Fire history in Mexican conifer forest (A study case)

UANL
UNIVERSIDAD AUTÓNOMA DE NUEVO LEÓN

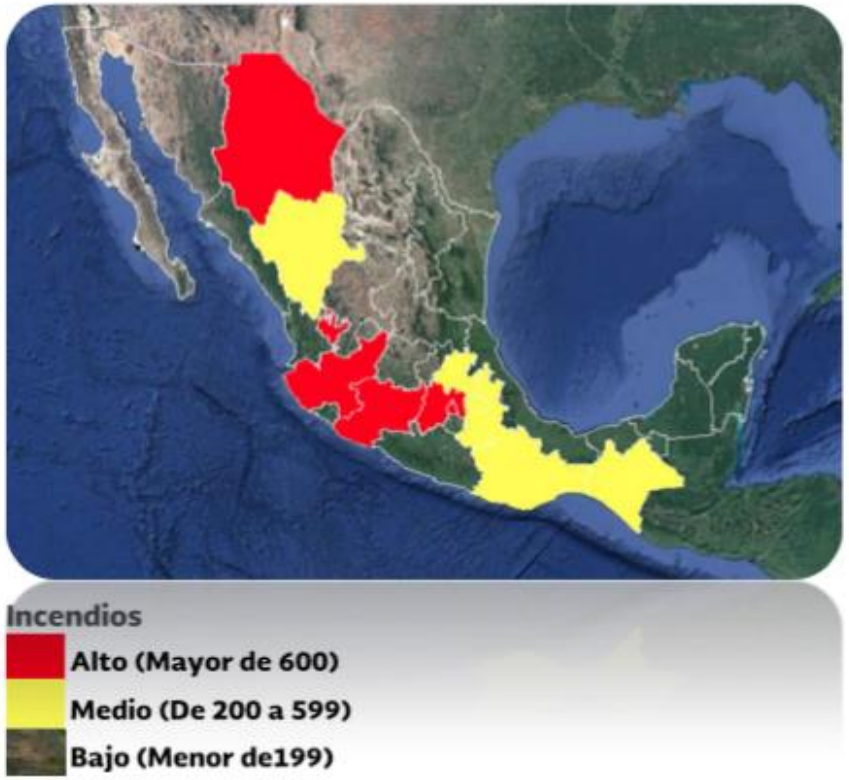
Marco Aurelio González Tagle
Marco.gonzaleztg@uanl.edu.mx

Overview

1. Mexican fire statistics
2. Fire regime
3. Fire history methods
   - Fire scars
   - Comparison to records
4. Fire history results
5. Forest fuels complex
6. Impact of Forest management on fire behavior

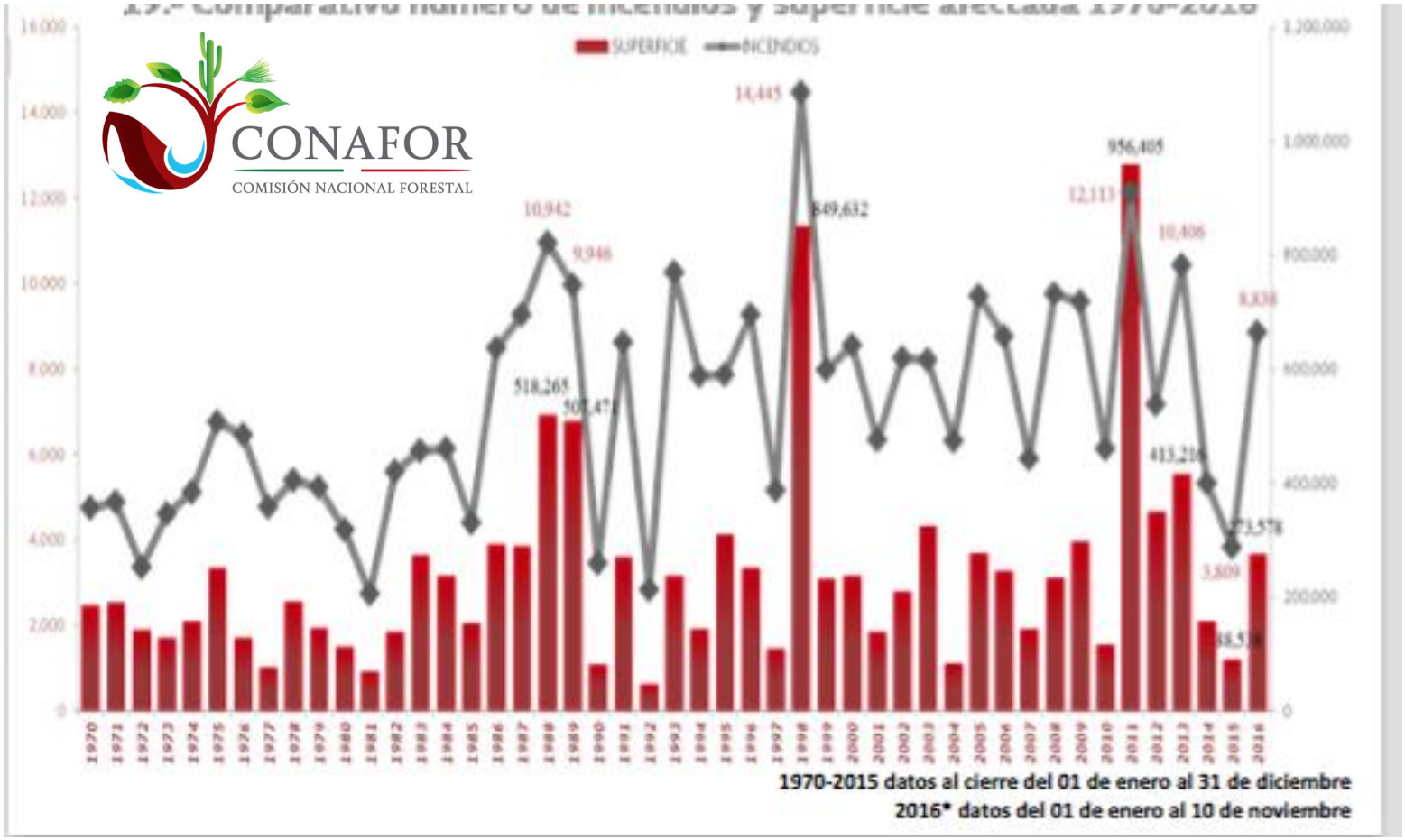
Fire Statistics in Mexico

- In 2016 more the 280,000 has affected
- Approx. 9000 fires across Mex.
- States > 600 forest fires (FF)
  - EDOMEX (1500 FF)
  - Jalisco (990 FF)
  - Chihuahua (900 FF)



Comisión Nacional Forestal [CONAFOR]. (2016). *Incendios forestales en México Temporada 2016*.

