LEAF AND BRANCH PRODUCTIVITY OF SEVERAL PLANT COMMUNITIES OF NORTHEASTERN MEXICO

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ABSTRACT

Leaf and branch biomass productivity of plant communities have been little studied in northern Mexico. Global warming concerns are prompting research dealing with biomass production and carbon sequestration by plant communities. Biomass components and productivity are key pieces of information for running several carbon models. In this research, we developed information on leaf and branch biomass productivity of sixteen different plant communities encompassing native pine, oak, shrub, and exotic pine forests. We established sampling plots, measured dasometric features of trees, and collected leaf and branch biomass for periods of 7 to 21 days during 2004 in Nuevo Leon, Mexico. Results indicate that leaf and branch productivity is on the average 3.70 Mg ha^{-1} y^{-1} (±0.98 Mg ha^{-1} y^{-1}) with only two plant communities (intermittent riverine Tamaulipan matorral and upland planted Cupressus spp communities) surpassing 7 Mg ha^{-1} y^{-1}. The exotic pine species (*P. nelsoni*, *P. pinceana*, and *P. cembroides*) planted in proceeding trials produced less than 3 Mg ha^{-1} y^{-1}. The statistical analysis of this information showed large spatial and temporal variations. The former was explained by microsite and plant density. The last source of variation was partially dependent on climate fluctuations and the natural annual productivity cycle. Further research is required to understand the fate of leaf and branch on soils.

INTRODUCTION

Environmental concerns by global warming are prompting renewed trends in productivity studies since biomass accumulation plays a key role in assessments of carbon cycling rates [*Jenkins et al*., 2001]. However, there are a few measurements at individual field plots that can be used to provide data to validate process model predictions of forest growth rates and biomass accumulation. Given the environmental importance, process model predictions of forest growth rates and biomass accumulation are being developed at an accelerating rate to assess the effect of plant cover on carbon fluxes [*Melillo et al*., 1993; *Cramer et al.*, 1999]. The objective of this research was to measure leaf and branch productivity of three main plant communities of northern Mexico with the aim to understand spatial and temporal differences between and within plant communities.

MATERIAL AND METHODS

The study was conducted in three main plant communities of the State of Nuevo Leon, Mexico: a) the Tamaulipan matorral, b) the upland native coniferous forests of the Eastern Sierra Madre mountain range, ESM, and c) planted, introduced pine species of the western slopes of the ESM mountain range of the State of Nuevo Leon, Mexico. Three plots were established in the Tamaulipan matorral (one in a riverine site, one in a valley, and the last one in a meseta), eight plots in reforested sites (two in P. pinceana, two in P. nelsoni, two in P. cembroides, one in Cupressus spp, and one in P. pseudostrobus reforested sites), two plots in pine forests and two plots in oak forests. Three sampling nets (each 1 m x 1 m) in each plot were suspended with ropes to collect branch and leaf fall. Branches and leaves in nets were collected every two weeks, weighted and oven dried and weighted again. Branch and leaf fall was assumed to be the productivity. Since measurements were conducted during one year this assumption is probably correct.

RESULTS

The average (±confidence intervals) leaf and branch productivity for all plant communities was 3.70 Mg ha^{-1} y^{-1} (±0.98 Mg ha^{-1} y^{-1}). There was a large variation between and within plant communities (Fig. 1). High confidence intervals (α=0.05) mask the potential statistical differences in branch and leaf productivity

