Interim report of survey on soil degradation in National Forest Inventory by monitoring forest floor cover, through FAO Japan Fund Project.

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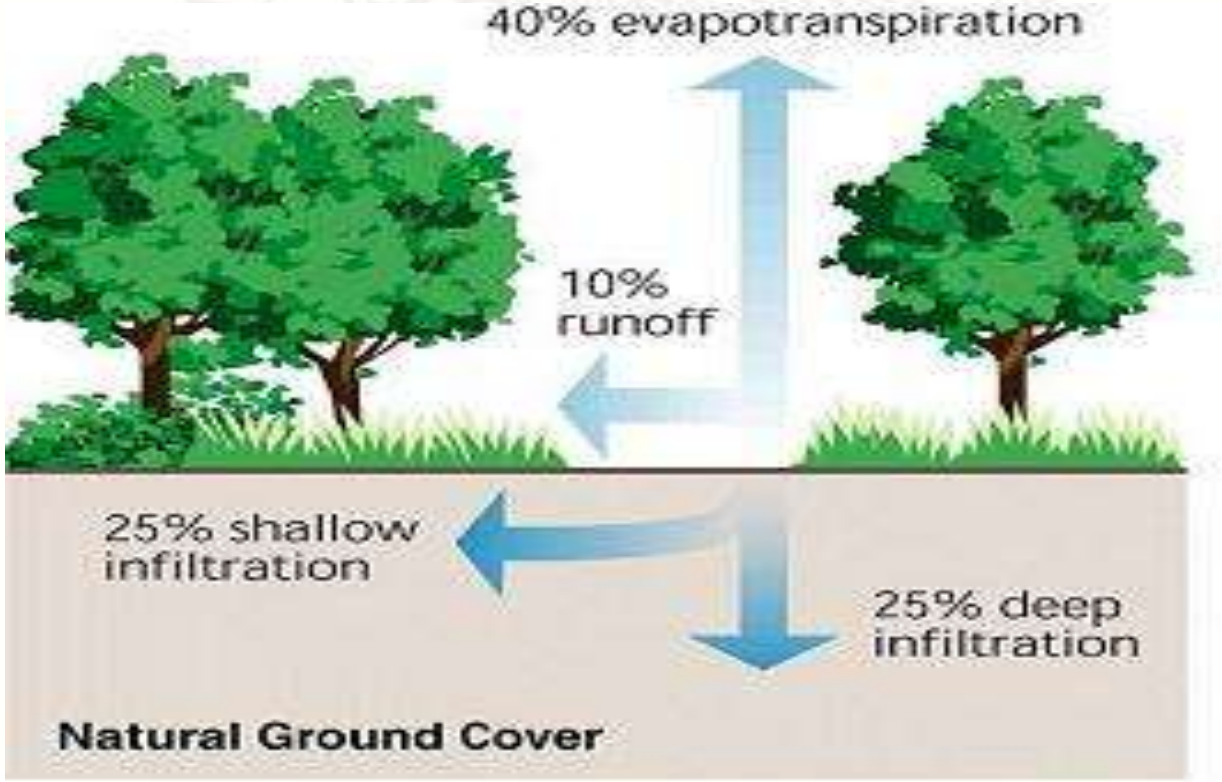
Country profile

65% is arid and semiarid land, the coast are tropical and the mountains are temperate.

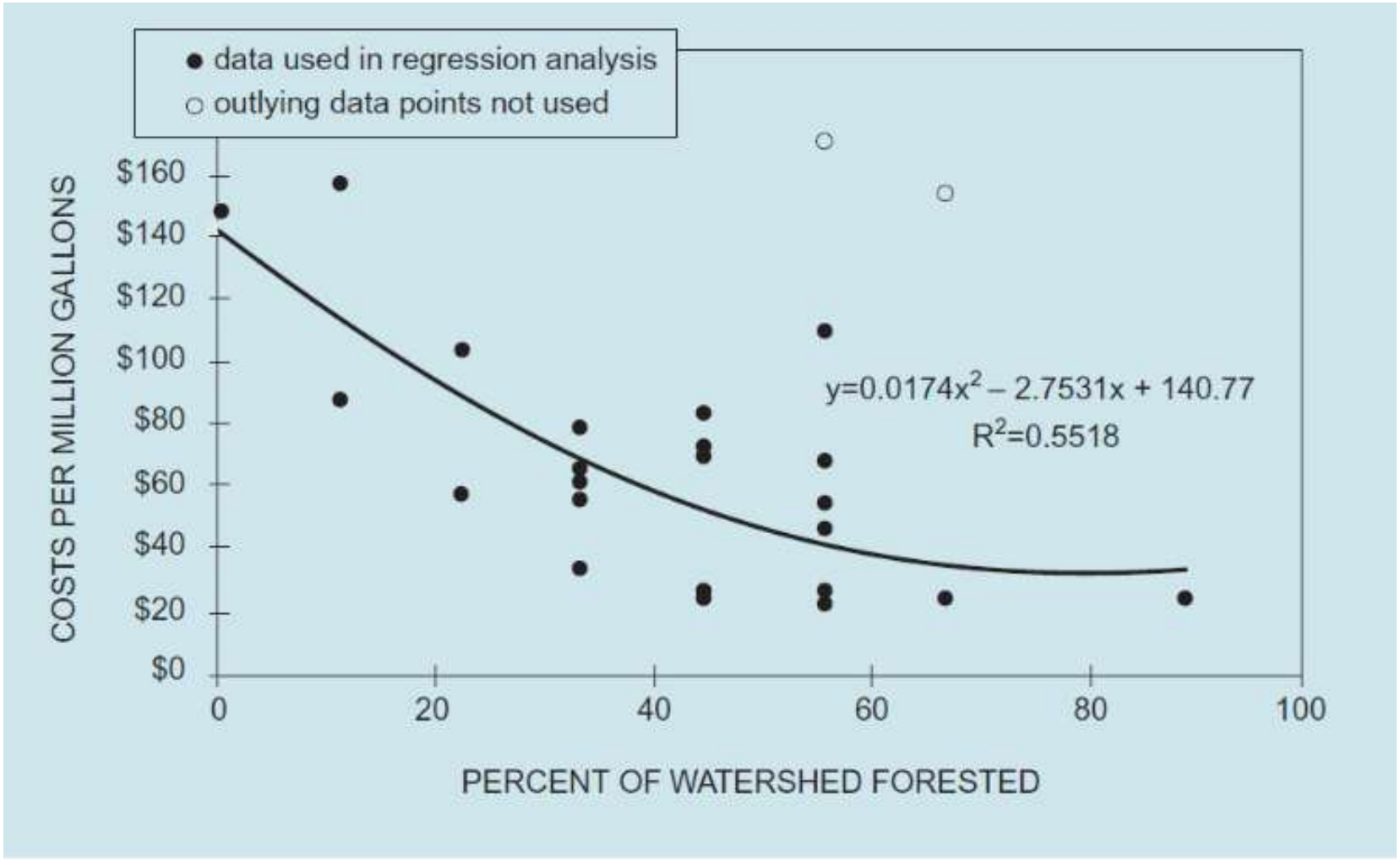
Introduction

- How works water cycle in an undisturbed forest?



Importance of forest floor cover

- The understory, herbs, litter and duff, protect soil for the raindrop impact.
- The forest floor cover its more important than forest canopy cover for water quality, water infiltration and soil erosion process.
- Forest canopy cover it isn't a enough indicator for monitoring health forest and soil conservation process.
- Some studies in forest plantations in Chile, demonstrated that the forest floor cover, reduce soil erosion after forest harvest (without canopy).



Relationship between watershed forest cover and drinking water treatment cost (Ernst, 2004)

Trust for Public Land and the American Water Works Association, 2002, http://www.forestsforwatersheds.org/forests-and-drinking-water/