Future scenario



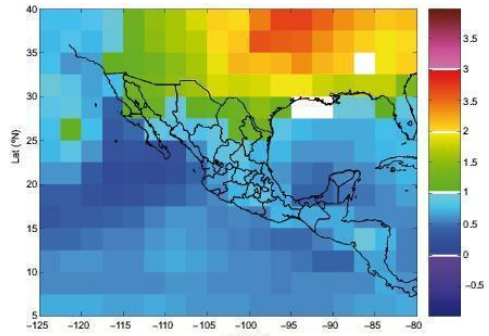
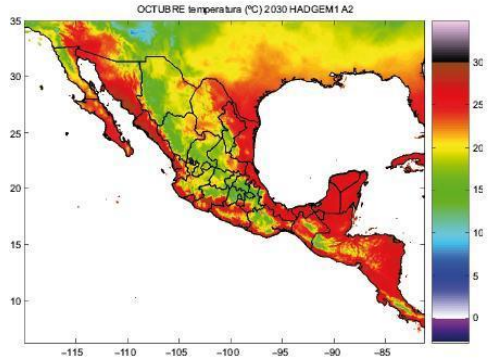


Fig. 2a. Differences in temperature (°C) for October, 2030. Model



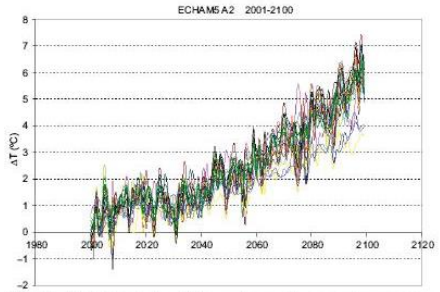
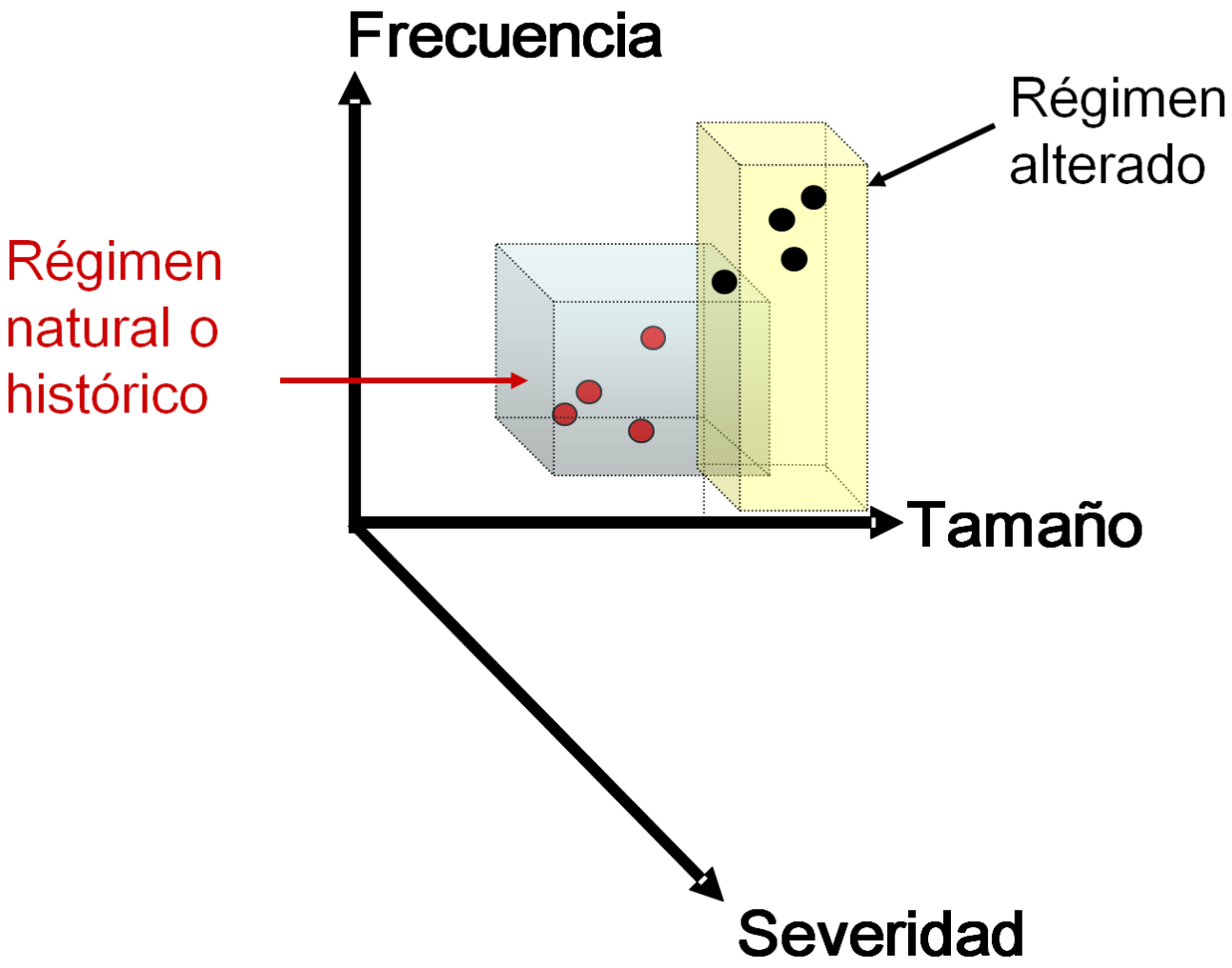


Fig. 2e. State-level simulations of annual average temperature (2001-2100), using ECHAM5 model and the A2 emissions scenario.

CONDE, C., ESTRADA, F., MARTÍNEZ, B., SÁNCHEZ, O., & GAY, C.. (2011). Regional climate change scenarios for México. *Atmósfera*, *24*(1), 125-140.

Fire Regimes



Fire Regimes

Historical Severity	Historical Mean Fire Interval (yr)		
	0-35	35-200	200+
Low & Mixed	I	III	V
Replacement	II	IV	

Illustration of the relationship between fire frequency and fire severity in the fire regime groups. Taken from Barret *et al*., 2010.

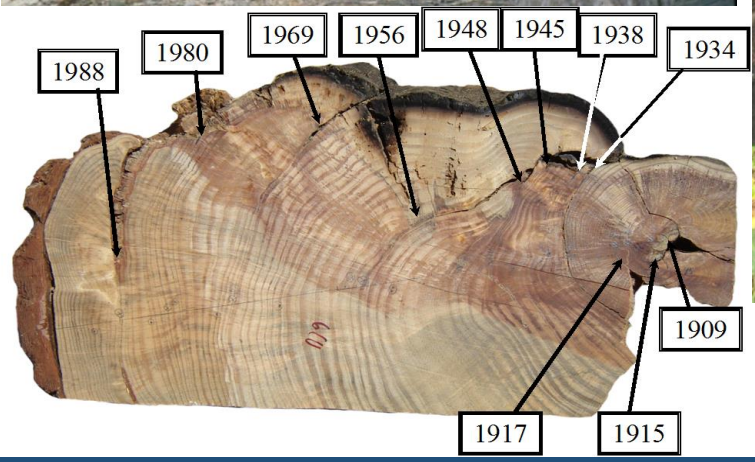
Fire History Methods

Fire scars: common technique in surface-fire ecosystems

Advantages: exact dates (even season of fires), location of scarred trees.