between plant communities. Large intrinsic differences in site features explained part of the variation within plant communities. Intermittent riverine sites inside the Tamaulipan thornscrub recorded similar productivity values (7.22 ± 2.09) than Cupressus forests (9.25 ± 2.60). The remaining plant communities recorded similar productivity values, between 2-5 Mg ha^{-1} y^{-1}. Deep, well drained soils, which improves the water balance in semi-arid, subtropical ecosystems explained high productivity values in Tamaulipan riverine matorral communities. In Cupressus forests, plant adaptation to upland slopes of the ESM mountain range characterized by shallow soils, semi arid-temperate climate explained high productivity values, in contrast to the introduced pine species, P. pinceana (3.05 ± 1.64), P. cembroides (2.29 ± 1.33), P. nelsoni (2.06 ± 1.05), and the native pine species, P. pseudostrobus (3.75 ± 2.62) planted in similar site conditions. Native pine forests dominated by P. pseudostrobus recorded also high branch and leaf productivity values (4.03 ± 0.92) unlike native oak forests (3.00 ± 1.39). Contrasting temporal trends were observed in leaf and branch productivity. In Tamaulipan matorral the tendency followed a typical bell shape with March and April attaining the largest productivity values. In contrast, in planted pine sites productivity mimicked an inverse bell shape, with March and April attaining the smallest productivity values. This information must be taken cautiously since larger periods of time could be required to meet the assumption that branch on trees remains constant at the beginning and at the end of the study period to properly measure this productivity component.

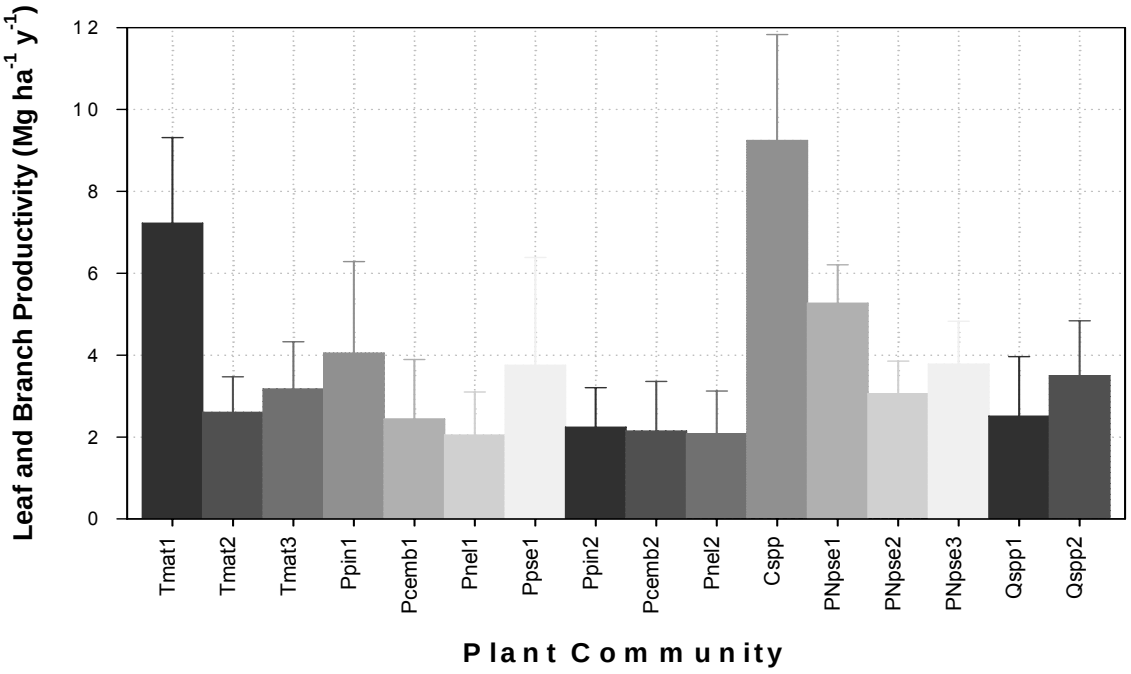

Fig. 1. Total leaf and branch productivity by plant community in the State of Nuevo Leon, Mexico (Tam Tmat= Tamaulipan Matorral, Ppin= P. pinceana, Pcemb= P. cembroides, Pnel= P. nelsoni, Ppse = P. pseudostrobus,Cspp= Cupressus spp, PNpse = Native P. pseudostrobus, Qspp = Native Oak forests.

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