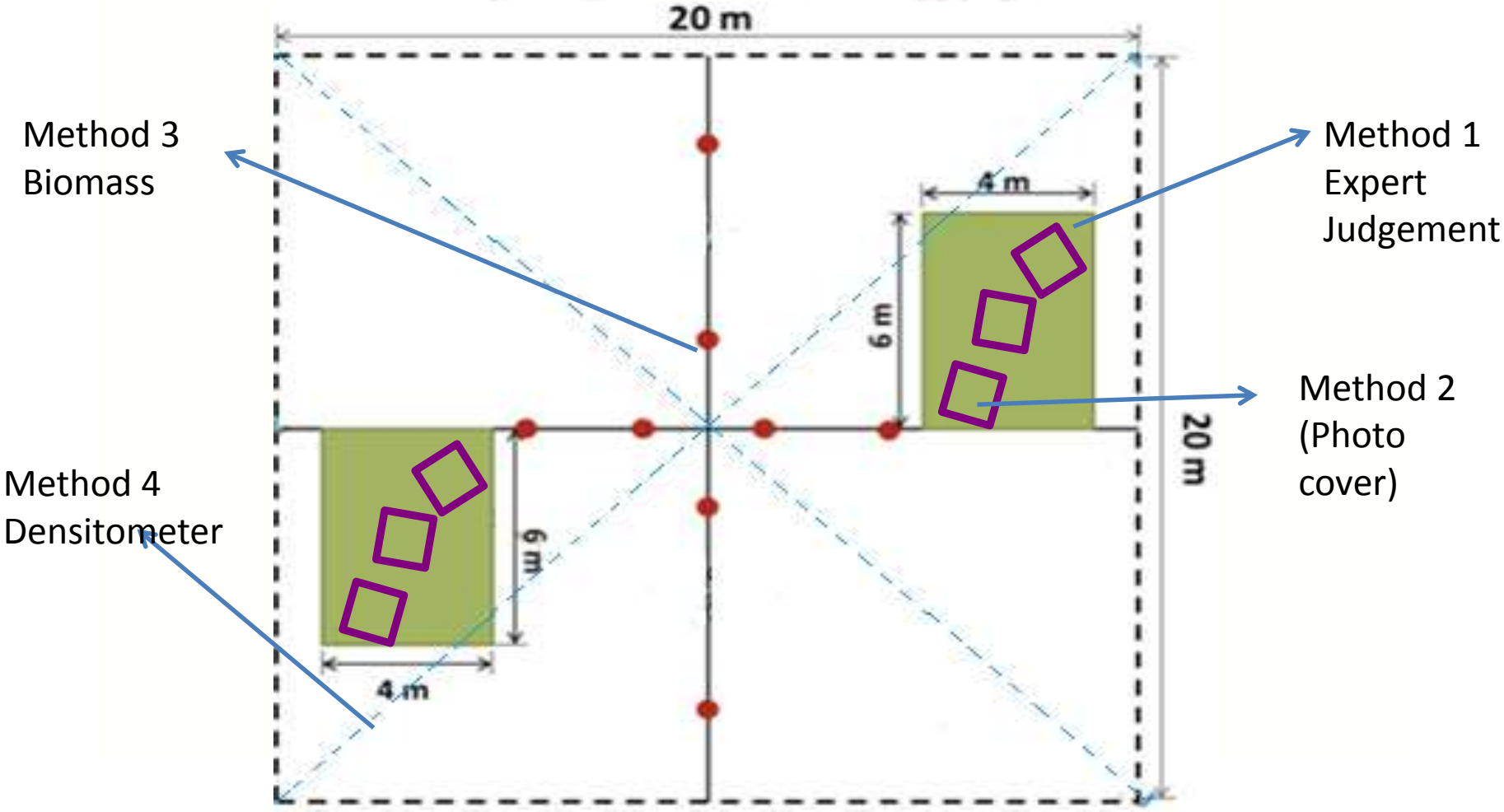
Goal

- Measure forest floor cover (percent and among), in some differents forest in México.
- Determine the best method by accuracy and cost-effective for measure forest floor cover.
- Try to take measures instead of estimate.

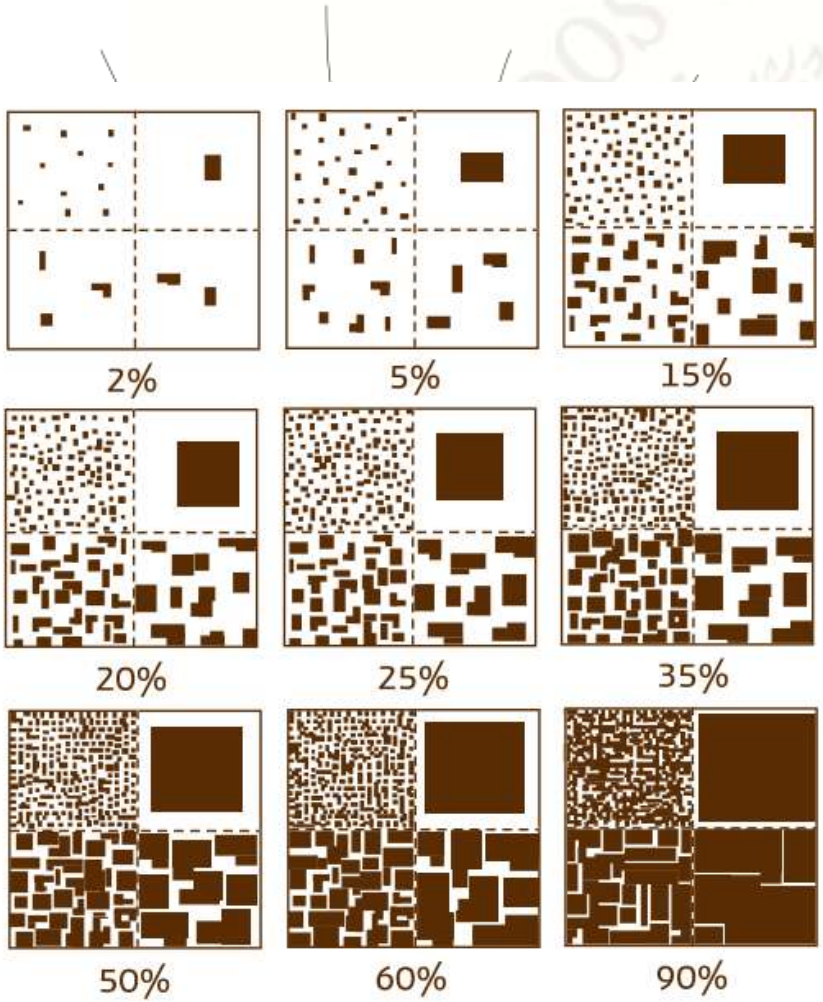
Methods, Sites and Materials

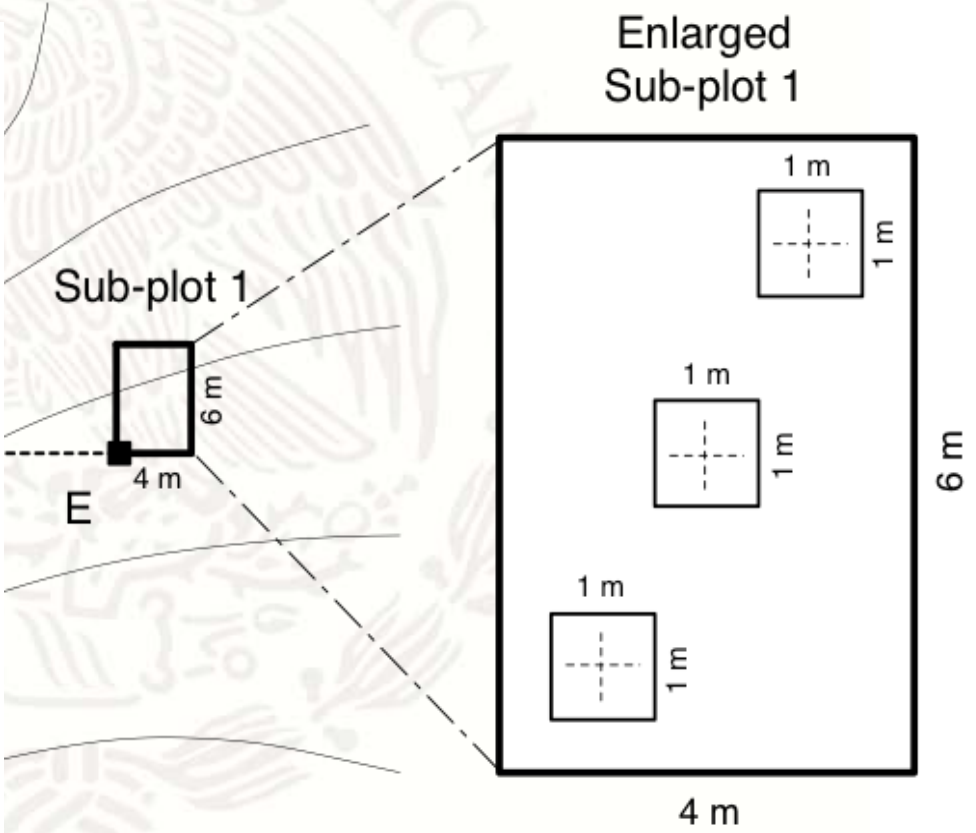
- We evaluate four methods, three methods for measure forest floor cover and one method for quantify understory and forest floor cover biomass.
  - Expert Judment (Method 1)
  - Photo Floor (Method 2)
  - Densitometer (Method 4)
  - Biomass quantify (Method 3)

Field Method's



Expert Judgement (Method 1)
Visual assessment of forest floor cover

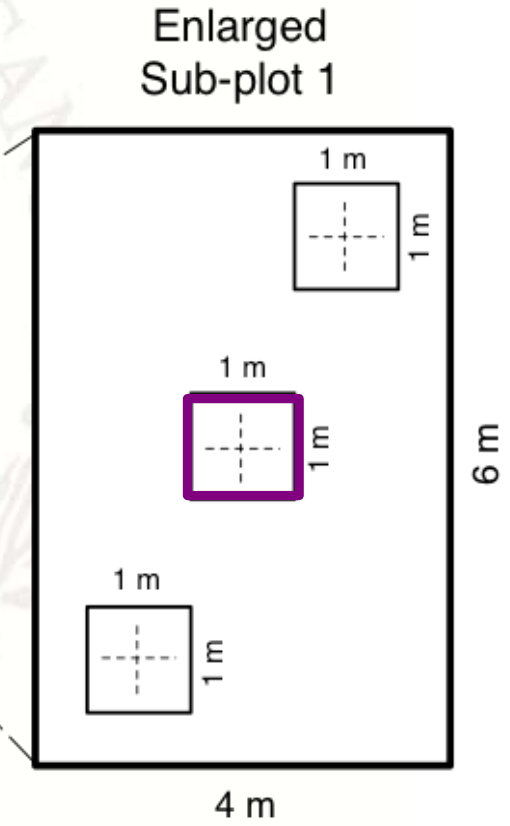




- This method is used to determine protective functions and to take note of evidence of surface soil erosion.
- This method records:
  - Forest floor cover
  - Gullies
  - Rills
  - Pedestals
  - Debris
  - And other material to protect soil of raindrop splash, flowing, etc.

Soil Erosion types

Photo Floor (Method 2)
Forest canopy and forest structure assessment (canopy structure from the ground, lower 80 cm).

