



UNIVERSIDAD AUTÓNOMA DE QUERÉTARO  
**FACULTAD DE INGENIERÍA**

**INRAE**  
la science pour la vie, l'humain, la terre



# European Geophysical Union: Sharing Geosciences Online Session: Soil-Plant Interacion

“The role of vegetation in the redistribution of infiltration in a semiarid zone”

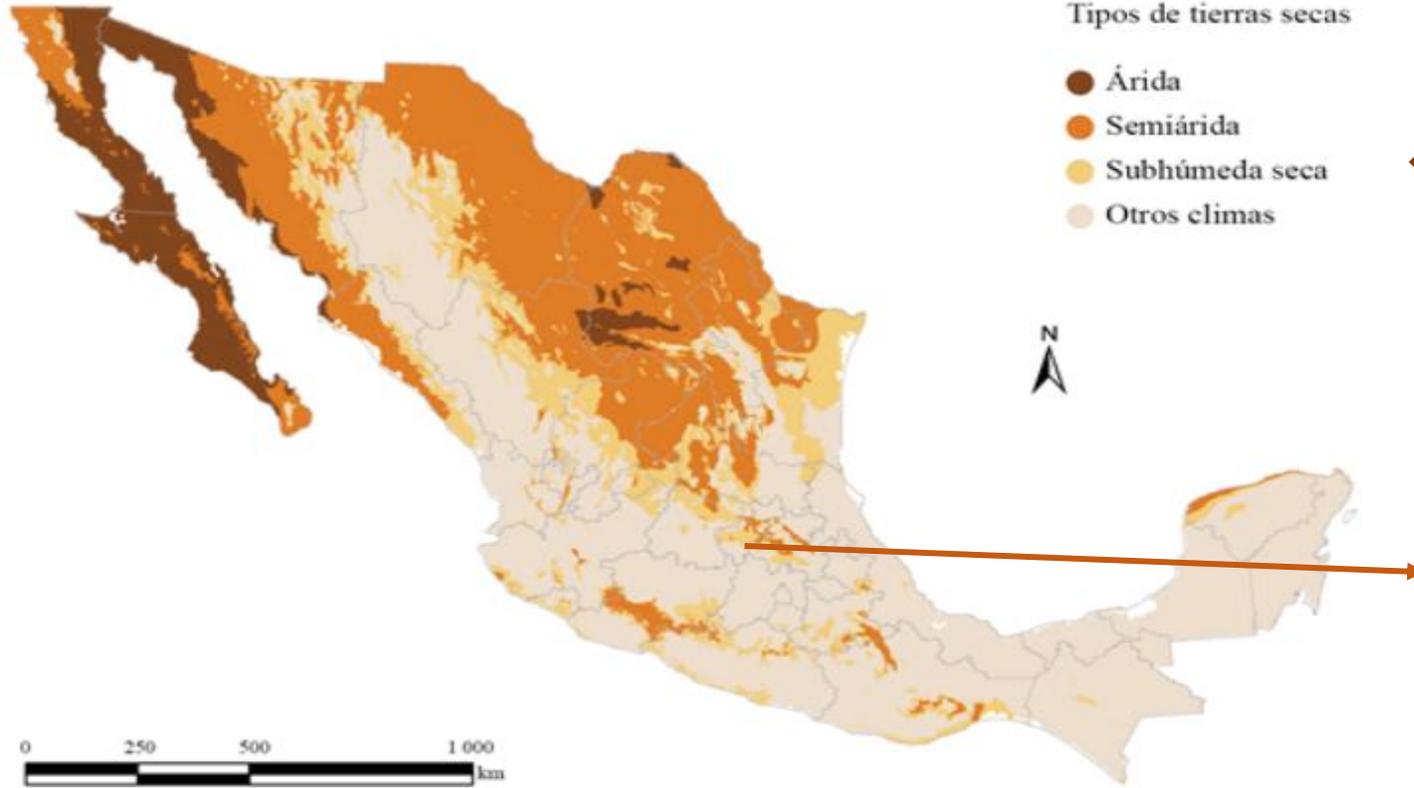
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# INTRODUCTION



Tipos de tierras secas

- Árida
- Semiárida
- Subhúmeda seca
- Otros climas

- ❖ Arid and semi-arid regions cover approximately 48% of the national territory in Mexico.
- ❖ The predominant species in this area are mostly made up of huizache (*Acacia Farnesiana*) and mesquite (*Prosopis Laevigata*)



The importance of the Huizache's tree in the redistribution of the infiltration as well as their value in the semi-arid ecosystems of Queretaro is unknown.

**Nota:**  
¹Clasificación basada en el criterio del índice de aridez.

Figure 1. Dryland distribution in Mexico. SEMARNAT (2012)



# SCIENTIFIC QUESTIONS

1. Is the infiltration process affected due to the presence of huizaches tree?
2. It is the initial humidity the cause of the redistribution of the infiltration?



# HYPOTHESIS

The initial (and final) decline in moisture from the trunk outward may depend on a combination of 3 factors: bioturbation, slope and soil moisture gradient because in non-wooded areas the sun and wind are likely to dry out the surface of the ground around the trees, producing a displacement of bound and free water in all directions with a more pronounced effect to the south and may be the predominant wind direction.

