Litterfall Deposition and Leaf Litter Nutrient Return in Different Locations in Northeastern Mexico

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Introduction.

Litterfall and litter decomposition are key fundamental processes in nutrient cycling of forest ecosystems (Pausas, 1997). In addition to this processes, throughfall and stemflow are the main sources to maintain soil fertility to the forest floor. Despite the great number and well documented floristic studies carried out at the Tamaulipan thornscrub or subtropical thornscrub woodlands, northeastern Mexico, there are not investigations that have addressed the spatial and temporal patterns of litterfall deposition and nutrient returns, in spite of the importance of this process for nutrient cycling in this type of vegetation which is distinguished by a wide range of taxonomic groups, growth patterns, leaf life spans, textures, growth dynamics, and phenological development.

Objective.

To determine the litterfall production, macronutrient (Ca, K, Mg, N, and P) deposition and nutrient use efficiency through leaf fallen in different plant communities, northeastern Mexico.

Materials and Methods.

Research sites
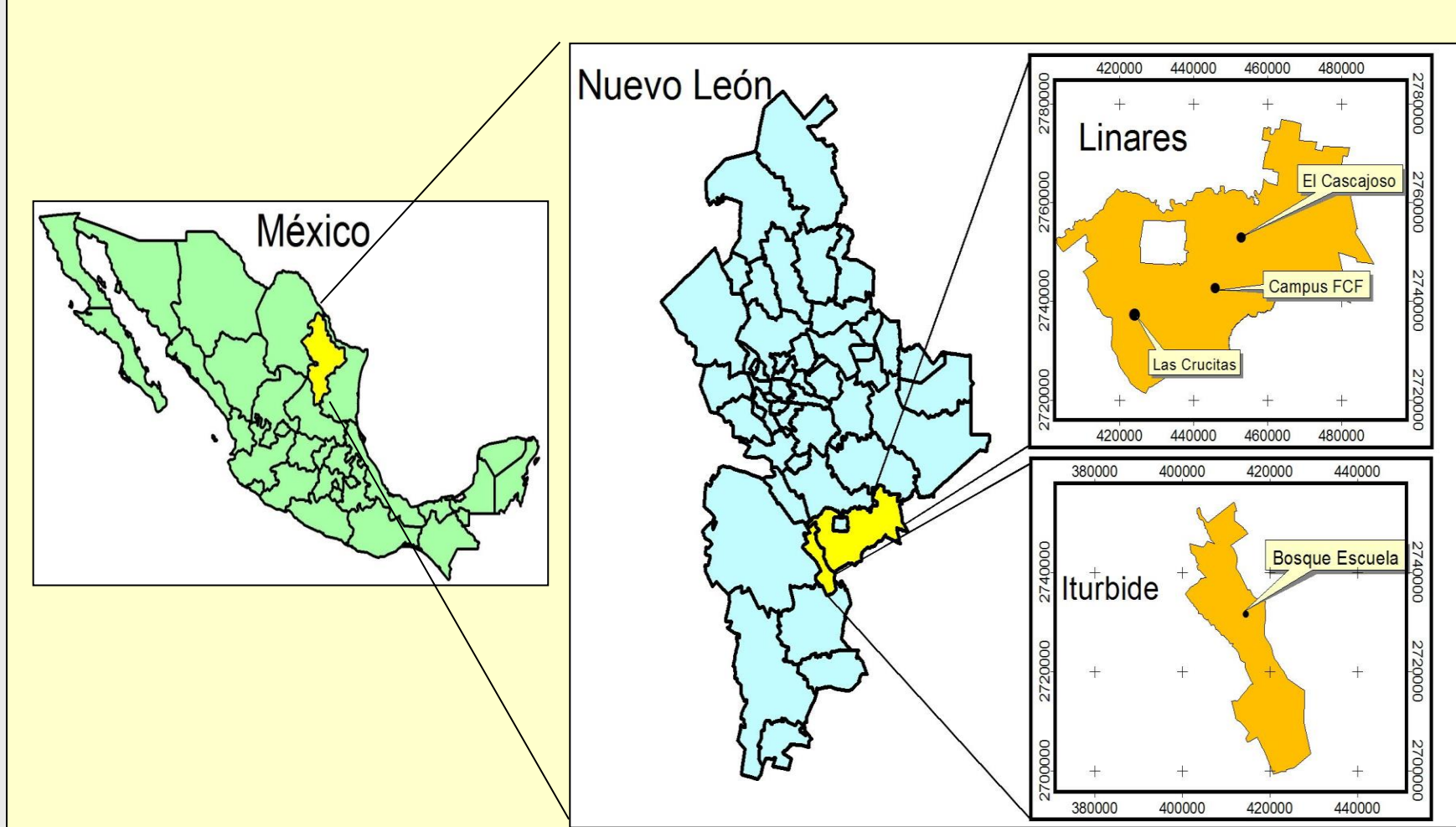
Research Site	Altitude (m. a s l)	Vegetation type
Bosque Escuela	1,600	Pine forest
Crucitas	550	Ecotone *Quercus*-Shrubland
Campus	370	Shrubland (Tamaulipan thornscrub)

