SPATIAL DISTRIBUTION OF FOREST FUELS BASED ON CLASSIFICATION AND REGRESSION TREES

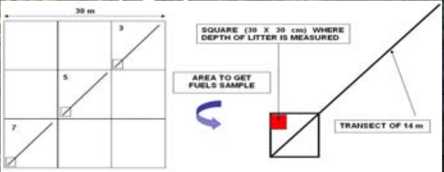
Dr. J. Germán Flores G.
M.C. David A. Moreno G.
Dr. Juan D. Benavides S.

Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias. Parque Los Colomos S/N, Col. Providencia. Guadalajara, Jalisco. México. C.P. 44660
(flores.german, benavides.juandedios, moren.davidarturo)@inifap.gob.mx

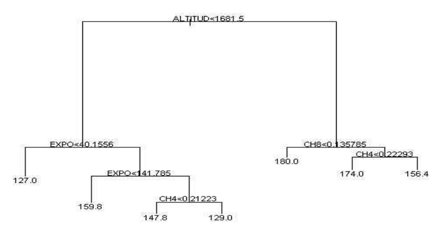
INTRODUCTION. Fire management planning require of a precise information of quantity and quality of many factors, such as forest fuels. Moreover, it is important to know fuels location and the spatial variation of fuel loads. Many direct and indirect techniques have been tested, some of the work with ancillary information, such as satellite imagery. In fact satellite imagery has become a practical alternative to classify land covers, with a acceptable level of accuracy, which is strongly related to forest fuels. We also count with spatial information of topography, climate, altitude, soil, etc, which can used to define spatial distribution of forest fuels. This paper illustrate the use a classification and regression trees (CART), to spatially model forest fuel distribution.

METHODOLOGY. The study area was located arround Guadalajara city (Jalisco state, Mexico). The project was divided into two phases: I) Sampling field data; and II) Generating thematic fuel maps. For the former, the following fuel types were sampled to support thematic maps generation: (a) 1-HR fuels; (b) 10-HR fuels; (c) Downed woody; (d) Fine fuels weight; and (e) Fine fuels depth. Since we knew well the study area, we used a stratified sample design, with sample plots located randomly into each stratum. The stratum were defined based in the reflectance of satellite imagery, in an area of around 1400 ha. A total of 79 sample plots were measured, Plot center locations were determined using a global positioning system (GPS) receiver.

To generate the thematic maps we use the technique CART, which was based on the use of each band of the Landsat TM imagery of 2003. Recently, CART, also known as recursive partitioning regression, has received more attention from land use/cover classifiers. CART´s subdivide the space spanned by the predictor variables into regions, for which the values of the variable response are approximately equal, and then estimate the variable response by a constant in each of these regions



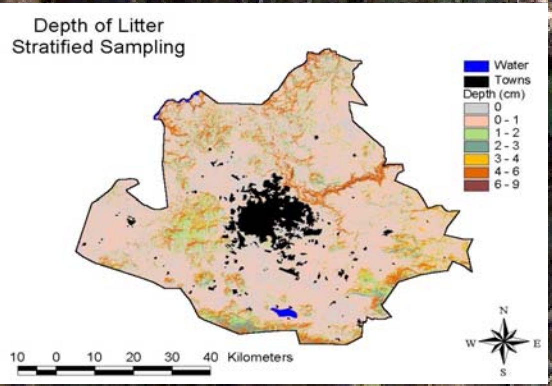
Sample plot design used to measure forest fuels characteristics: a) A 30 x 30 cm square for sampling fine fuels (litter and humus); b) *C* ; A 14 m transect to evaluate downed woody of 0 - 7.5 cm of diameter.

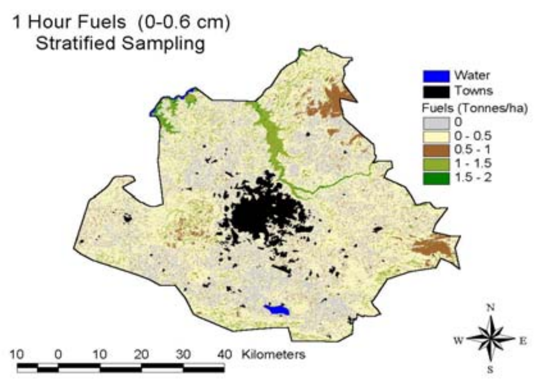


Regression tree defined to estimate the spatial distribution of 1-hour fuels.

RESULTS AND DISCUSSION. According to the CART´s generated, the variables defined using the digital elevation model have a higher influence to modeling the spatial distribution of fuels. The resulting maps shows that higher fuel loads (tn/ha) occurs in the central region of the study forest land. The larger depth measures of both litter and organic matter were located were pine species occur: Due to the low amount of sample plots, there are some limitations regarding models precision. Nevertheless the methodology showed allows to consider a larger number of control plots and improve the resulting models.

The higher fuel loads are located in forested areas. The black spot located in the center of the map corresponds to Guadalajara, city The areas with lower values correspond mainly to agricultural lands or grass lands. On the other hand, Figure 3b it is possible to see the spatial distribution of fuel loads corresponding to 1-hour fuels (0-0.6 cm of diameter). In this case, the higher values are located in a strip at the north center region of the study area. This area is defined by the riparian vegetation along the Lerma river, which mostly is low tropical forest. In general we found a low amount of 1-hour fuels in the study area.





CONCLUSIONS. The definition of continuous surfaces is a great alternative to understand better the gradual changes of forest fuels. Based on this it will be possible to prioritize which areas have more risk of fire (related mainly in 1-HR distribution), and which areas could produce higher negative effect of the forest ecosystem elements (tree, grasses, soil, water, etc.). The latter is focused mainly on the potential of fire intensity fire, which are related to large dimensions fuels. the methodological process of CART is adequate to model the spatial distribution of forest fuel features. Although CART has certain level of complexity its use is very practical. Mainly because it so flexible that allows to test different layer of information. In further studies we recommend to compare the results when using other techniques, such as kriging, cokriging, non-supervised and supervised classifications, etc.

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