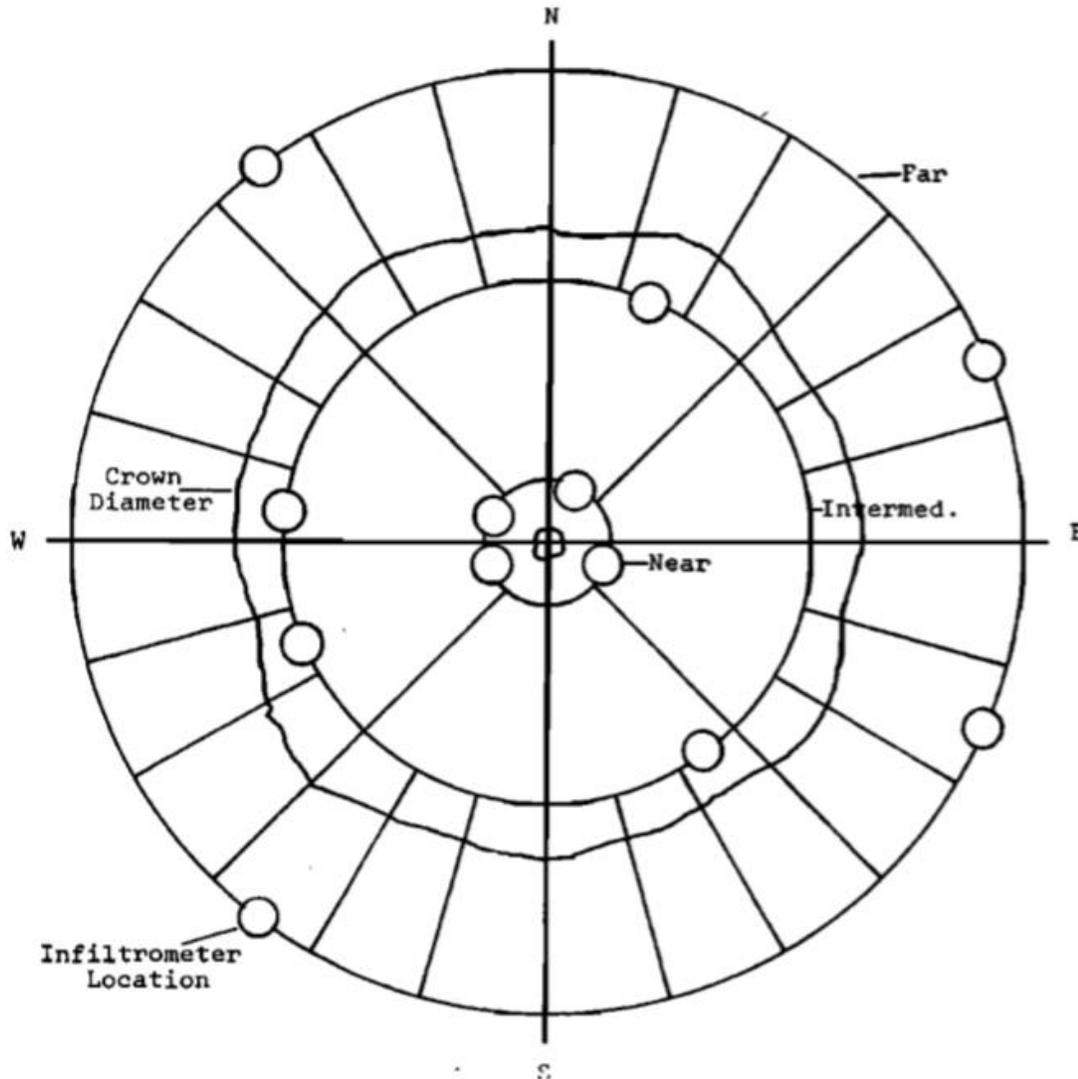


# BACKGROUND

## PALOVERDE



## CREOSOTE BUSH



Lyford(1969) developed a diagram in which he separated 3 zones around the tree: near, intermediate and far. He performed 1 random infiltration test in each of the zones in 4 quadrants

He found that the infiltration decreased as it moved away from the trunk of the trees

Figure 2. Diagram shows location of sampling points. Lyford(1969)



# METHODOLOGY

## Experimental site description

Semi-arid zone  
Mean anual temperatura of 17°C  
Mean elevation 1968 msnm  
Average anual precipitation 503 mm  
Rainy season from may to october  
Plot área of 0.19km<sup>2</sup>

The infiltration tests were carried out having between 1-4 days of rain prior to the test for trees 1 and 2. For tree 3 there were occasional rains since it was not the rainy season.