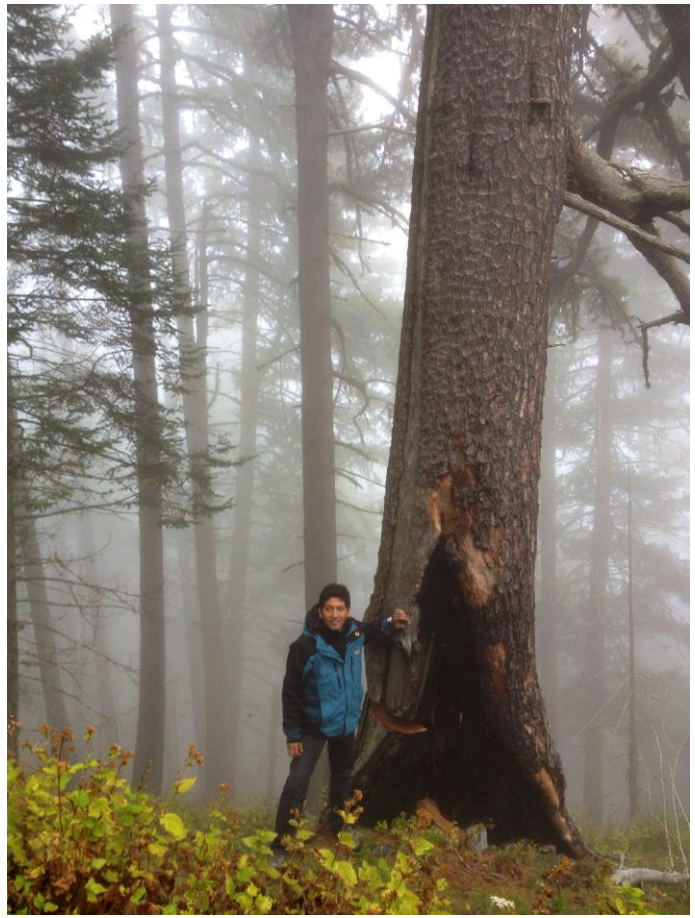
Disadvantages: can’t map fire perimeter, absence of scars ≠ absence of fire.

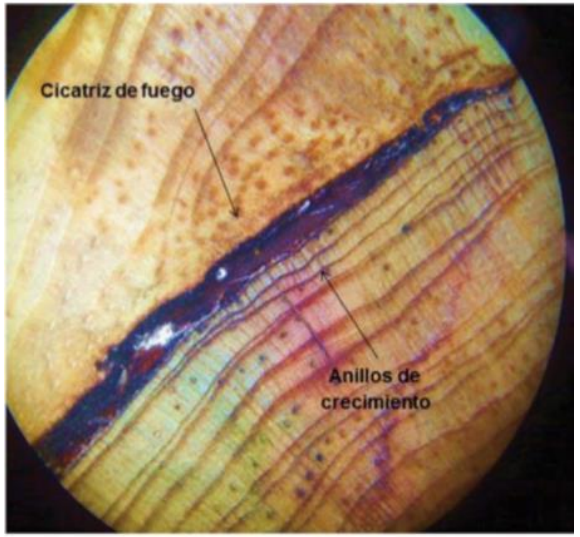
Sequential process of the formation of fire scars

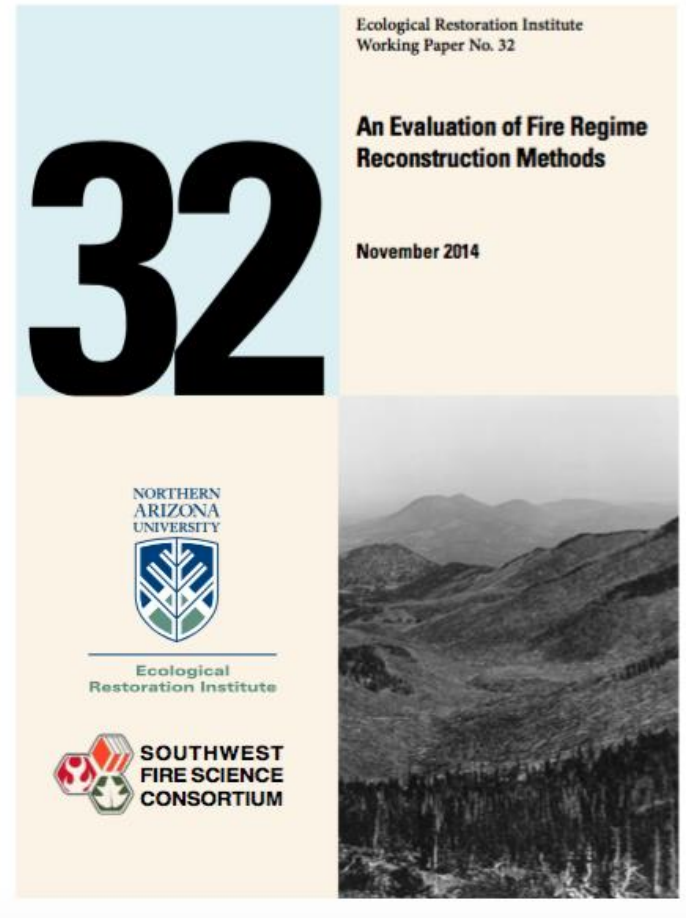


Ávila Flores, D. Y., **González Tagle, M. A.**, Jiménez Pérez, J., Aguirre Calderón, O. A., Treviño Garza, E. J., & Vargas Larreta, B. (2014). Dendrochronopyrology : analysis of the morphological evidence of forest fires. *Revista Mexicana de Ciencias Forestales*, *5*(21), 136–147.