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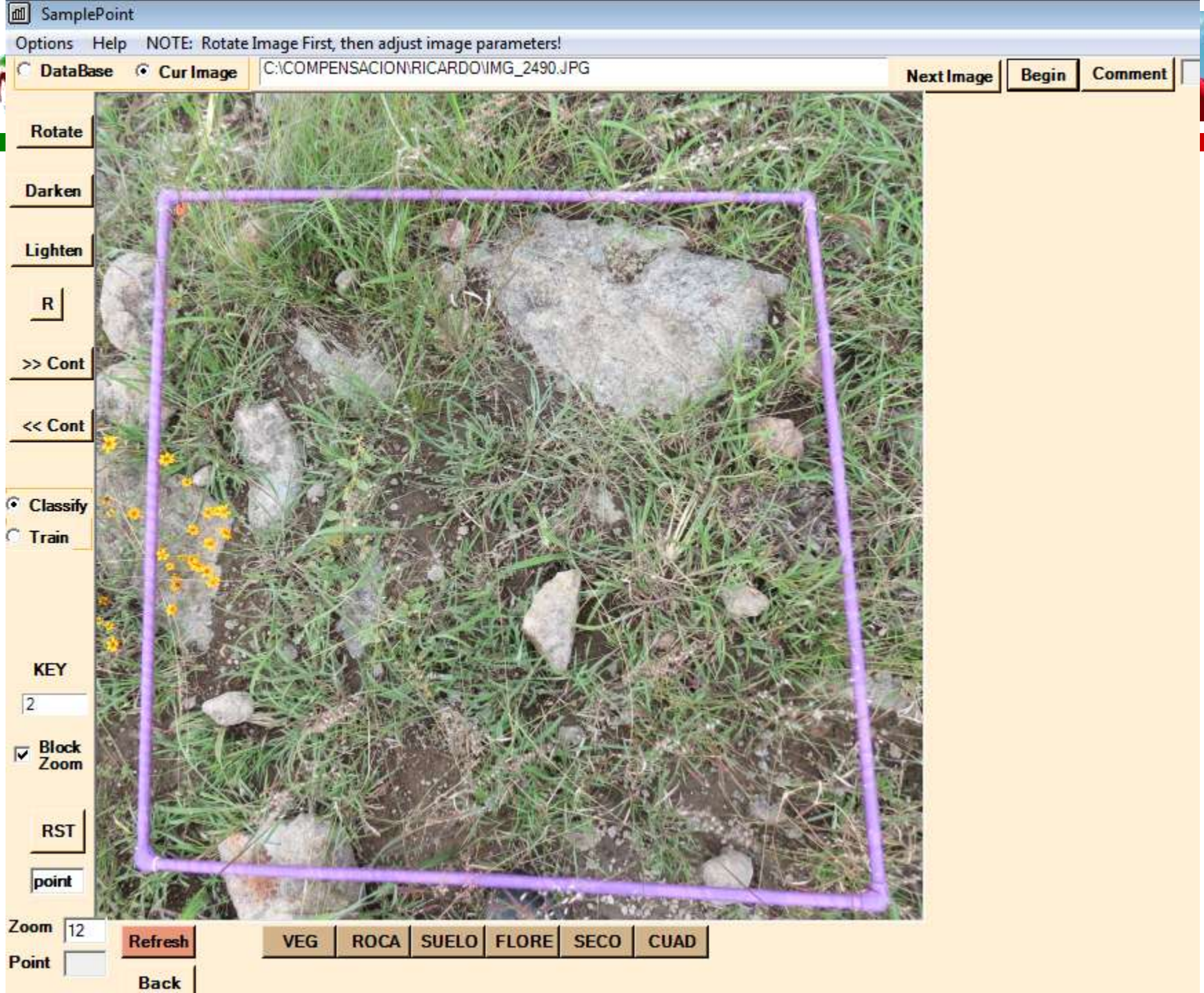
SamplePoint
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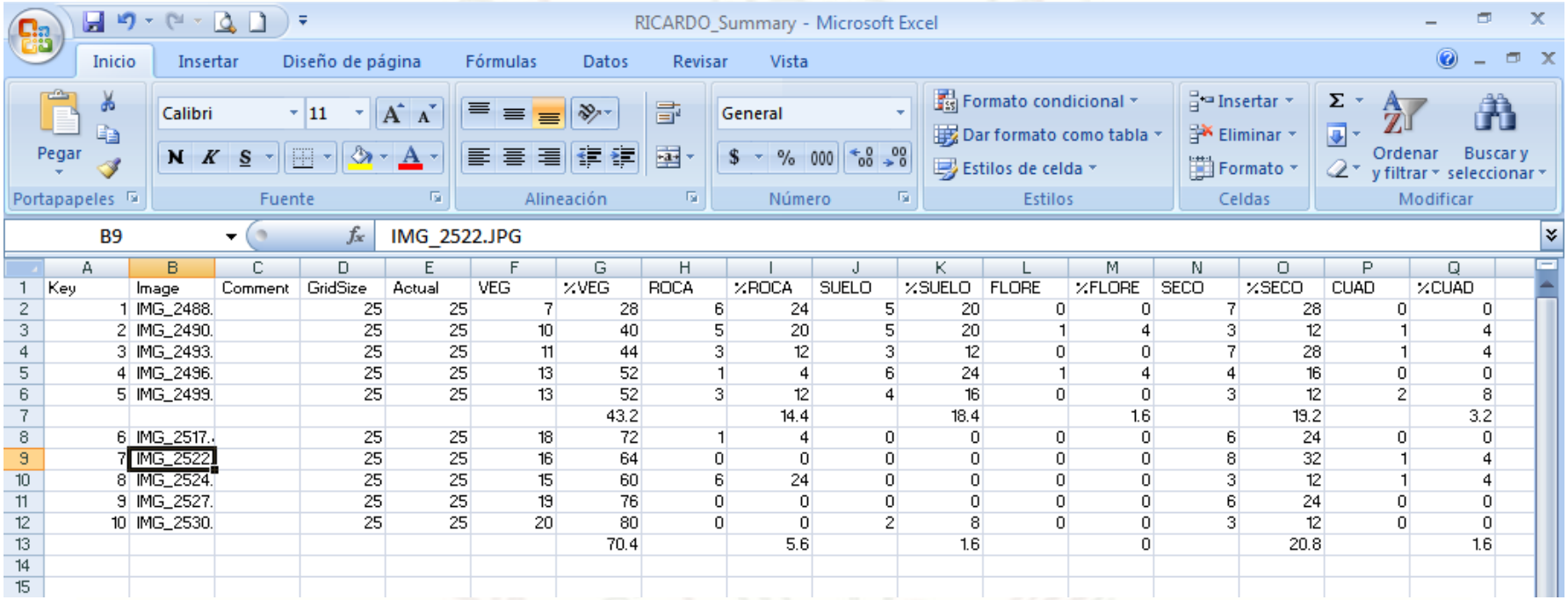
Sample Point results



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2	1	IMG_2488.		25	25	7	28	6	24	5	20	0	0	7	28	0	0
3	2	IMG_2490.		25	25	10	40	5	20	5	20	1	4	3	12	1	4
4	3	IMG_2493.		25	25	11	44	3	12	3	12	0	0	7	28	1	4
5	4	IMG_2496.		25	25	13	52	1	4	6	24	1	4	4	16	0	0
6	5	IMG_2499.		25	25	13	52	3	12	4	16	0	0	3	12	2	8
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8	6	IMG_2517.		25	25	18	72	1	4	0	0	0	0	6	24	0	0
9	7	IMG_2522		25	25	16	64	0	0	0	0	0	0	8	32	1	4
10	8	IMG_2524.		25	25	15	60	6	24	0	0	0	0	3	12	1	4
11	9	IMG_2527.		25	25	19	76	0	0	0	0	0	0	6	24	0	0
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13							70.4		5.6		1.6		0		20.8		1.6
14																	
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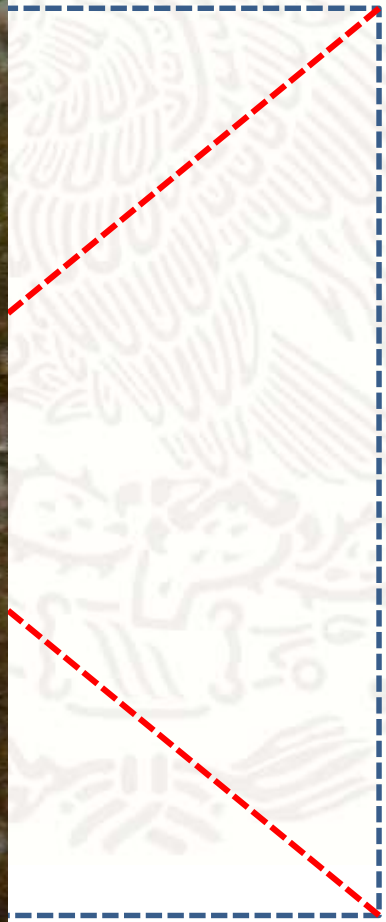
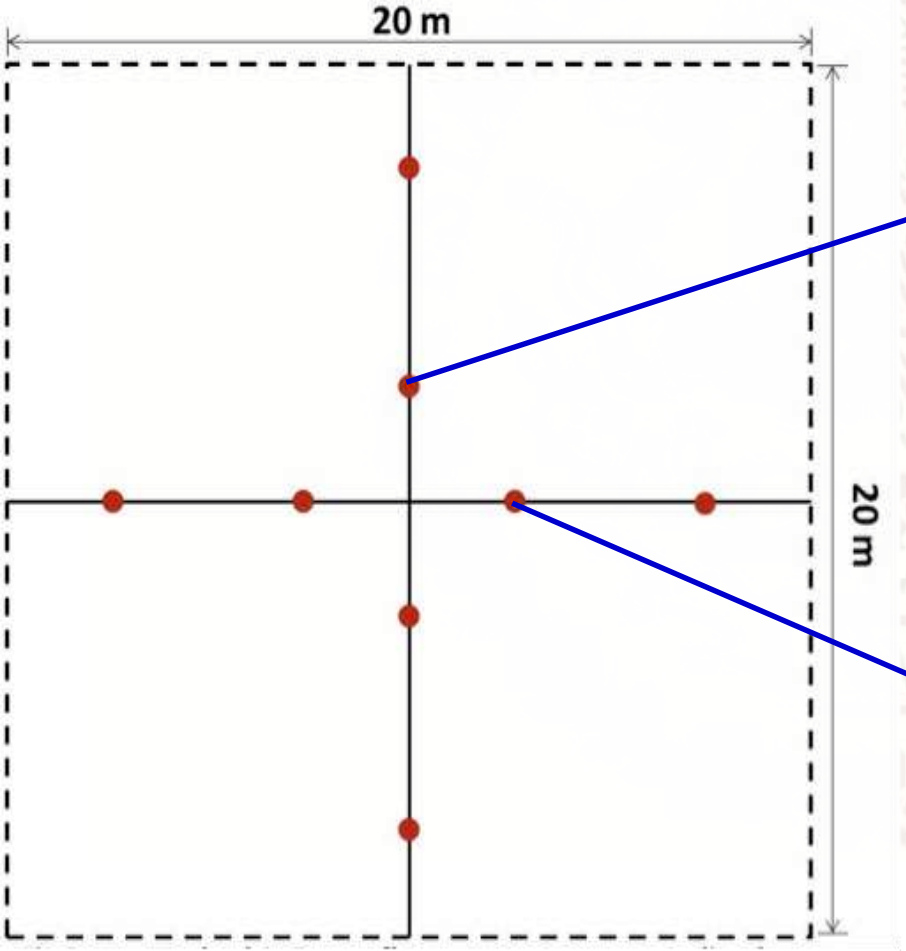
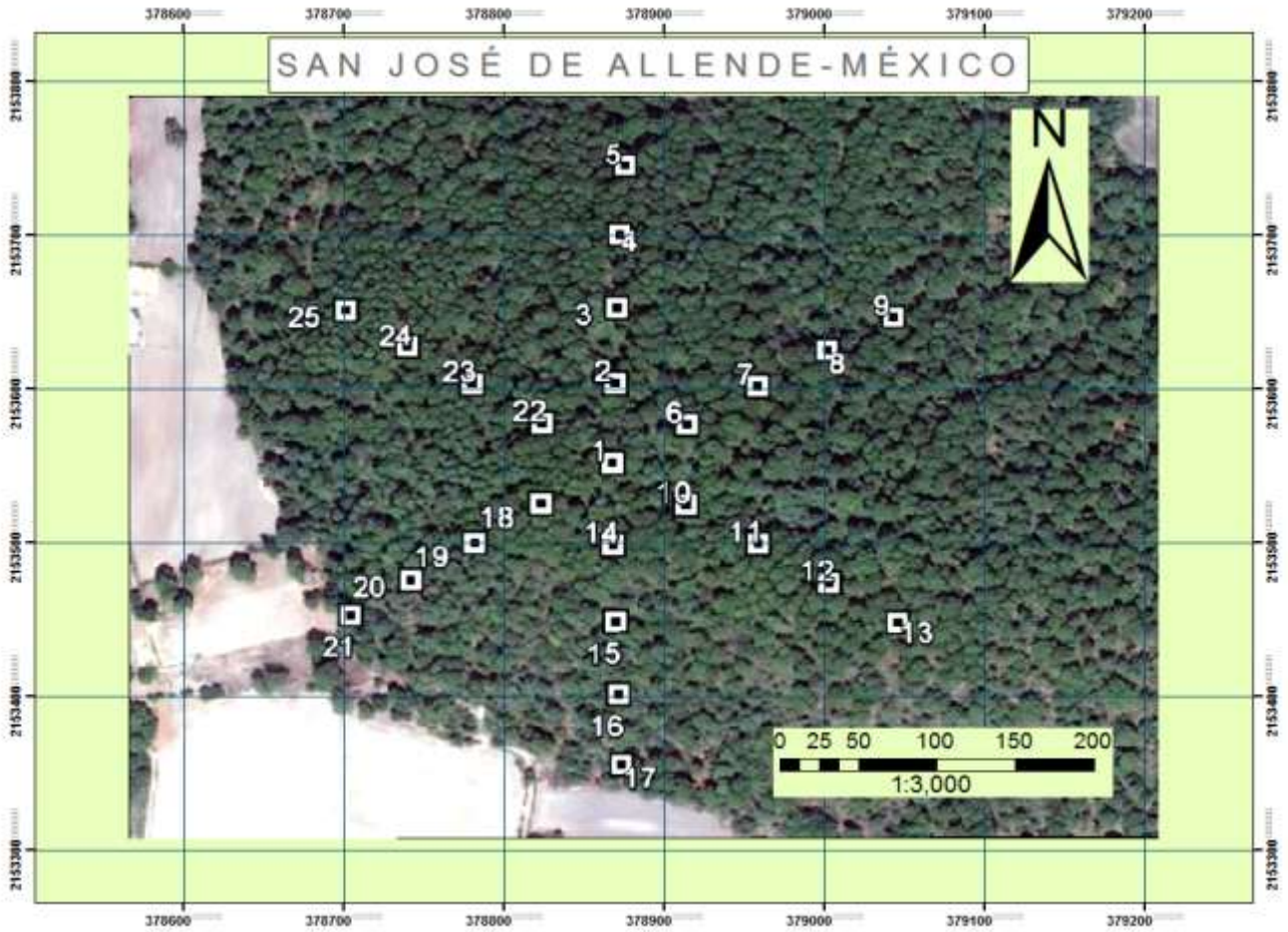
Method 4 (Densitometer)
Line-point transect method of sampling



