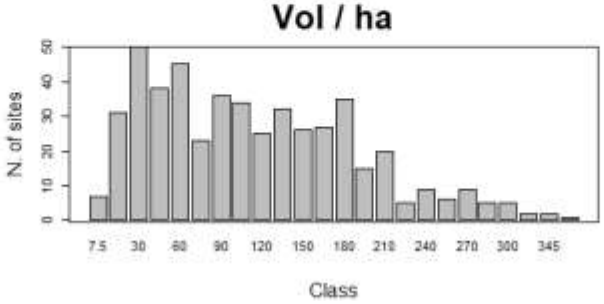








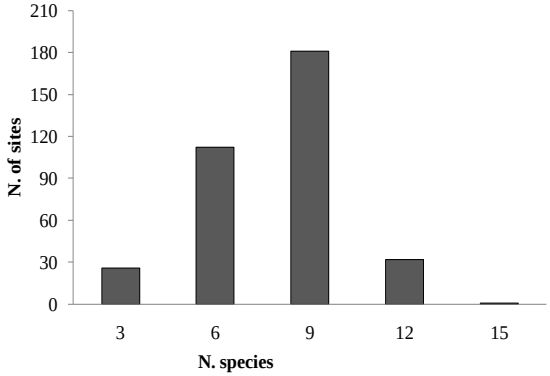


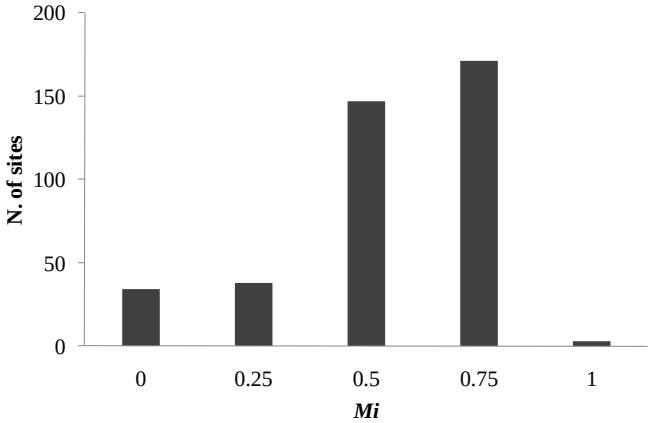


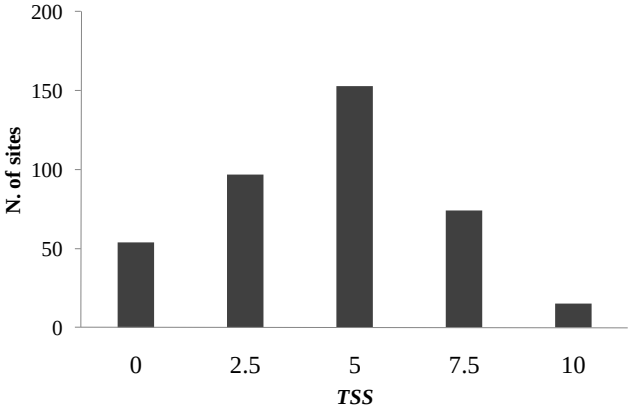
Description/spatial structure

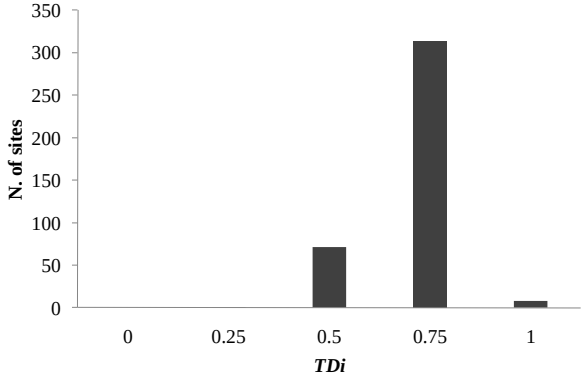
Durango

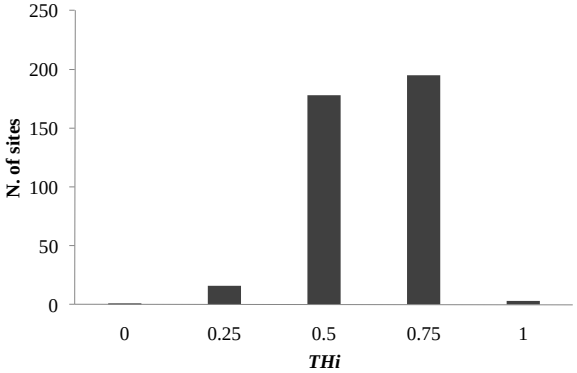
Structural parameter	*S*	*Mi*	*TSS*	*Ri*	*TDi*	*THi*
Mean	8	0.54	4.59	1.90	0.66	0.60
Maximum	18	0.86	10.16	2.48	0.89	0.83
Minimum	1	0.00	0.00	0.94	0.38	0.23
Standard deviation	2	0.19	2.02	0.16	0.07	0.10