Fire scars evaluation



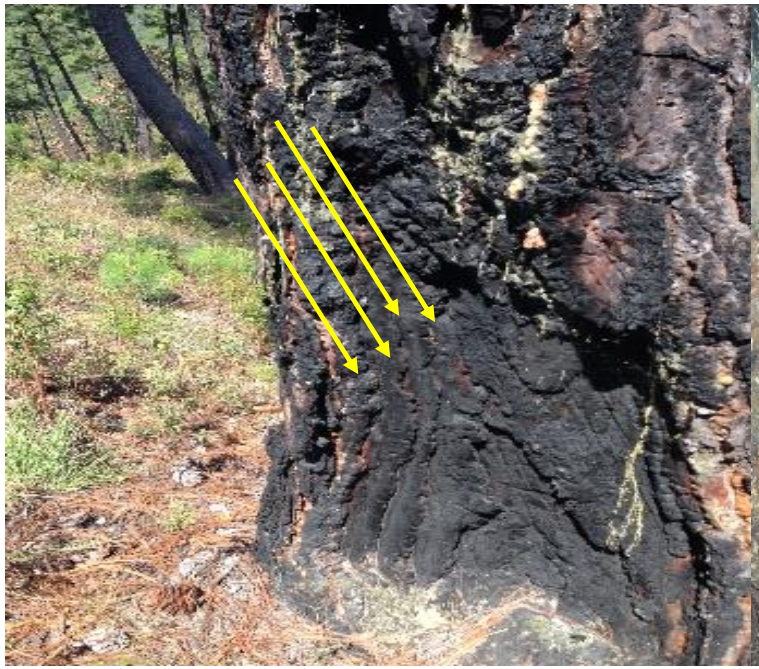




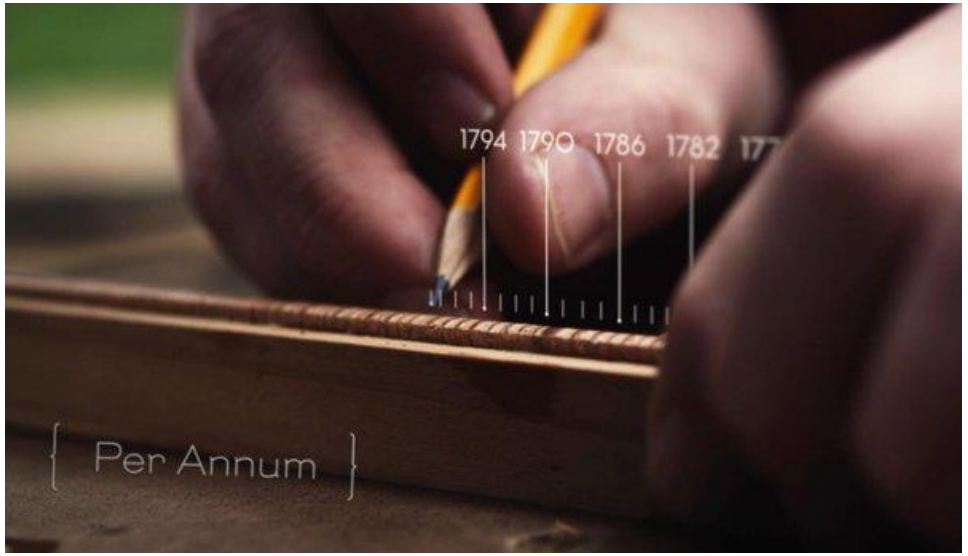
Baker, W. L., & Dugan, A. J. (2013). Fire-history implications of fire scarring. *Canadian Journal of Forest Research*, *43*(10), 951–962. JOUR. https://doi.org/10.1139/cjfr-2013-0176

Fire scars sample extraction

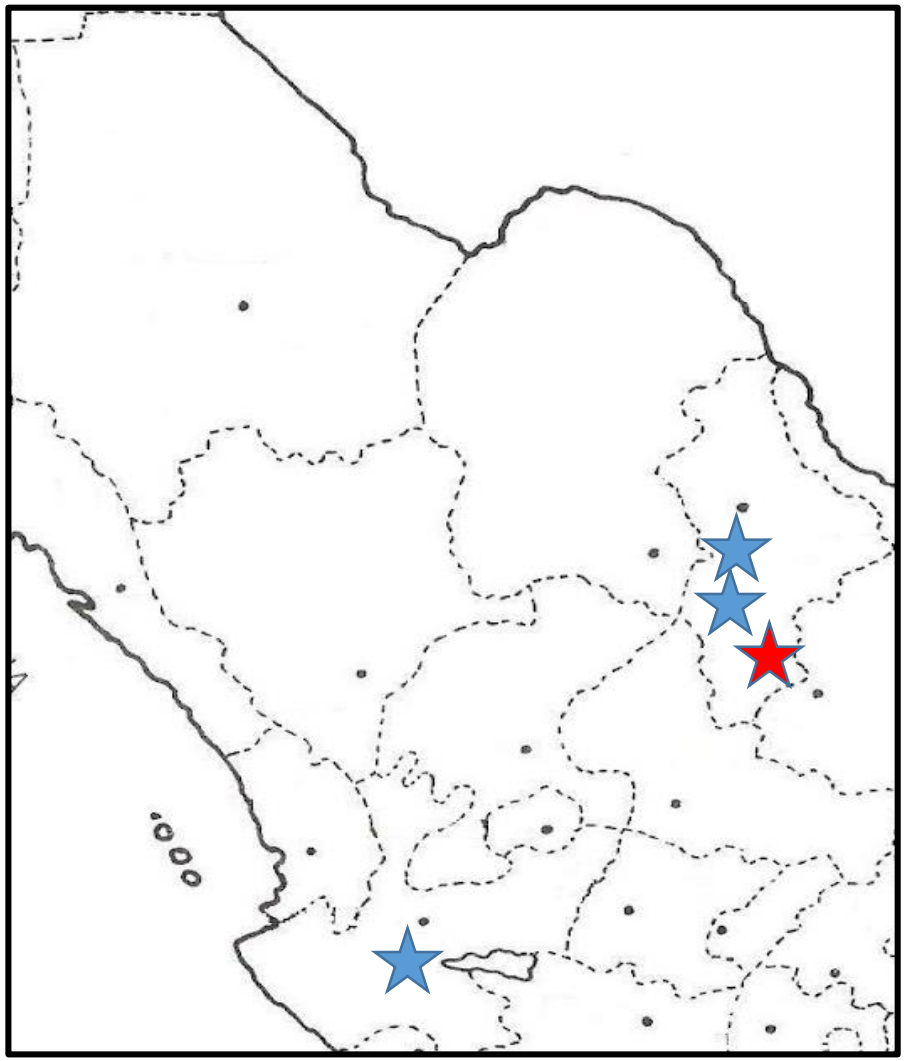
- Search for fire scarred tree samples
- Cut a sample of a scarred tree
- Identification for later work at lab