Method 3
Biomass quantity (dry matter)



Sample design



25 plots at 50m of long distance. Sampling total area is of 12.56 hectars.

Sites

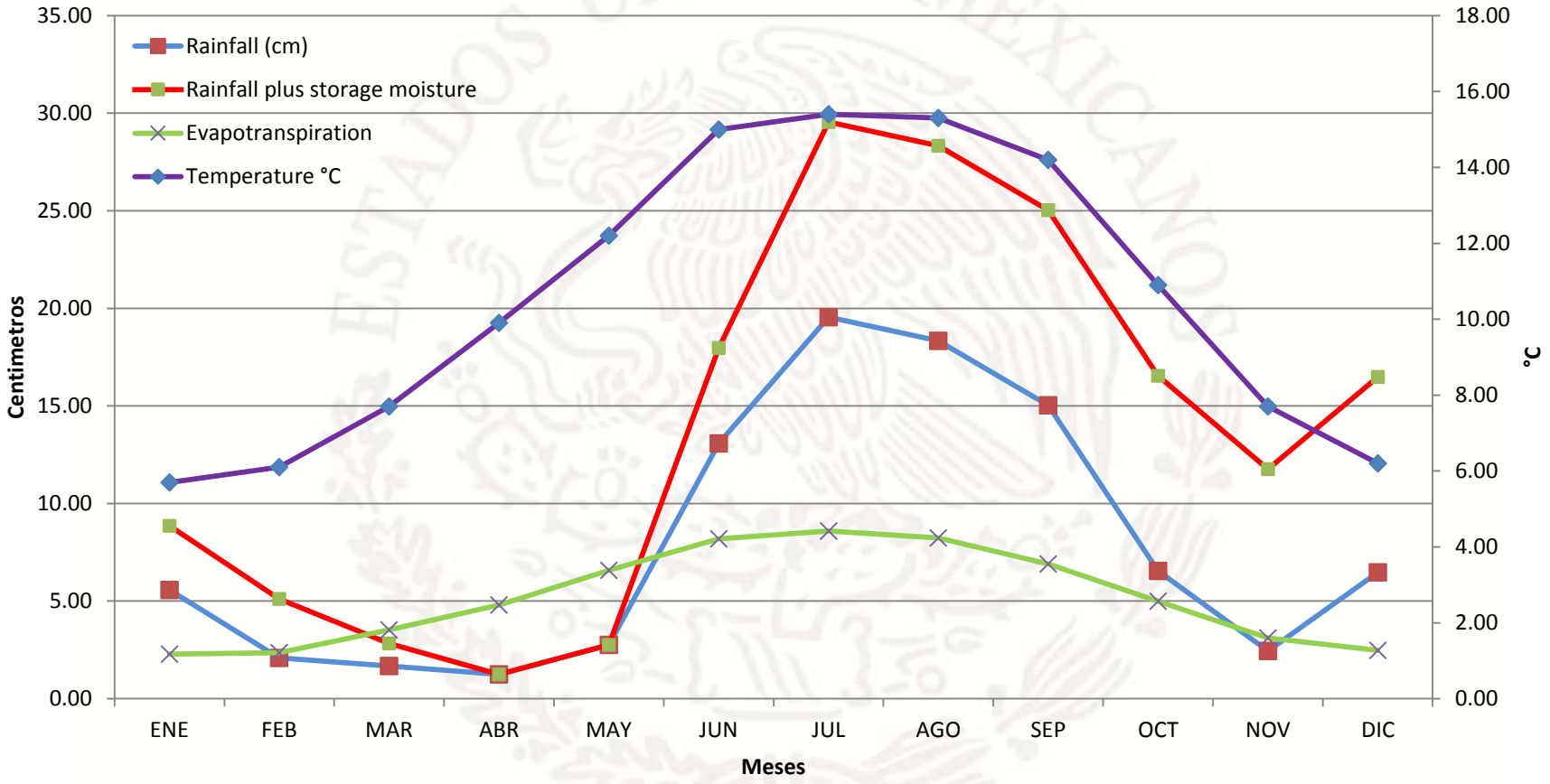

Temperate forest (Pine)
bushland
Tropical deciduos forest
Temperate forest (Abies)
México City
Crassulasian Srhubland
Tropical perennial forest

Sites

Parameter	Temperate		Tropical		Arid Land	
	Molinillos; Durango	Estado de México	Tomatlán, Jalisco	Selva Lacandona	Altiplano Potosino	Tehuacán, Puebla
Structure	Trees, Shrub and herbs	Trees, Shrub and herbs	Trees, Shrub and herbs	Trees, Shrub and herbs	Shrubs (short), herbs	Shrubs (tall), herbs
Vegetation type	Oak –Pine Forest	Oak –Pine and douglas fir, Forest	Tropical deciduos forest	Tropical perennial forest	Chaparral	Shrubland
Dominant species	Pinus sp, Quercus sp.	Pinus sp, Quercus sp., Abies sp.	Cordia elaeagnoides, Enterolobium cyclocarpum	Swietenia sp. Terminalia sp	Larrea tridentata y Lophophora Williamsii	Bursera sp. , Acacia sp., Cactaceae family
Canopy cover	30-70	40-80	80-90	80-90	0	0
basal area m2/ha (not for specific site)	10.25	36.91	18.69	3.88	-	11.13
Management	Forest production management	Conservation	Rangeland	Conservation	Conservation	Conservation
Soils	Feozems	Andosoles	Regosoles	Ultisoles	Calcisoles	Regosoles

Temperate Forest (Molinillos, Durango, México)