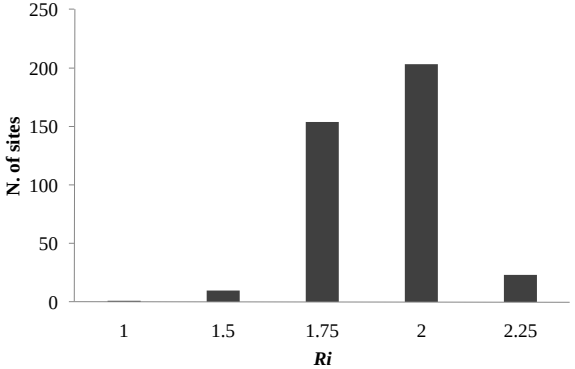






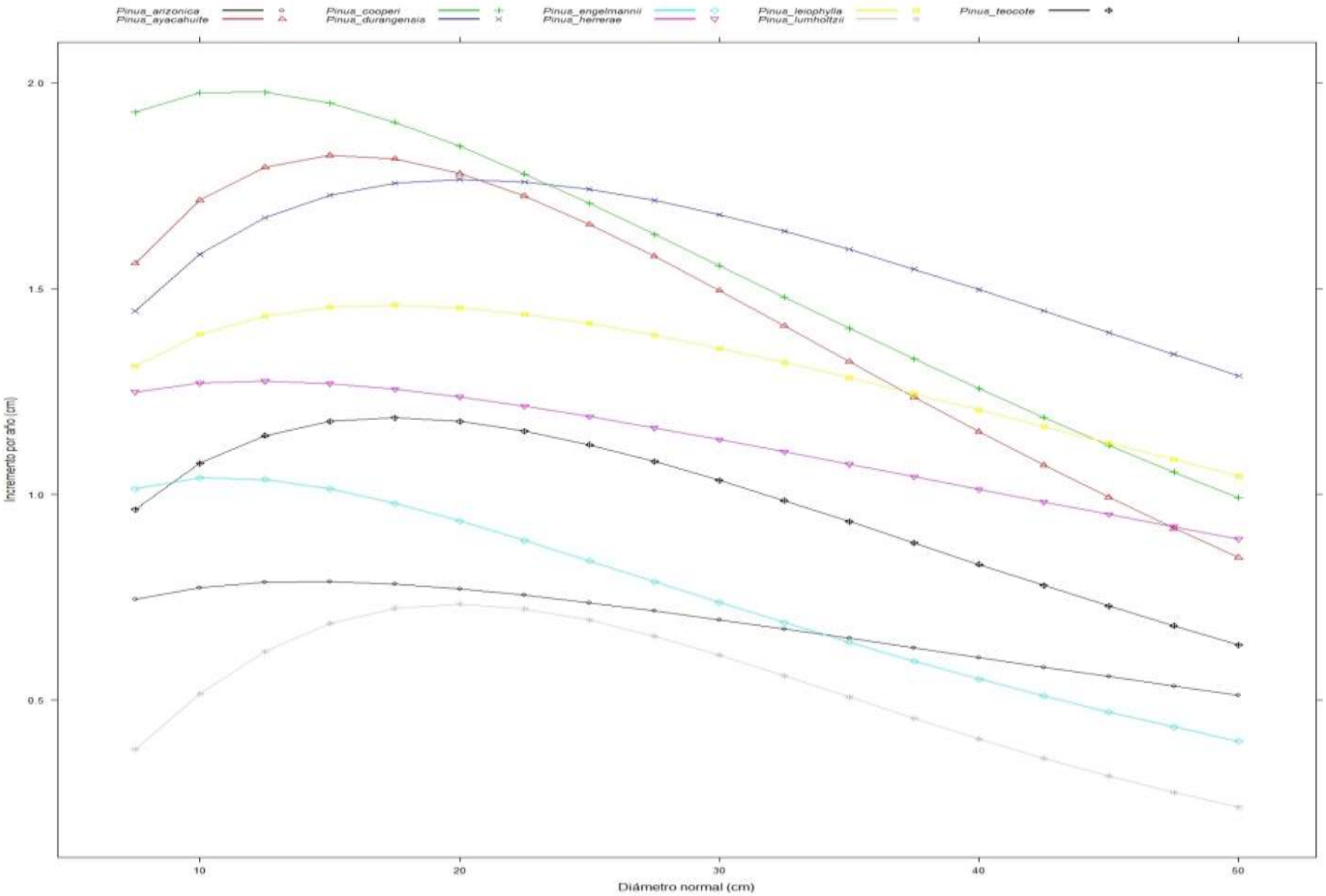






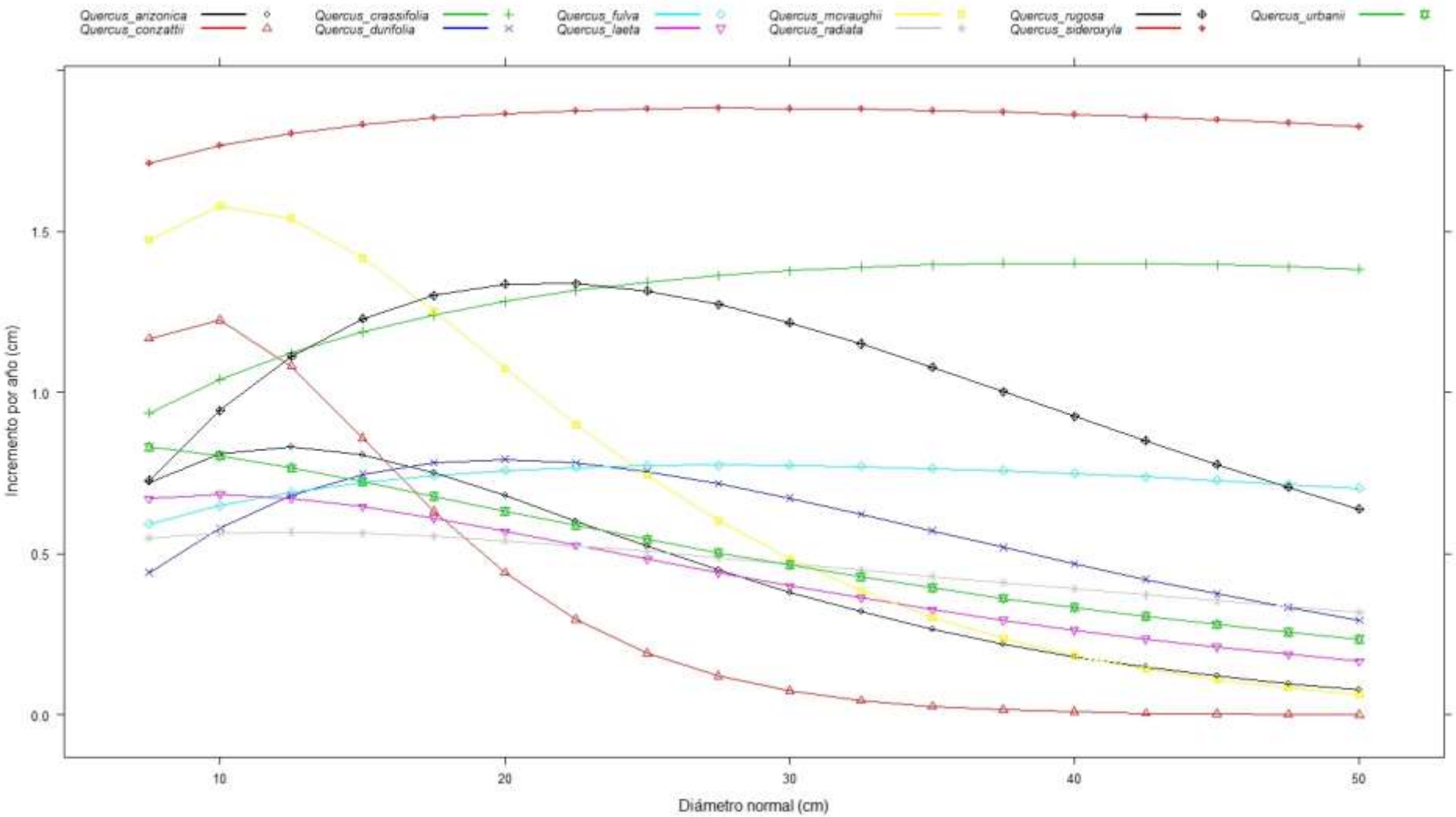
First Results

Durango



First results

Durango



First results/Publication

1. García-Montiel E., Cubbage F., Rojo-Alboreca A., Lujan-Álvarez C., Montiel-Antuna E., **Corral-Rivas J.J**. 2017. An Analysis of Non-State and State Approaches for Forest Certification in Mexico. Forests (in press).
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First results/Publication

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Conclusions

- During the next two years a total of 2580 research sites should be remeasured in Mexico.
- Reseachers of different disciplines and of different countries are needed to interpret and monitor ecosystem dynamics of these complex forests.

Estado	Tipo de bosque	Número de sitios a remedir						
		2016	2017		2018		2019	
		2° INV	2° INV	3° INV	2° INV	3° INV	2° INV	3° INV
Campeche	Selva	83	150					
Chihuahua	Templado				478		367	
D.F	Templado				4			
Durango	Templado	201	47	27	498	79	261	24
Edo. México	Templado		10					
Michoacán	Templado				68			
Nuevo León	Templado							**6**
Guerrero	Templado				12		192	
Jalisco	Selva	5						
	Templado				111		45	
Oaxaca	Templado				206		187	
Puebla	Templado				26		3	
Quintana Roo	Selva	243	245					
Veracruz	Templado				11			
Zacatecas	Templado				2			
Total por inventario		**532**	**452**	**27**	**1416**	**79**	**1055**	**30**
Total por año		**532**	**479**		**1495**		**1085**	
Gran total		**3591**						

Conclusions

- The network of permanent forest observational studies, described in this talk, aims to collect data over a long period of time. Opportunities already exist for short-term studies, but the real value of this network will emerge after a continued series of remeasurements.
- Cooperation between research institutions and the government is indispensable for achieving the objectives of the Mexican network.

¡Many thanks for your comments!

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