Laboratory work



Reconstructed Fire Regime



★ Study sites

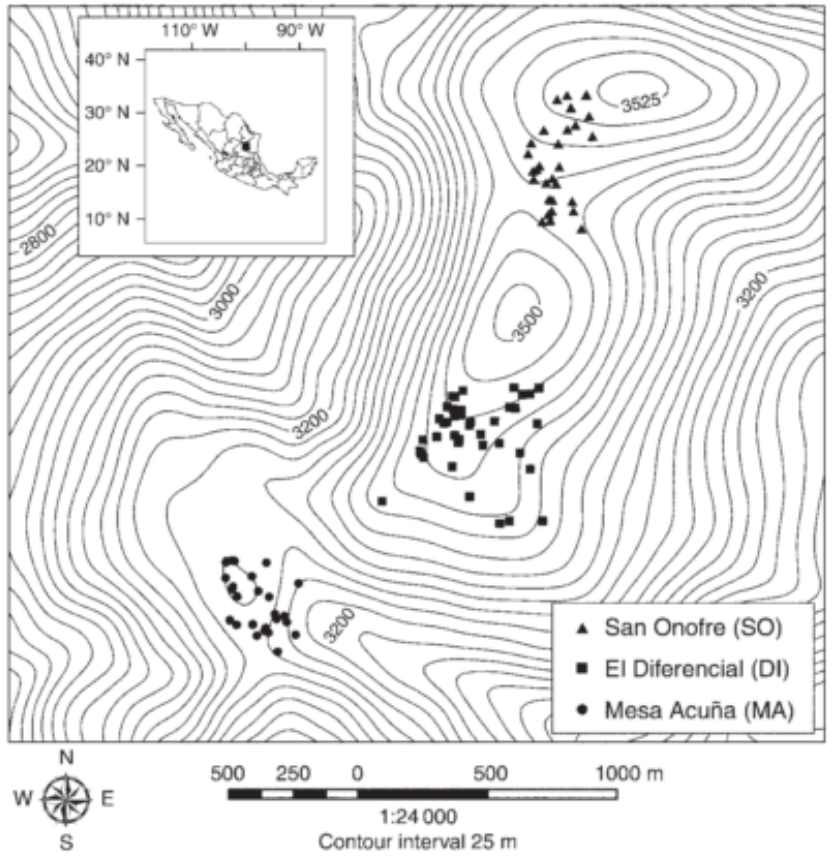
1) Chipinque (González Tagle *et al.*, 2005)
2) Cerro El Potosí (González Tagle *et al.*, 2016)
3) Ejido Gordiano, Jalisco (González Tagle *et al.*, 2015)

★ 1) Peña Nevada (Yocom *et al*., 2010)

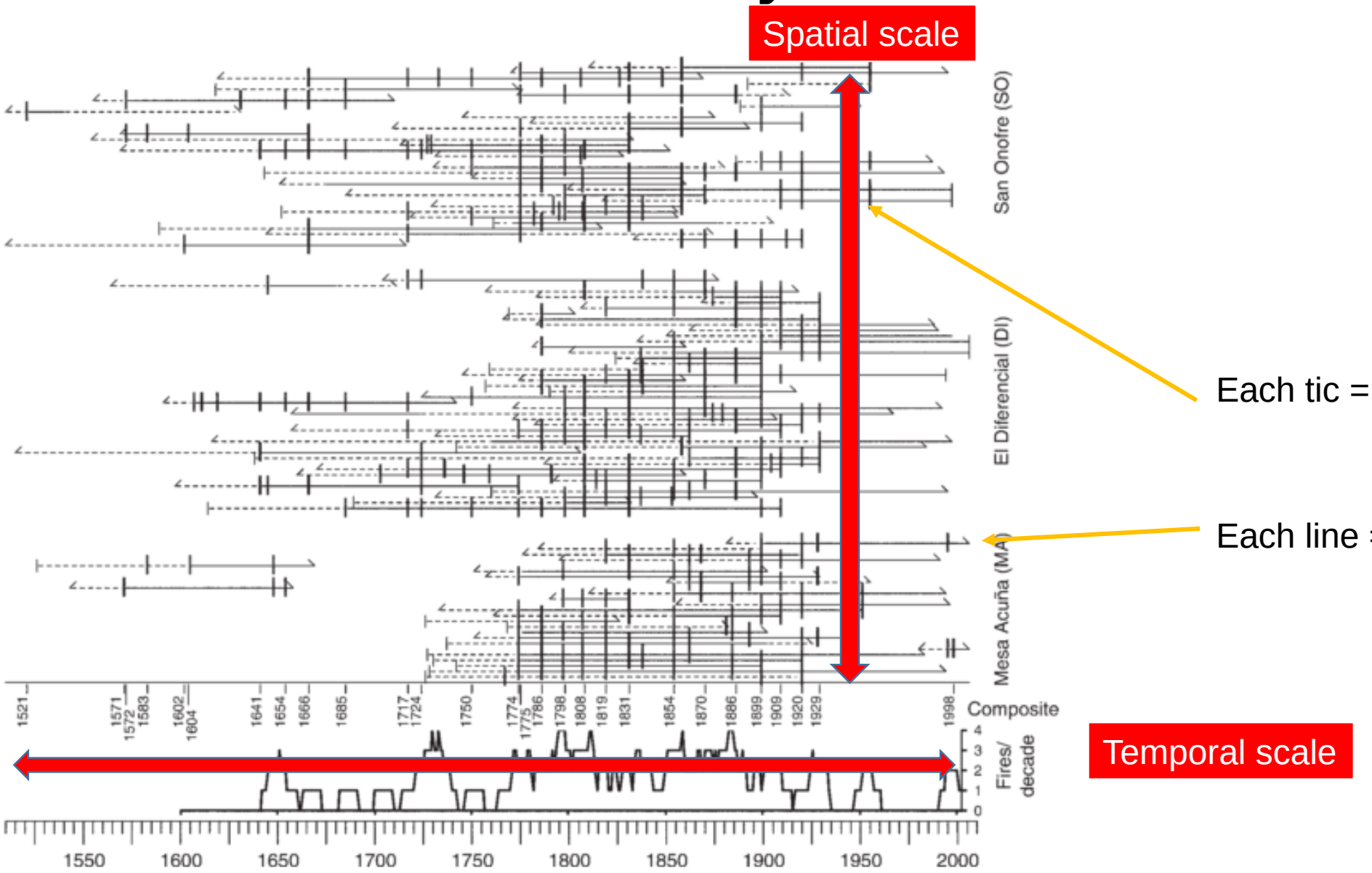
Fire History Results

Across Mexico, we usually find sites with good records, but not fires (Sierra Madre Occidental), or many fires but limited records (Sierra Madre Oriental).