## Huizache's tree description

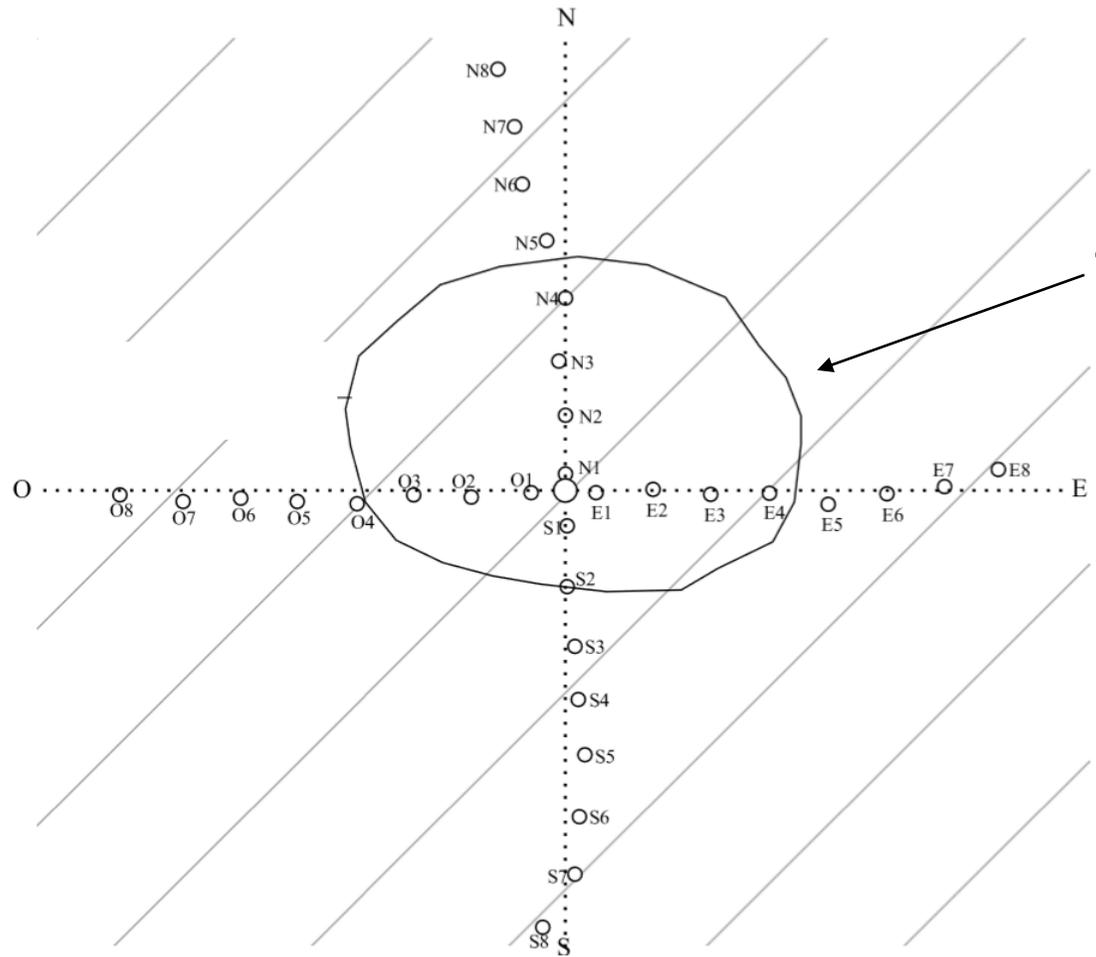


Variable	Tree 1	Tree 2	Tree 3
High	3.43m	3.68m	3.30m
Crown ratio	4.25m	4.10m	3.92m
Trunk diameter	0.45m	0.38m	0.40m