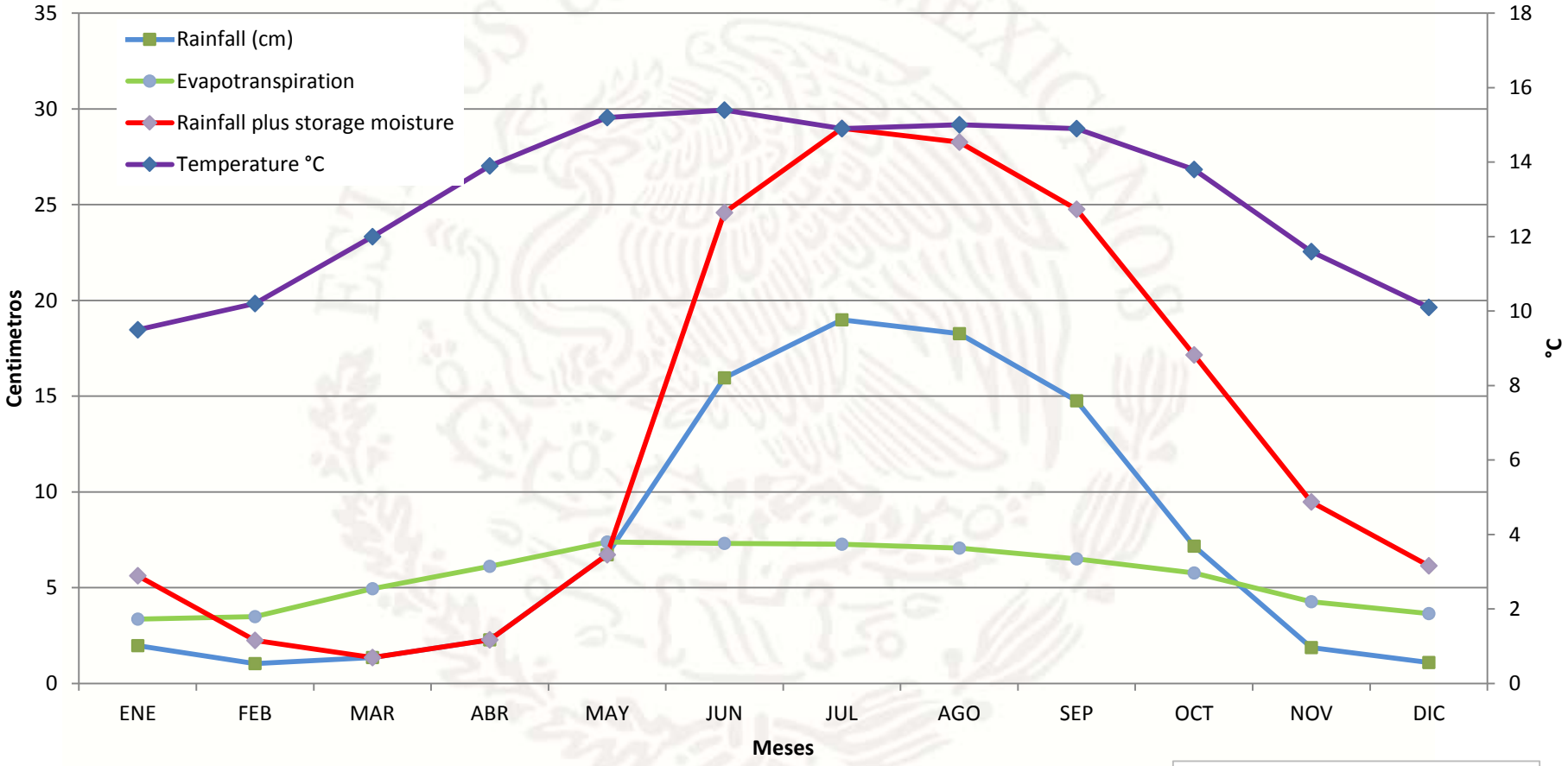
Climograma de El Salto, Estado de Durango



Dias humedos: 300

Temperate forest (humid) Villa Victoria, Estado de México, México.

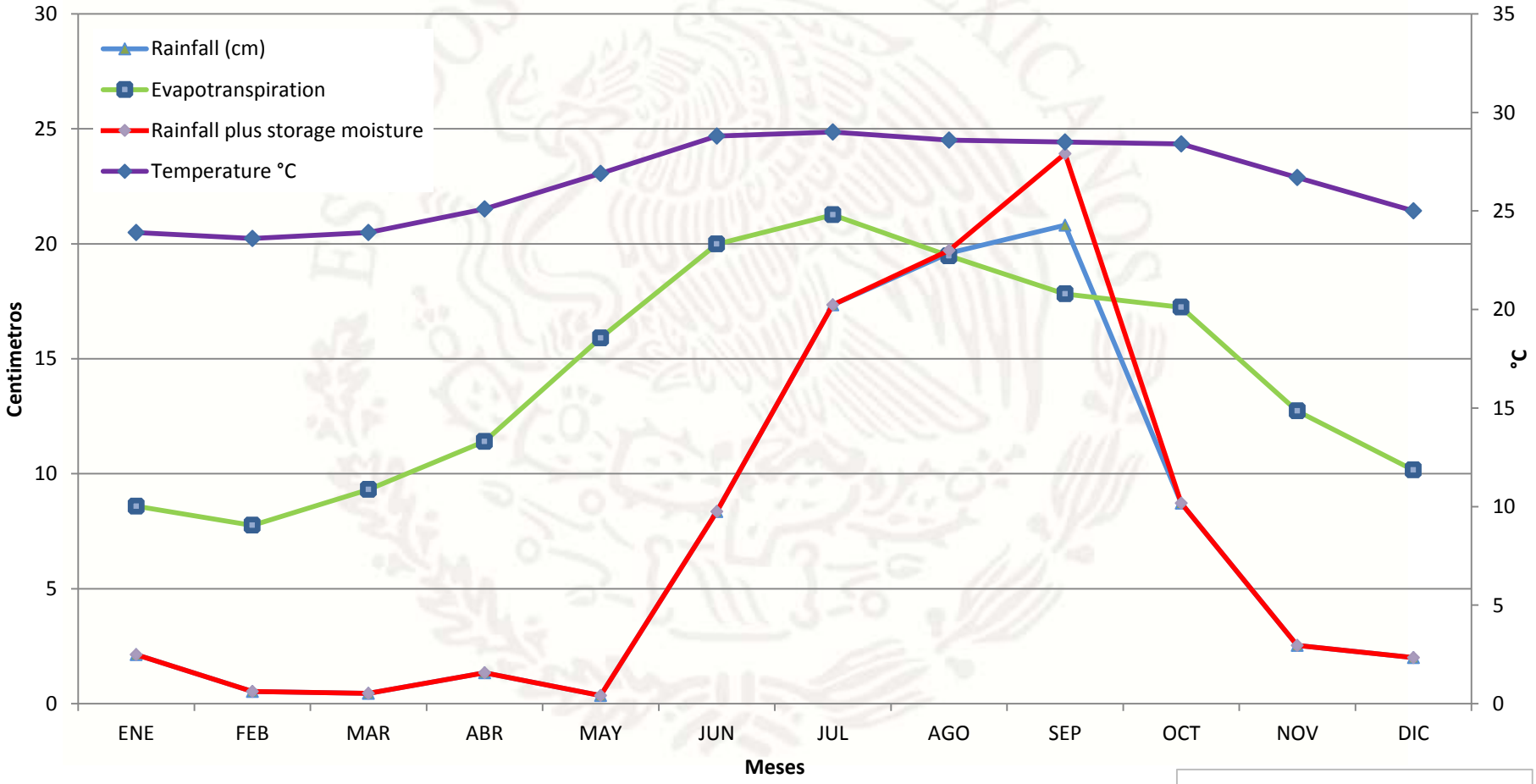
Climograma de Villa Victoria, Estado de México



Dias humedos: 270

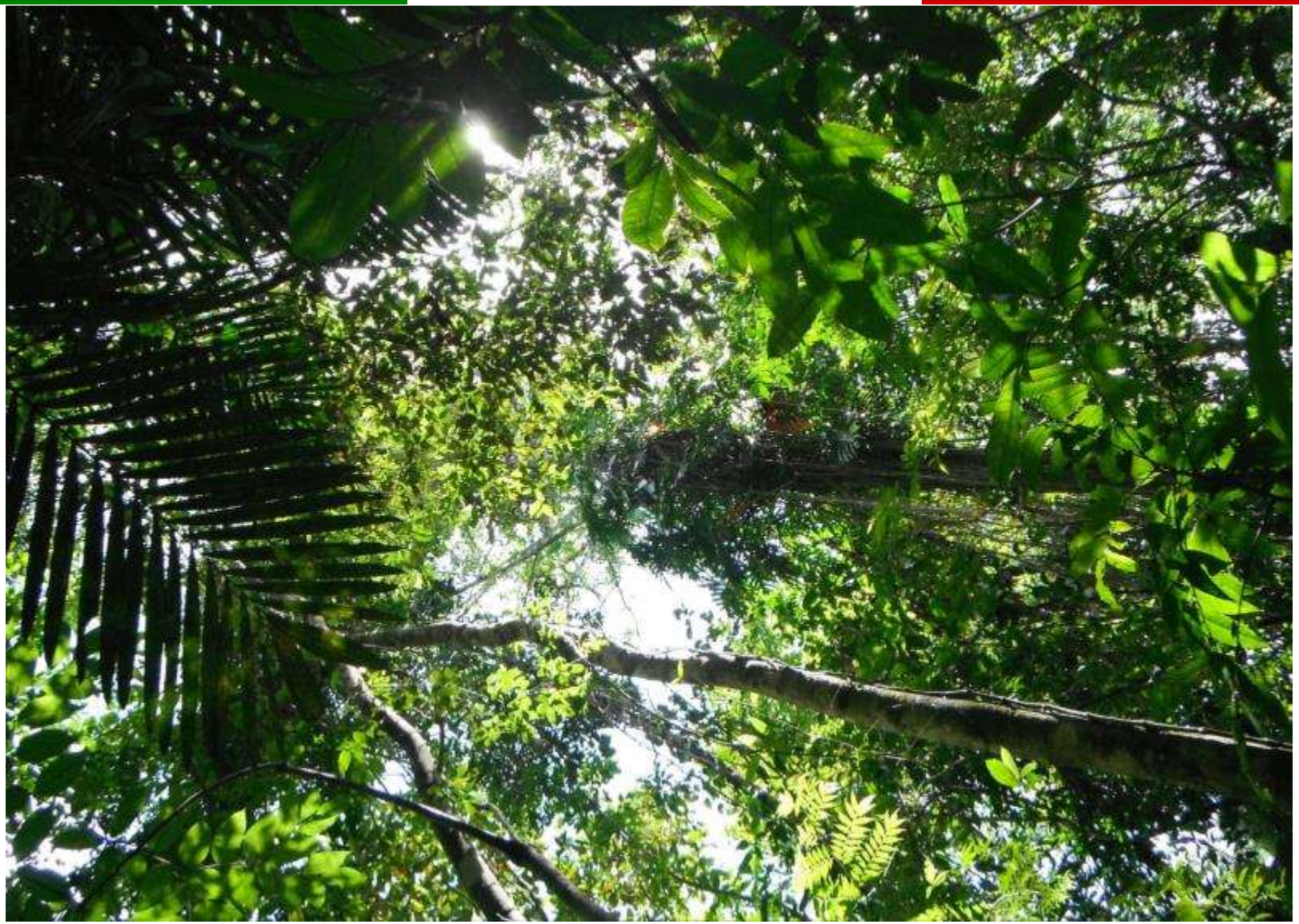
Tropical deciduos forest

Climograma de Tomatlán, Estado de Jalisco.