Sierra Peña Nevada (SM Oriental) has many fires but limited records



Fire History at Peña Nevada



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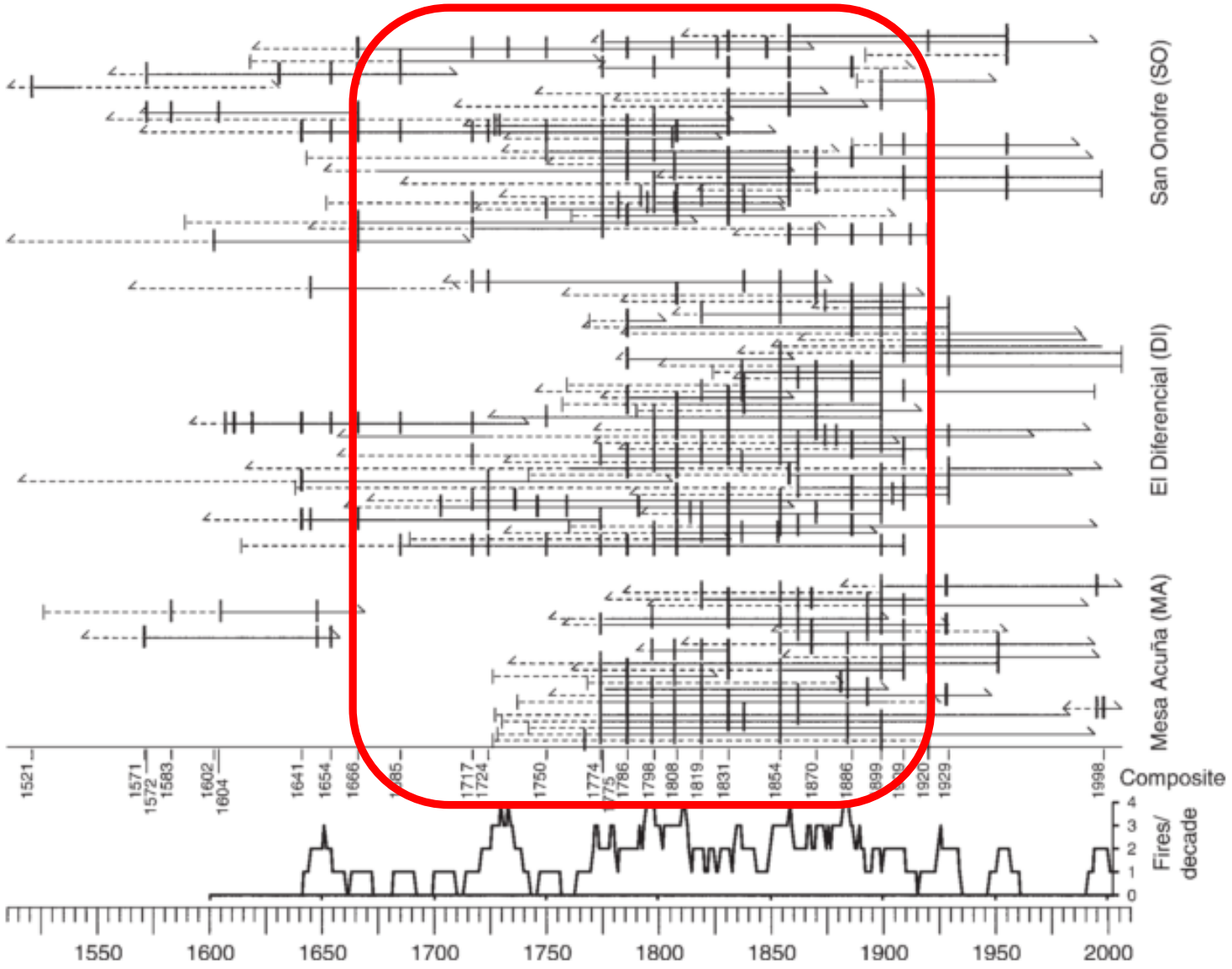
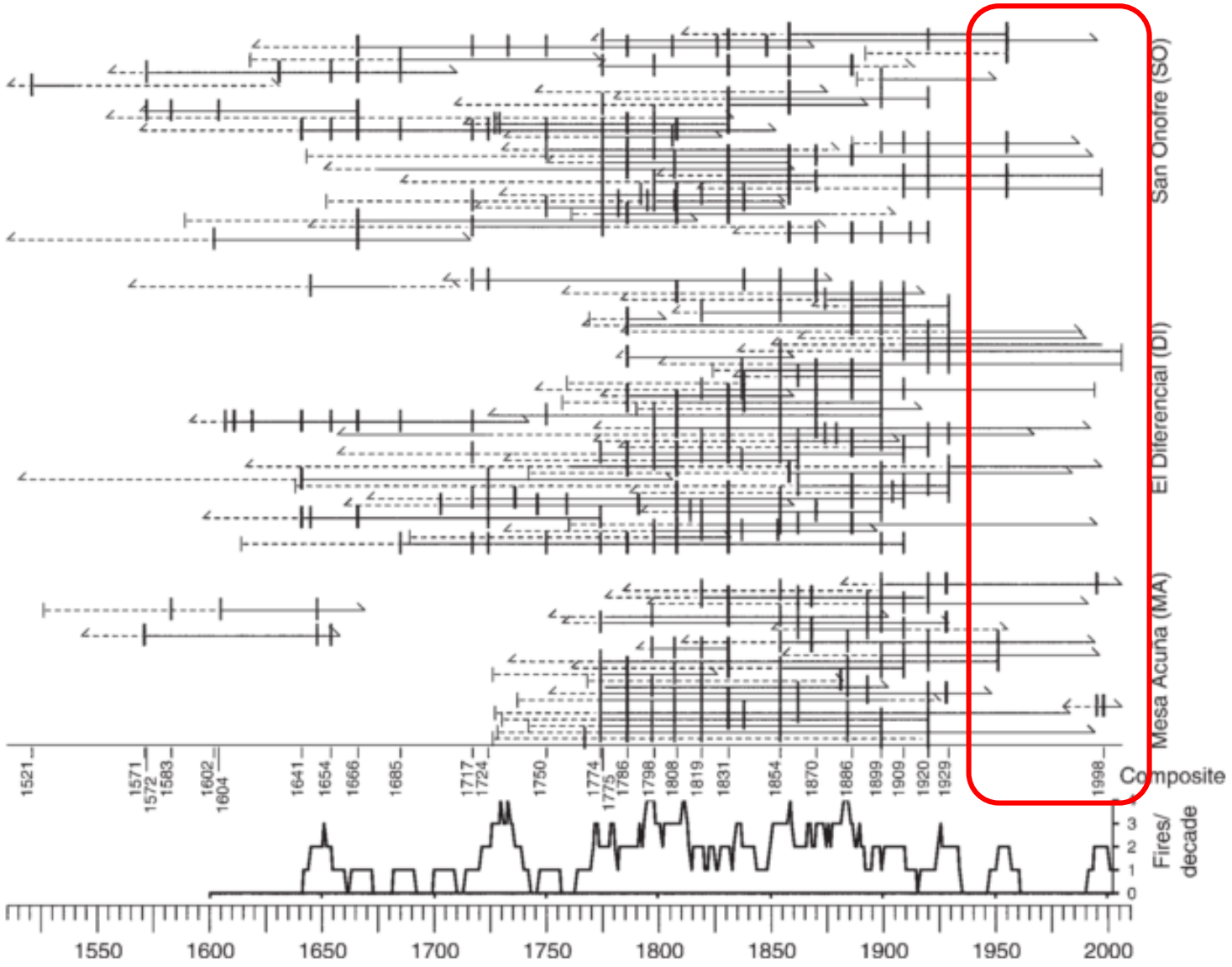