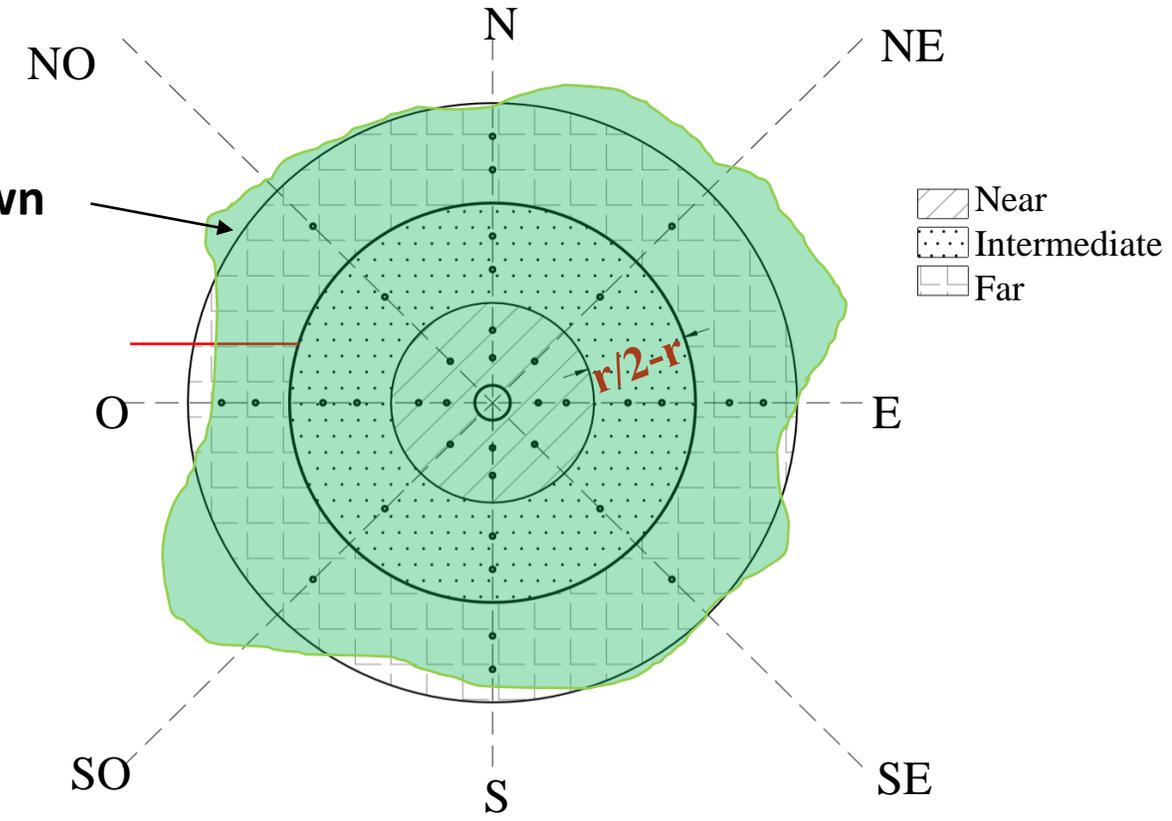
# Location of infiltration tests

## Hyphotesis Without partition



Tree Crown

## Co-arranged Hyphotesis with partition



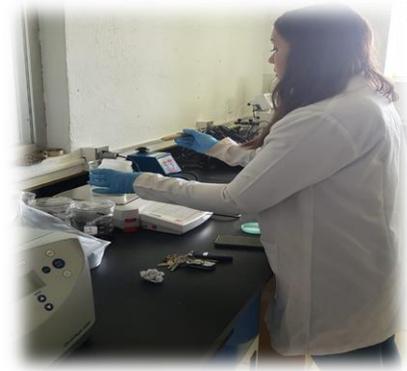


# METHODOLOGY

## Infiltration test through single ring



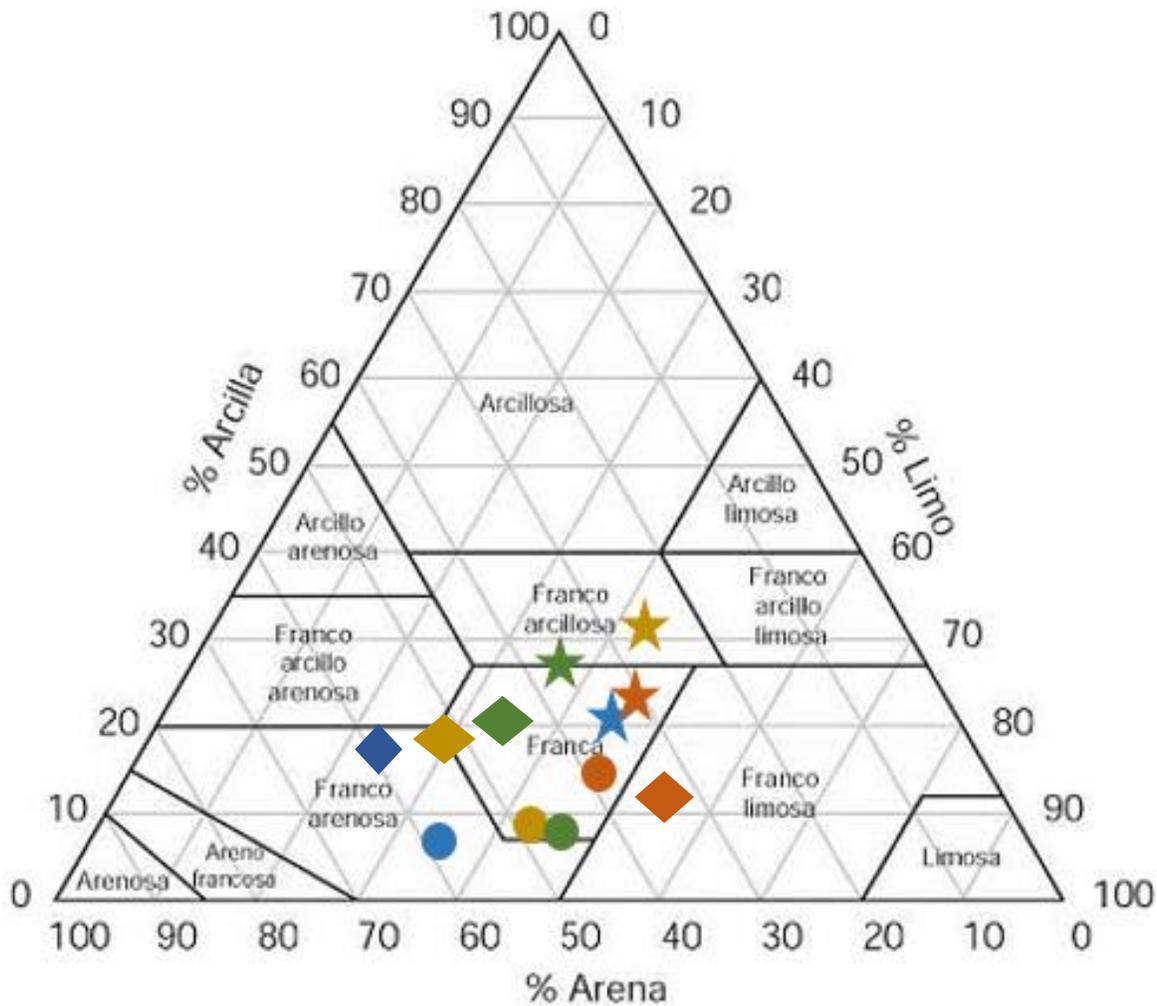
## Particle size análisis and texture of soils