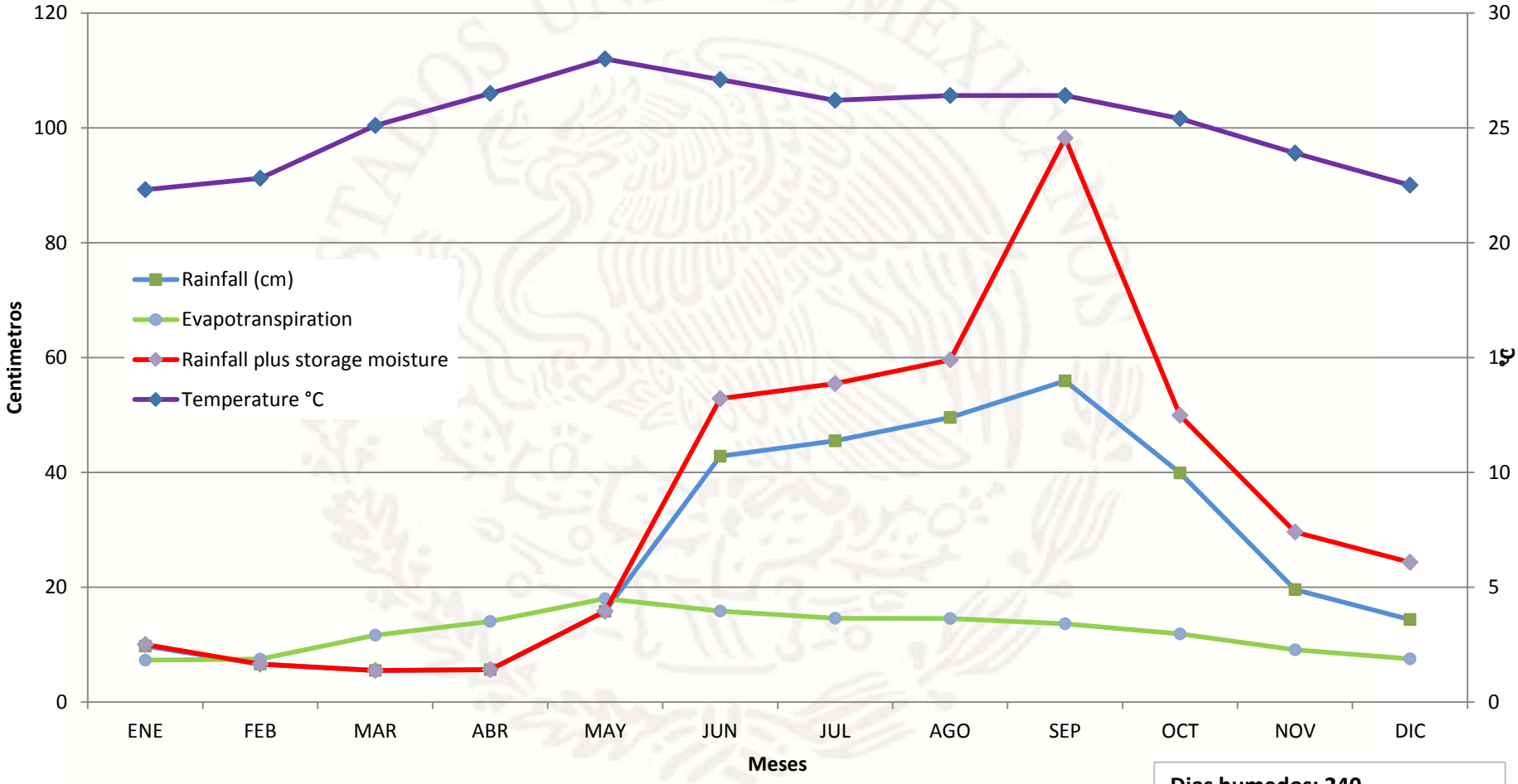


Dias humedos: 60

Tropical perennial forest



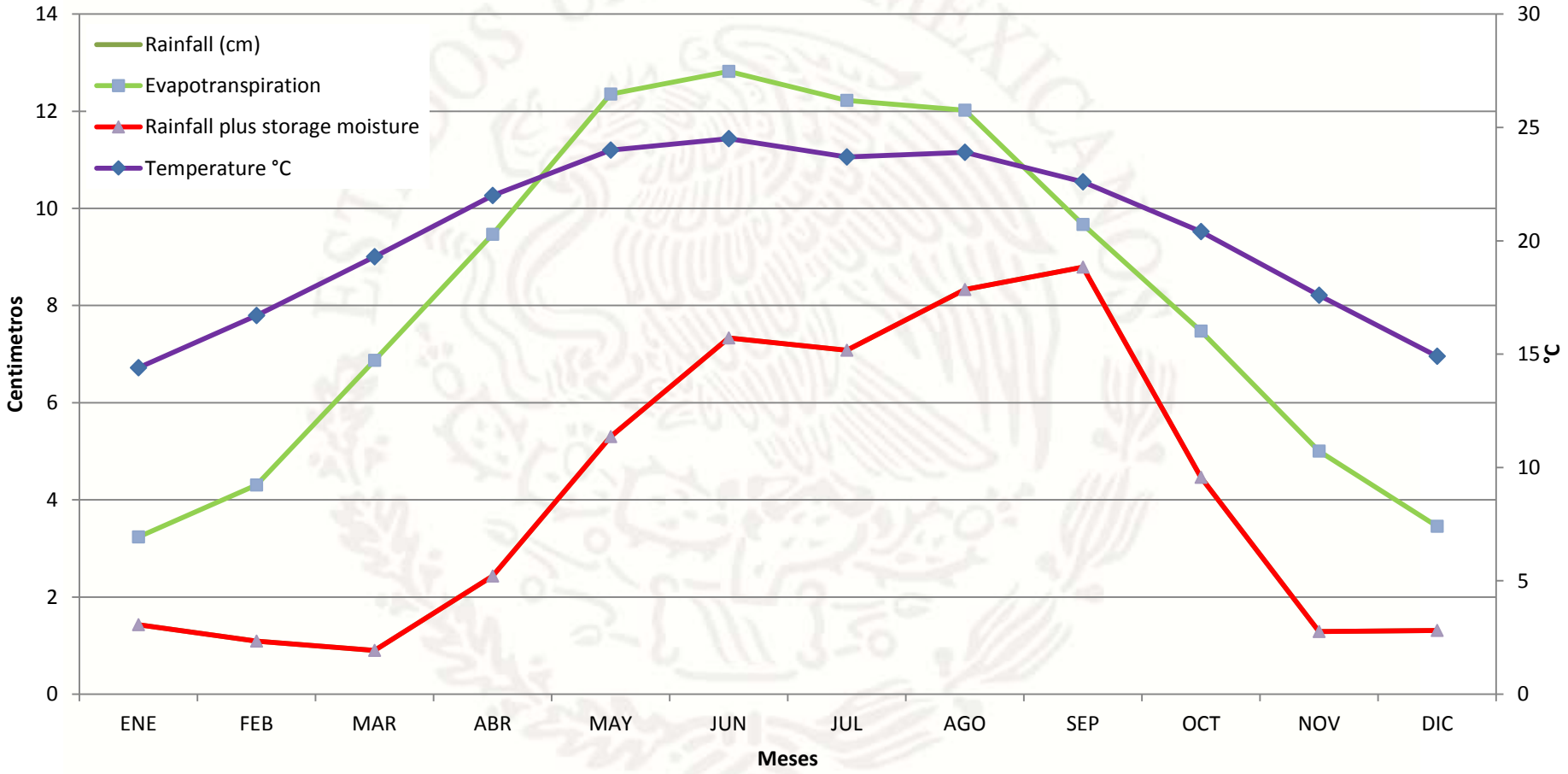
Climograma de Chajul, Estado de Chiapas



Dias humedos: 240

Arid Vegetation (*Larrea tridentata*)