- Mean fire return interval is 8.3 years
- Fire Regime (FR) during this period of time:

FR I: Low intensity but frequently fires

Fire History at Peña Nevada



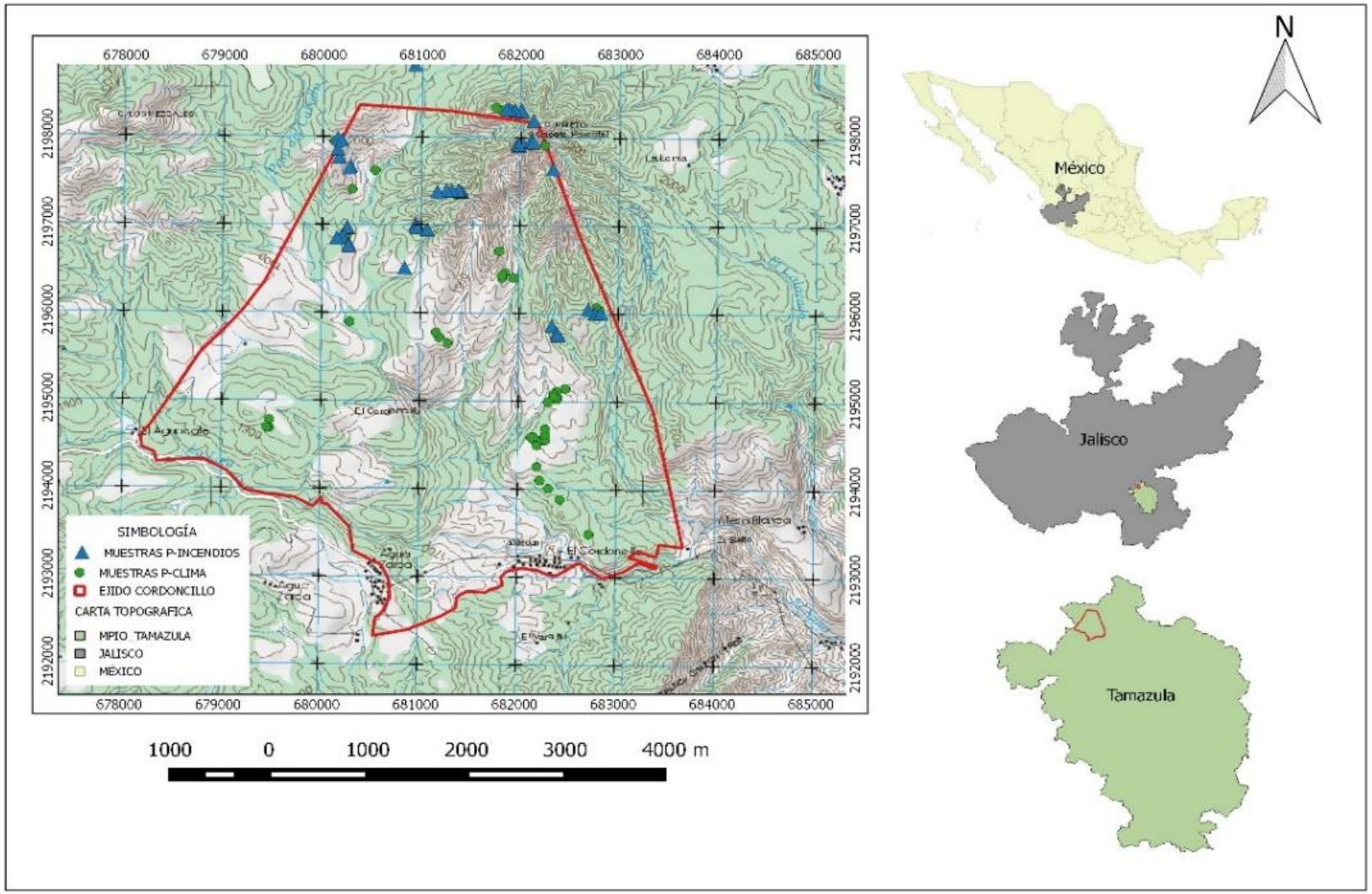
- Increasing fire return interval =absence of fire
- Mean fire return interval > 35 years