# RESULTS

## Soil texture

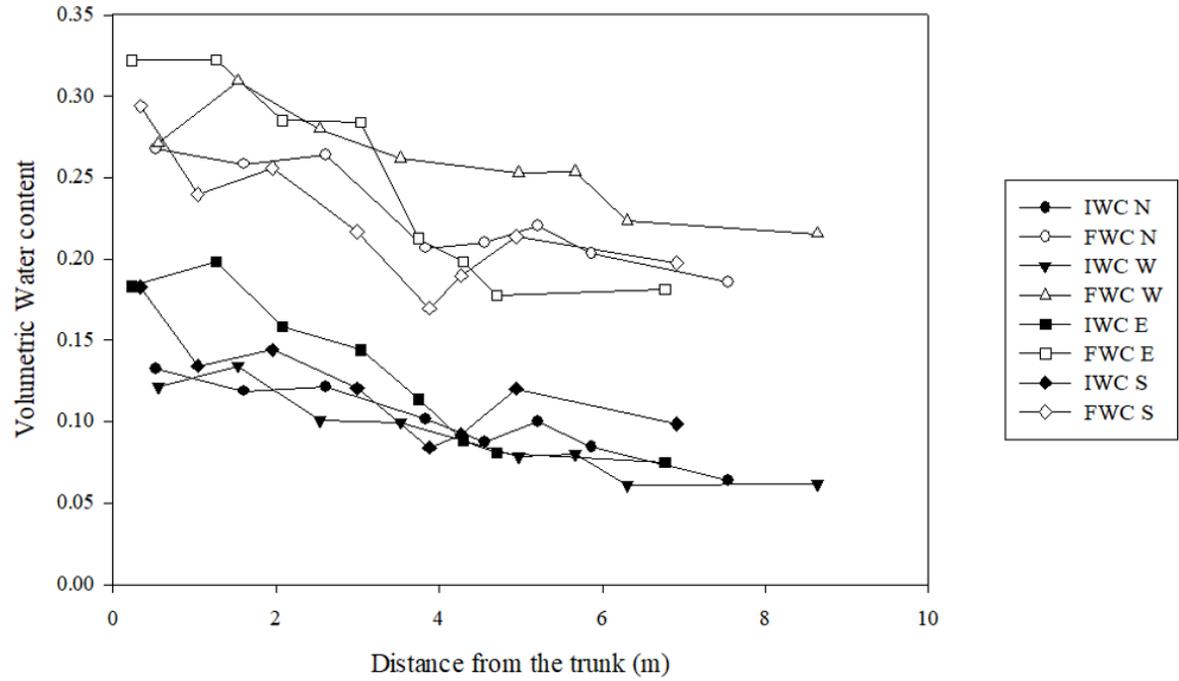


AXIS	TREE 1	TREE 2	TREE 3
NORTH	★	●	◆
SOUTH	★	●	◆
EAST	★	●	◆
WEST	★	●	◆

Figura 3. Soil triangle texture for 12 sampling points

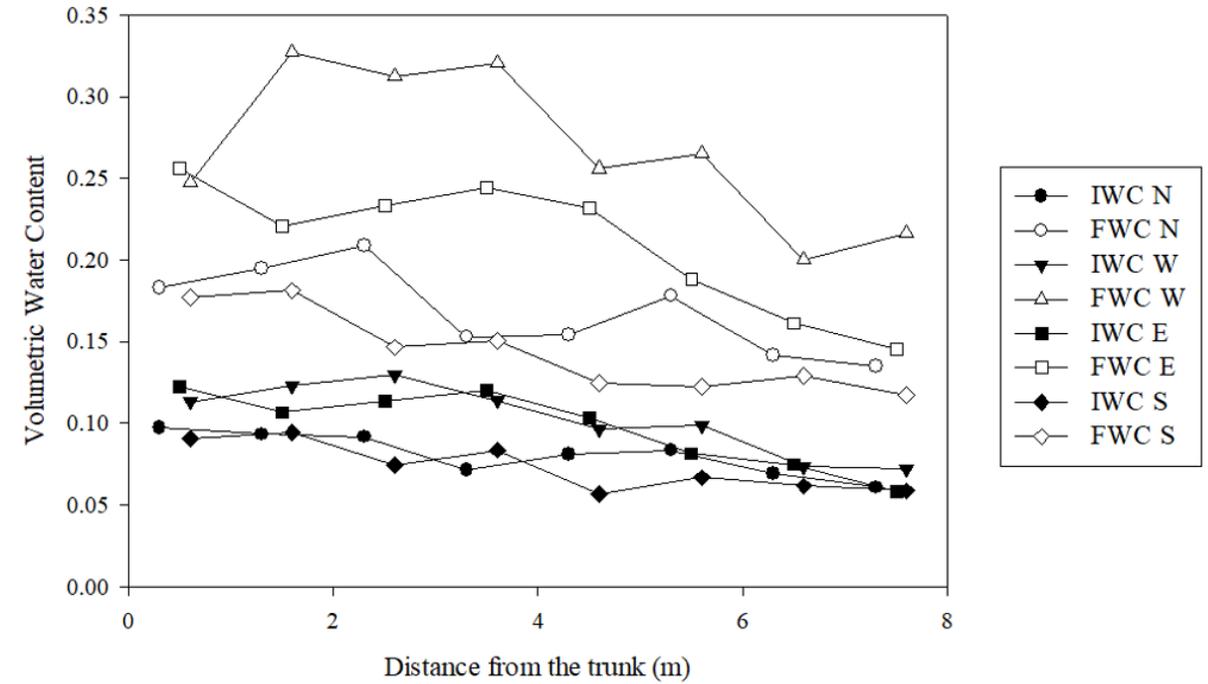


Initial Water Content (IWC) and Final Water Content (FWC): Tree 1



Spring- 2018

Initial Water Content (IWC) and Final Water Content (FWC): tree 2