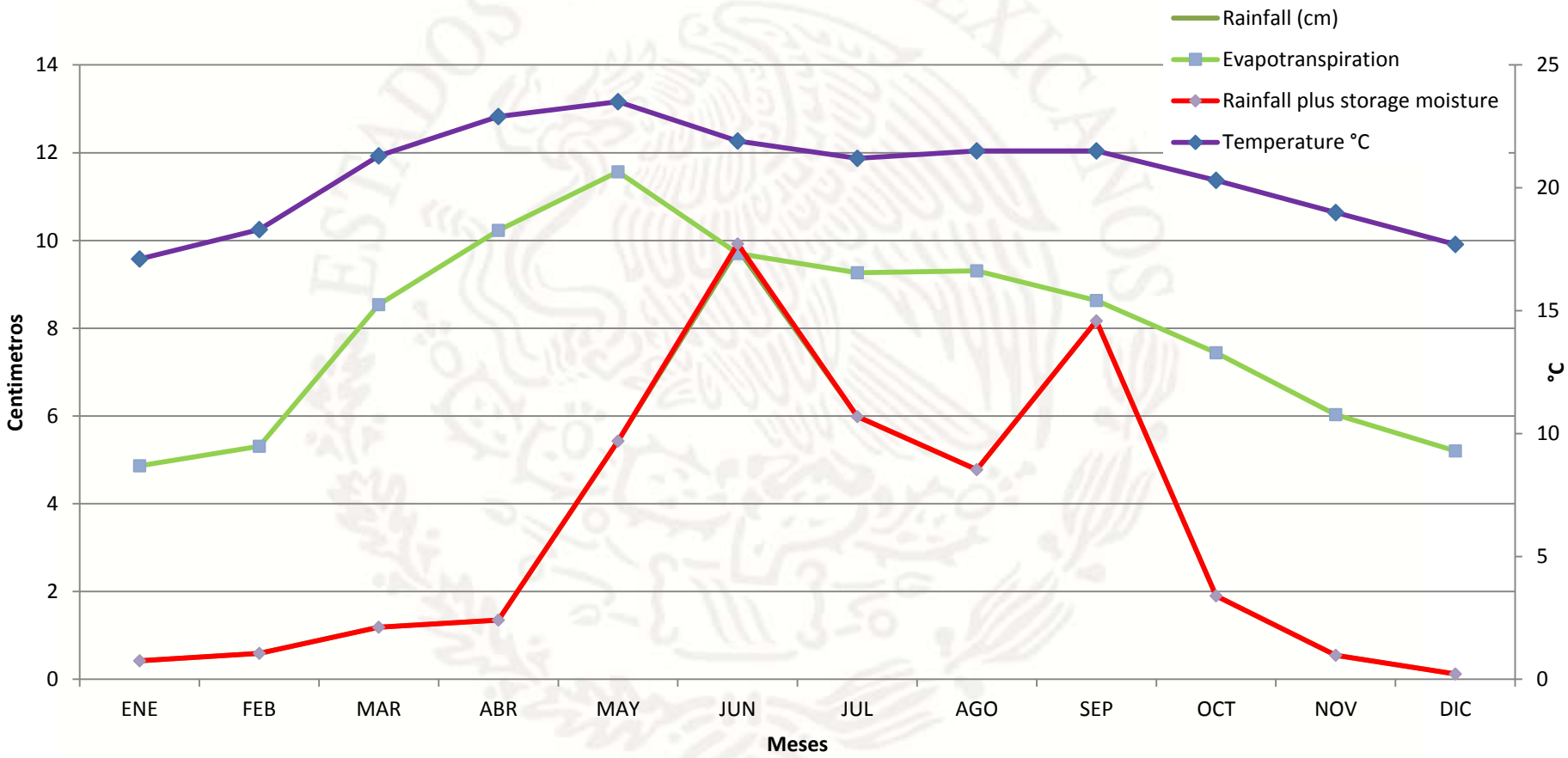
Climograma de Matehuala, S.L.P.



Dias humedos: 0

Semiarid vegetation (Crassulasian plants)

Climograma de Zapotitlán de Salinas, Puebla



Dias humedos: 30

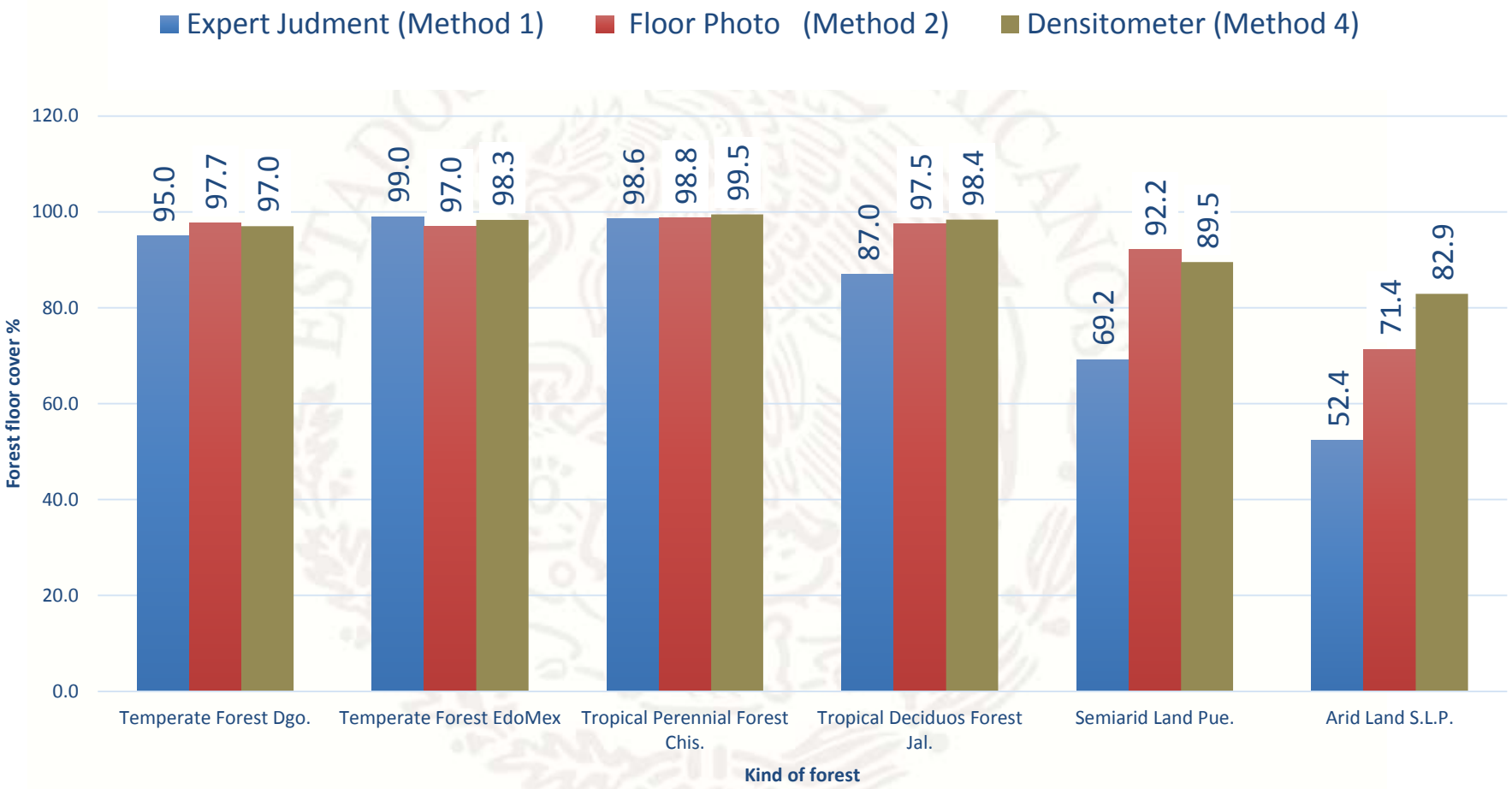
Materials


Results

Analysis of variance (Floor Cover Percent)

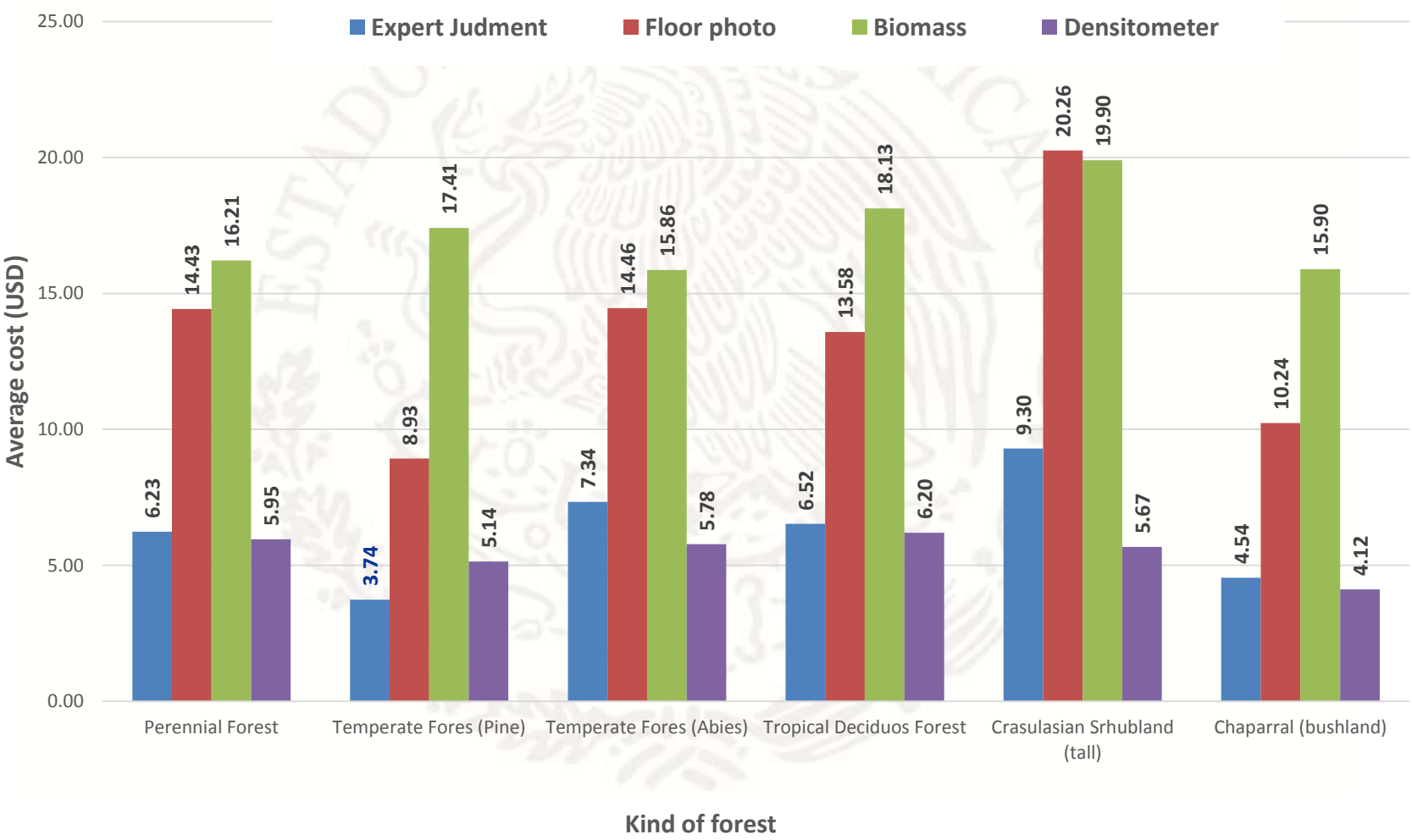
- The analysys of variance showed significative difference only on 3 of the 6 sites.
- The sites with significative difference between methods are:
  - Real de Catorce, SLP (Chaparral, bushland, *Larrea tridentata*)
  - Tomatlán, Jal. (Tropical deciduos forest)
  - Zapotitlán, Pue. (Crassulasian Srhubland)
- In temperate forest and tropical perennials forest, the method are not significantly different, at α =0.05.
- It isn't posible to compare biomass method vs others, because it doesn´t measure the same factor.