Sampling frequency

In an experimental undisturbed plot (50 m x 50 m) located at each research site, litterfall deposition was collected at biweekly intervals (Jan-05 thru Dec-20-09) by means of using ten litter canisters, placed randomly at each experimental plot. Each canister covered an area of 1.0 m^2 (1.0 m x 1.0 m).

Litter production

The collected litter was sorted into the following categories: leaves, reproductive structures (flowers, fruits and seeds), twigs or branches (<2 cm in diameter), and others (unidentified, fine plant residues, pieces of insect bodies or feces).

Nutrient analysis

Mineral content in leaf litter was estimated using the wet digestion technique. Concentrations of Ca, K and Mg were determined by AAS, whereas P was quantified colorimetrically. The Kjeldahl procedure was employed for nitrogen content. Nutrient use efficiency was calculated as the ratio of annual leaf fallen mass to annual leaf fallen nutrient content deposition (Vitousek, 1982).

Figure 1. Mean monthly litterfall deposition at research sites, northeastern Mexico.
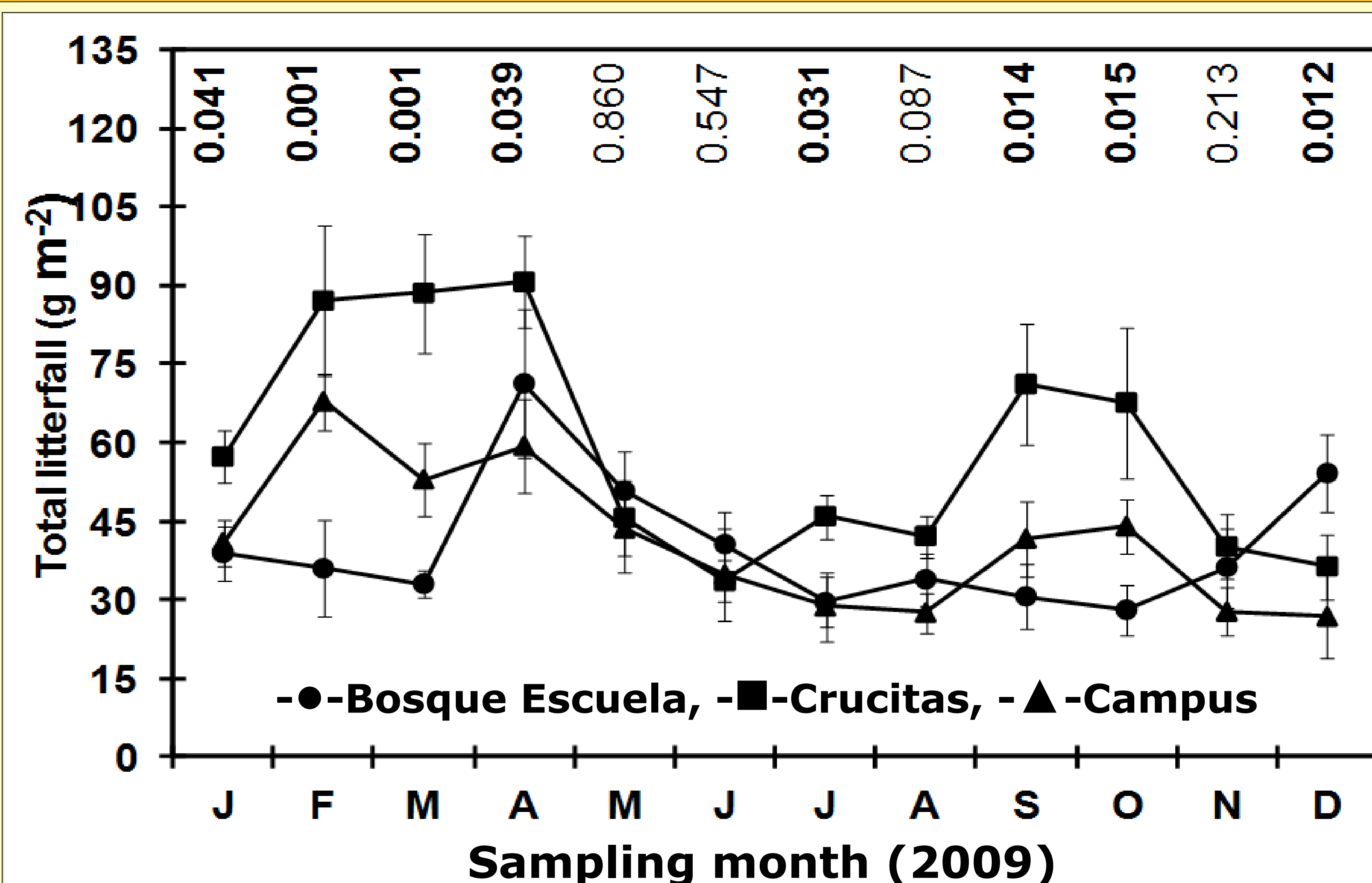
Results.