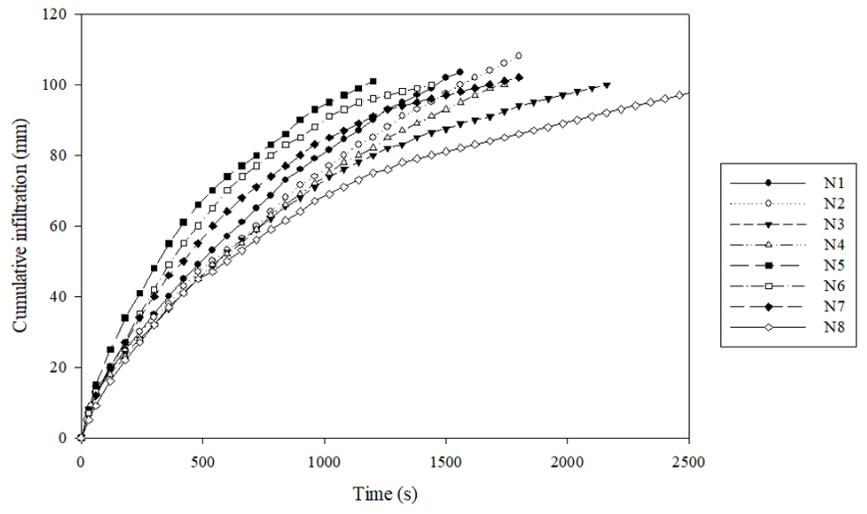


Winter 2019

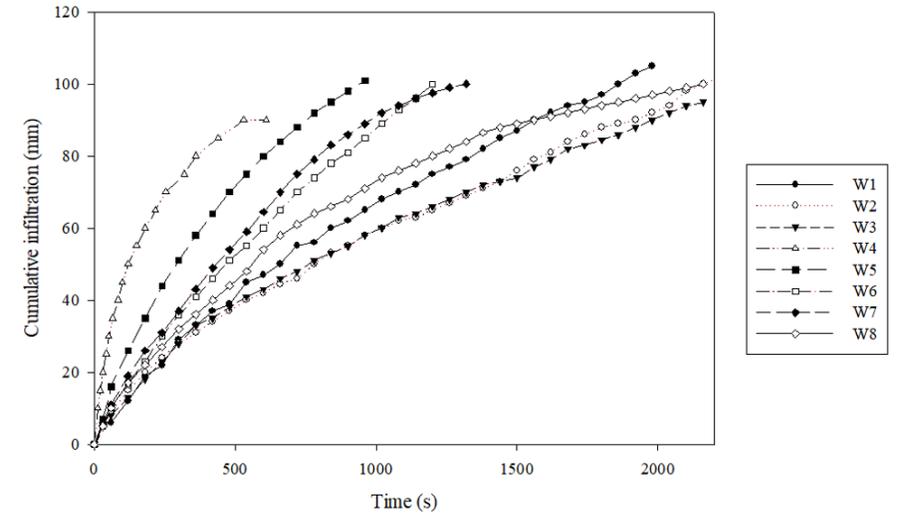


# Cumulative infiltration in 4 axes: tree 1

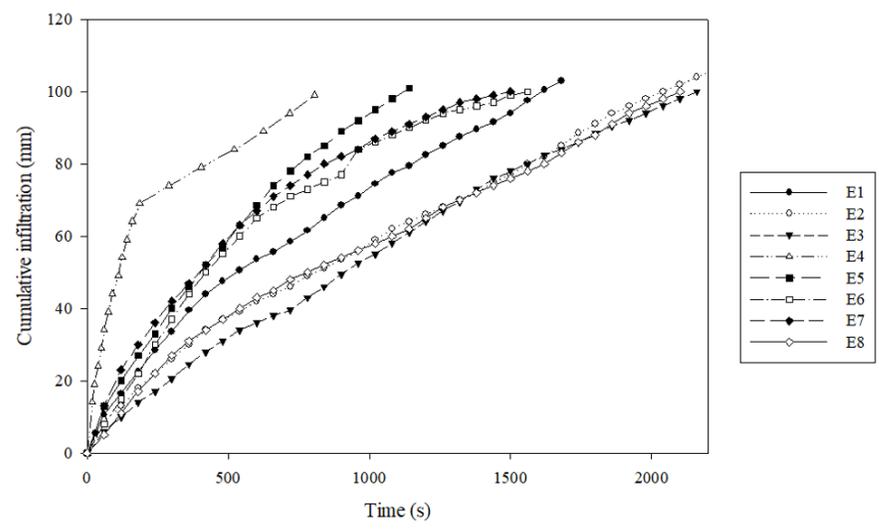
Tree 1: North Side



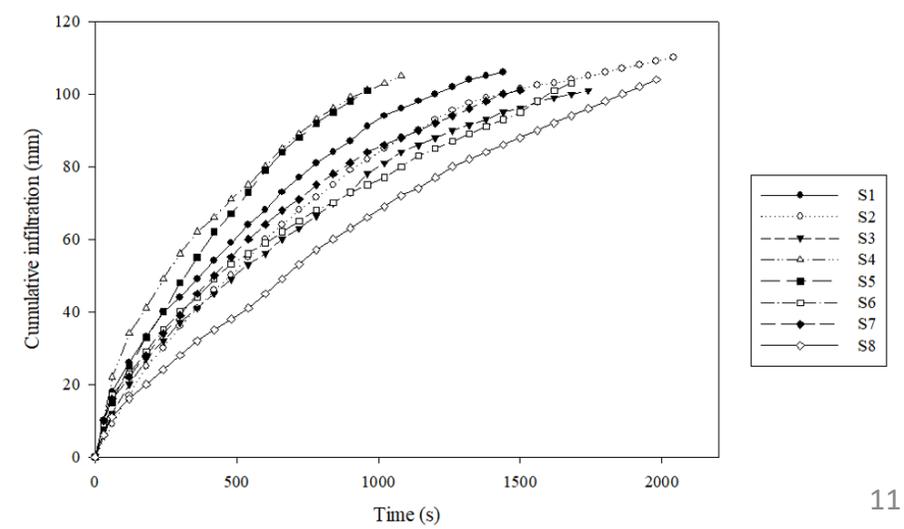
Tree 1: West Side



Tree 1: East Side

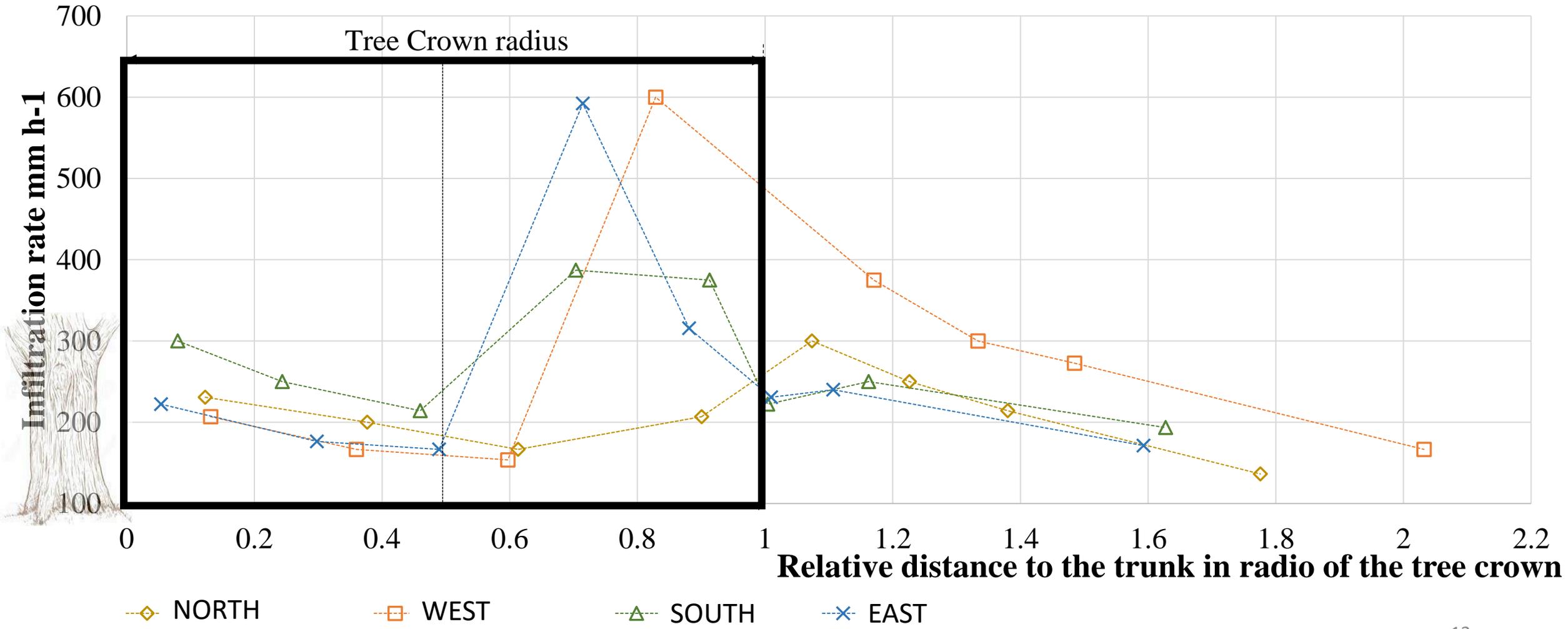


Tree 1: South Side



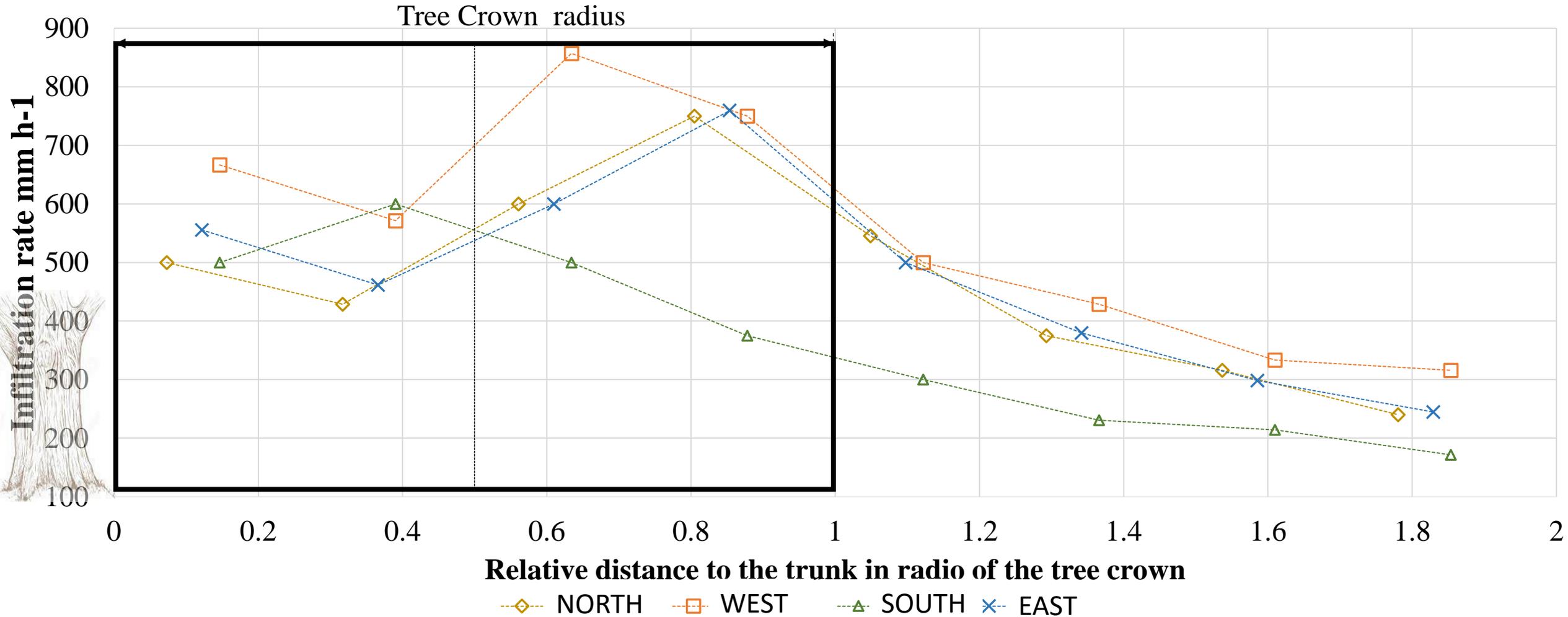