FR II: Replacement

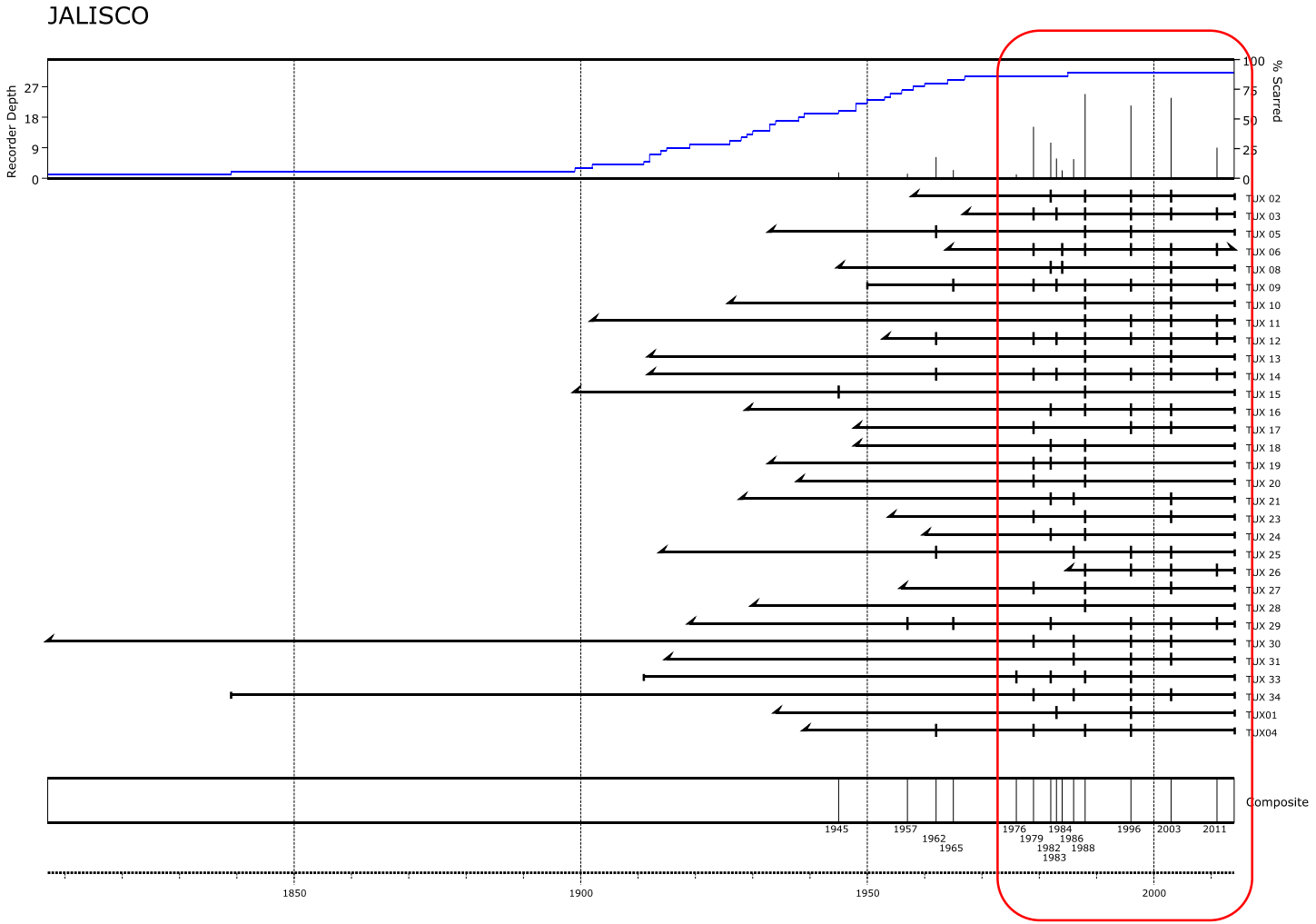
Shifted Fire Regime

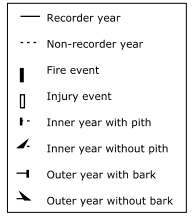
1998 Forest fire at Peña Nevada

Fire History at Ejido Gordiano



Fire History at Ejido Gordiano





sites with good records,
but not to many fires

Evaluating Forest Fuel Complex

RESUMEN DEL INVENTARIO DE COMBUSTIBLES FORESTALES (Mg/ha^{-1})

1 HR	10 HR	100 HR	1000 HR FIR	100 HR PUD	HO	HU	TOTAL	PROF HO (cm)	PROF HU (cm)
1.05	5.05	5.25	3.01	5.50	8.64	21.40	49.91	7.23	8.64

Evaluating Forest Fuel Complex

RESUMEN DEL INVENTARIO DE COMBUSTIBLES FORESTALES (Mg/ha^{-1})

1 HR	10 HR	100 HR	1000 HR FIR	1000 HR PUD	HO	HU	TOTAL	PROF HO (cm)	PROF HU (cm)
1.35	7.41	5.41	2.95	6.95	2.26	4.44	30.78	2.96	3.31

Implications on Forest Management

PELIGRO DE INCENDIOS FORESTALES EN RELACION A LA CARGA DE COMBUSTIBLES

ALTO

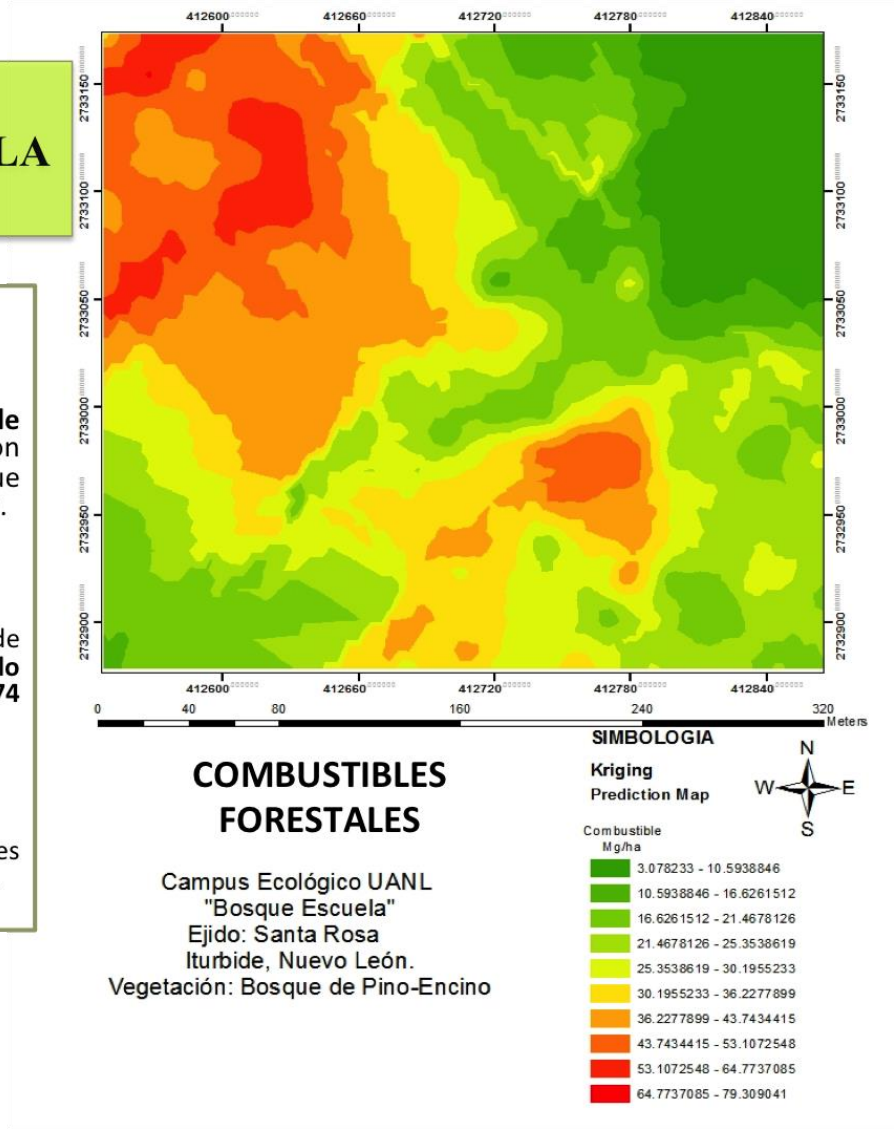
Áreas con mayor acumulación de combustible de **64.77 a 79.30 Mg/ha^{-1}** por lo tanto son propensas a sufrir daños severos en caso de que un incendio forestal se presentara en esta zona.

MEDIO

Áreas propensas a tener alta acumulación de combustible forestales color **naranja y amarillo** donde los valores se encuentran entre **25.52 a 43.74 Mg/ha^{-1}.**

BAJO

Acumulación de combustible menor con valores que se encuentran entre los **3.07 y 16.62 Mg/ha^{-1}**.



SAGA

System for Automated Geoscientific Analyses

Implications on Forest Management

Fire regime restoration by means of:

- Prescribed fires

Implications on Forest Management

Fire regime restoration by means of:

- Silvicultural treatments +
- Prescribed burning