Table 1. Mean (±SE) annual litterfall deposition at research sites, northeastern Mexico.

Annual deposition (g m^{-2} yr^{-1})	Research Site			Mean ± SE
	Bosque Escuela	Crucitas	Campus	
Leaves	351.5±24.3	466.8±28.9	337.6±28.9	385.3±18.7
Rep. Struct.	27.0±6.2	102.7±30.4	37.5±7.4	55.7±12.0
Twigs	39.2±7.6	111.2±11.3	103.4±20.3	84.6±9.8
Others	65.1±20.2	25.1±3.7	17.1±3.6	35.8±7.7
Total	483.0±42.7	706.0±32.7	495.6±45.2	561.5±29.5

Table 2. Mean annual macronutrient deposition through leaf-fallen at research sites, northeastern Mexico. (±Standard Error)

Macronutrient deposition (mg m^{-2} yr^{-1})	Research Site			Mean (SE)
	Bosque Escuela	Crucitas	Campus	
Ca	3669.7 (357.2)	11476.6 (1364.3)	13452.2 (1255.6)	9532.8 (991.9)
K	984.3 (82.2)	3804.3 (381.0)	3047.1 (463.9)	2611.9 (294.8)
Mg	488.5 (41.0)	1298.0 (141.2)	1165.9 (152.0)	984.1 (94.6)
N	2.6 (0.2)	8.2 (0.7)	7.1 (0.6)	NA
P	141.6 (12.3)	260.1 (17.2)	237.8 (23.7)	213.1 (13.9)

Table 3. Macronutrient use efficiency at research sites, northeastern Mexico. (±Standard Error)

Nutrient Use Efficiency	Research Site			Mean (SE)
	Bosque Escuela	Crucitas	Campus	
Ca	99.2 (5.9)	43.2 (2.8)	25.9 (1.6)	56.1 (6.2)
K	363.6 (15.5)	131.3 (11.1)	124.1 (10.6)	206.3 (21.8)
Mg	729.5 (24.2)	390.5 (37.1)	308.5 (22.7)	476.2 (37.4)
N	134.3 (6.8)	58.6 (3.3)	47.3 (1.1)	80.1 (7.5)
P	2539.0 (111.5)	1813.8 (80.1)	1442.5 (48.6)	1931.8 (96.6)

Conclusions

❖ On an annual basis, the order of nutrient deposition through leaf fallen was: Ca>K>Mg>P; whereas, on a site basis, total (Ca+N+K+Mg+P) nutrient deposition was as follows: Campus > Crucitas > Bosque Escuela.

❖ Ca, K, Mg, N, and P nutrient-use efficiency values were higher in Bosque Escuela, while lower figures were acquired at Crucitas and Campus sites.

❖ Highest litterfall deposition was found in the ecotone of a *Quercus* spp. forest (Crucitas site).

❖ The Tamaulipan thornscrub vegetation (shrubland) (Campus) showed greatest leaf fallen nutrient returns.

❖ There were spatio-temporal variations in the quantity of litterfall collected and return of minerals.