# Infiltration redistribution: tree 1





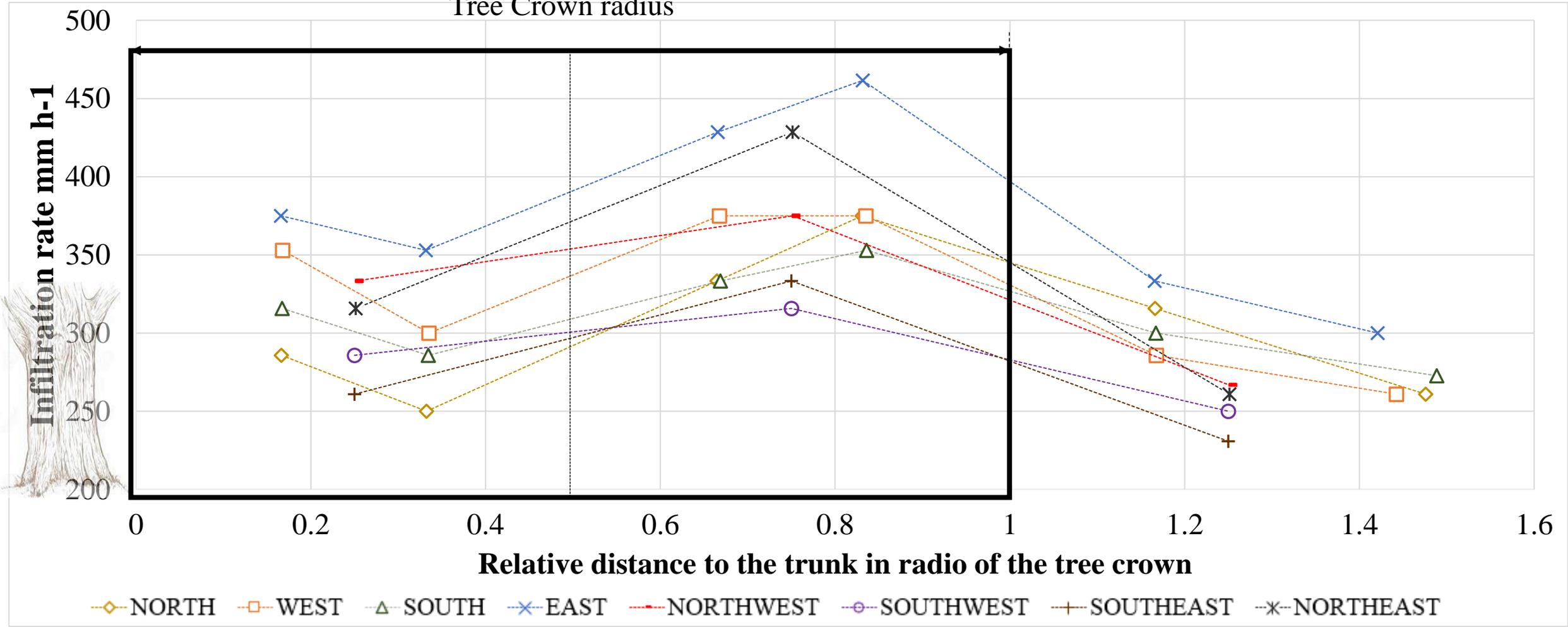
# Infiltration redistribution: tree 2





# Infiltration redistribution: tree 3

Tree Crown radius





## Summary and outlook

- ❖ It is consistent in the 3 individuals that infiltration grows remarkably in the area delimited by  $r/2$  and  $r$  of the tree crown, from the tree trunk, in the 4 axes analyzed.
- ❖ Sampling points with higher initial humidity have a greater infiltration, but respecting the observed bell shape.
- ❖ The previous results suggest that the predominant species in the central plateau desert in Mexico play an important role in the redistribution of infiltration.

**We recommend carrying out tests on other native species in the area in order to generalize the behavior of the infiltration.**



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