% of forest floor cover measure by differents methods

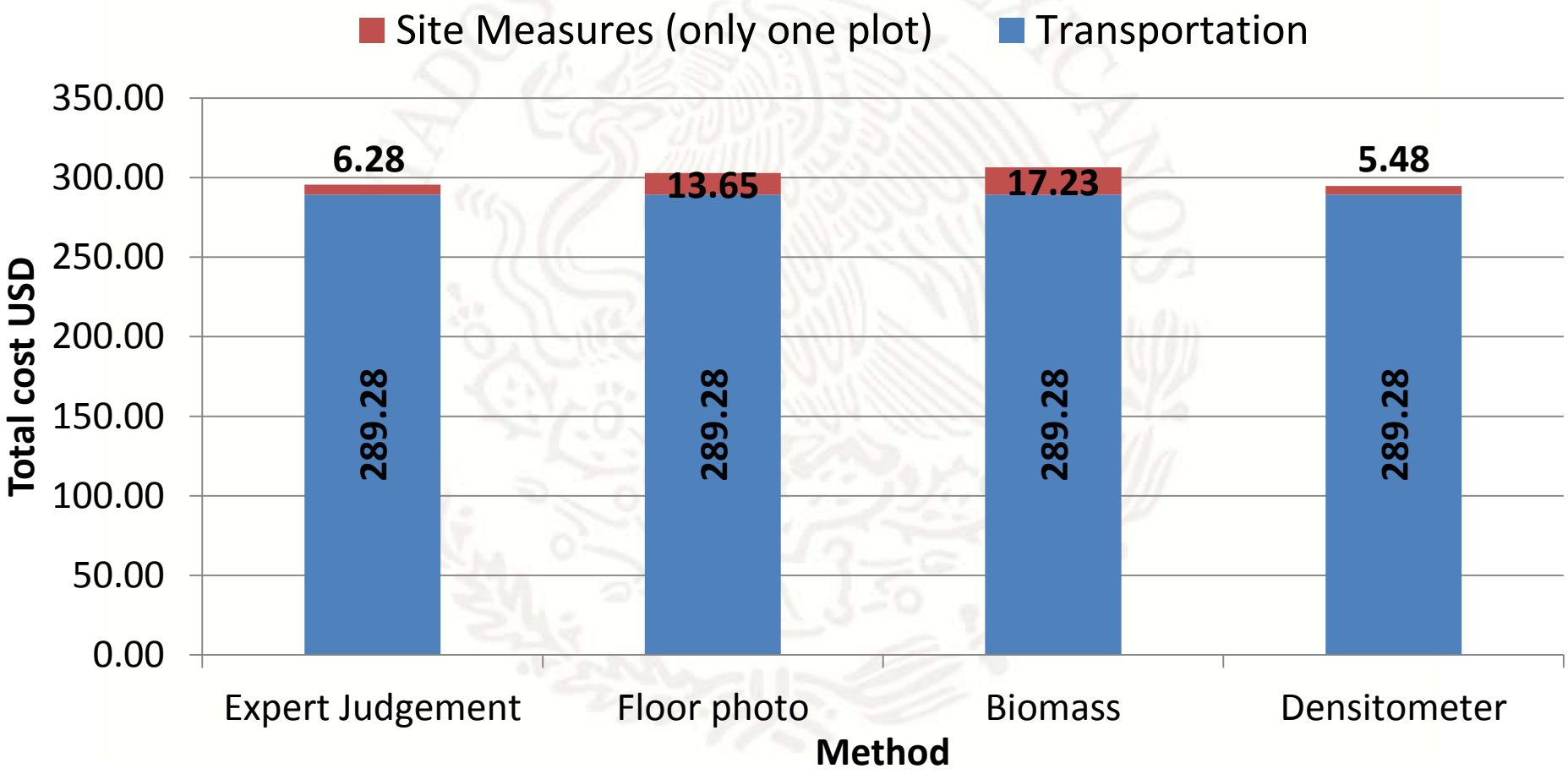


Analysis of variance (Cost)

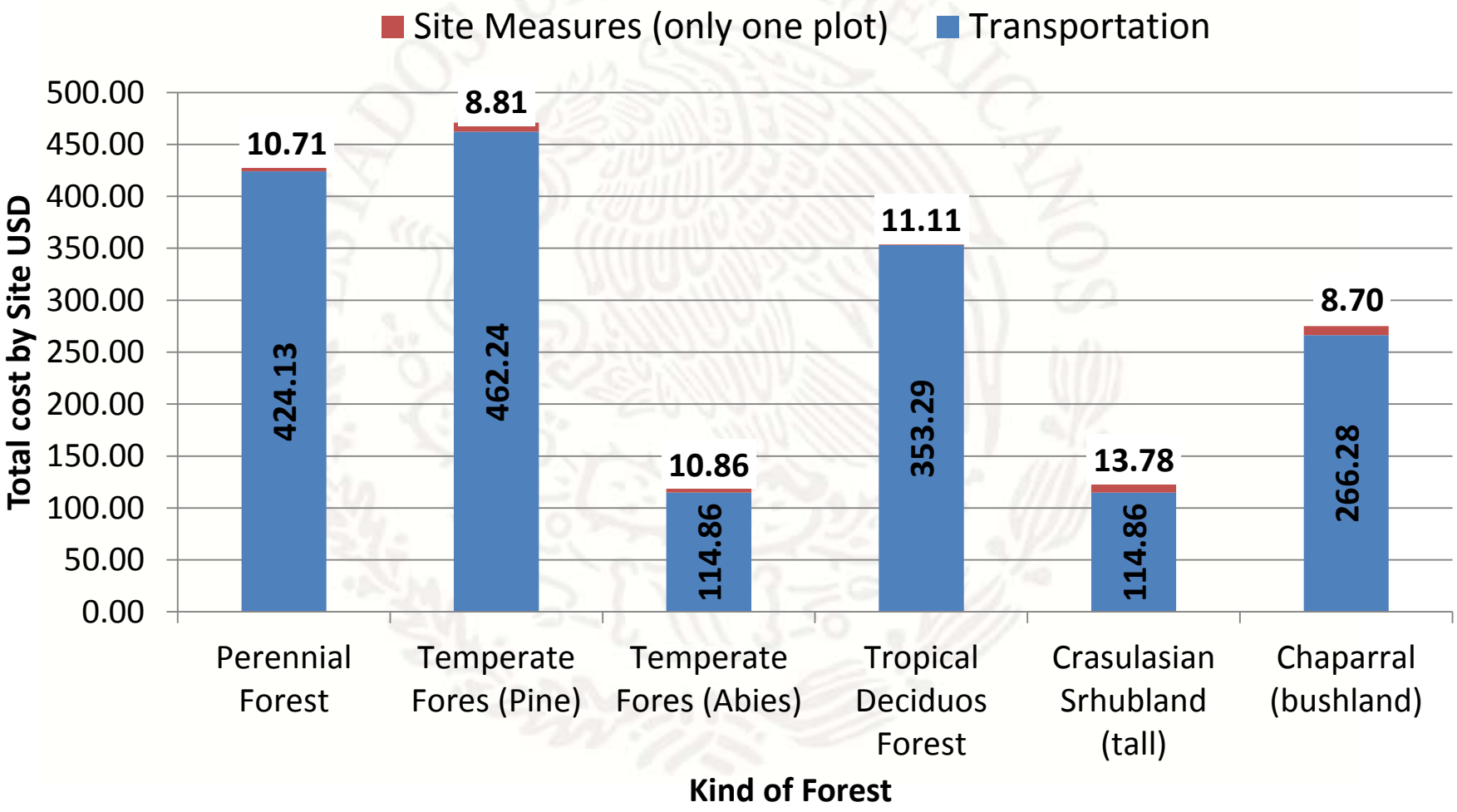
- The analysis of variance showed significative difference in all methods.
- Expert judment and Densitometer are not significantly different, only in one site (Abies forest) are different.
- The cheapest method was Densitometer (Method 4), and the most expensive method was biomass.


Average cost (USD) for diferent method to evaluate forest soil cover
Expert Judment
Floor photo
Biomass
Densitometer
25.00
20.00
15.00
10.00
5.00
0.00
Average cost (USD)
6.23
14.43
16.21
5.95
3.74
8.93
17.41
5.14
7.34
14.46
15.86
5.78
6.52
13.58
18.13
6.20
9.30
20.26
19.90
5.67
4.54
10.24
15.90
4.12
Perennial Forest
Temperate Fores (Pine)
Temperate Fores (Abies)
Tropical Deciduos Forest
Crasulasian Srhubland (tall)
Chaparral (bushland)
Kind of forest

Average total cost per method



Total cost by site



Conclusions

- The best methods to measure forest floor cover was Densitometer (Method 4) and Floor Photo (Method 2).
- The cheapest method was densitometer.
- Expert Judment is the most subjetive, and it depends too much for the people experience and criteria.
- The most expensive thing is the travel to arrive at the site, so we need to collect the most data as posible.

Recomendations

- We think that is good mixed the densitometer and photo floor method, and add biomass.
- Reduce de number of samples for the biomass method.
- Cuantify the litter layer width.
- Correlated the forest floor cover with measures variables in the Forest National Inventory

- It’s a good method for evaluate forest restauration process.

Next steps

- Mexico's National Forest Inventory, is going to measure forest floor cover and erosion evidence in about 6,000 sites.

- Mexico's National Forest Inventory, is going to take soil samples at different deep in about 1,000 sites.

Acknowledgements

- Japan Goverment, Forestry Agency, for found and advice the study.
- Food and Agriculture Organization, by select to Mexico, found and advice.
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Thanks