SYSTEM TO IDENTIFY THE POTENTIAL FOREST FIRE DANGER IN CHIHUAHUA MEXICO

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1. INTRODUCTION[1]

The state of Chihuahua has the most extense forest surface in México and every year it's between the first places in forest productivity. However has too a high record in forest fire ocurrence. During the years 1998, 1999 and 2000 ocurred the most incidence of fire forest from the last 15 years (SEMARNAT 2002). This was due to the extreme meteorological conditions that ocurred in those years, when it was present a prolonged drought event. In the affected areas decreased the productivity and commercial surface, this conditions are favorable for the pest presence. In México there is a forest fire danger model developed to national scale. This model shows the regions with fire danger daily. Also the National Meterological Service has a early alert system and daily publishes the active fire localization. Similarly the CONABIO detects and publishes daily the localization of the sites with the highest temperatures and that potentially represents active fire occurrence (CONABIO, 1998a). Unfortunately this information does not provide the sufficient detail level that is required for to develop prevention strategies to regional and local scale

In Chihuahua was developed a system to identify the potential forest fire danger with the purpose of contribute to improve the actual prevention scheme of forest fire. The model Developed integrate climatic, topographic and socio-eocnomic variables associated to the forest fire ocurrence in Chihuahua and shows temporarily and spatially the forest fire danger.

2. OBJETIVE

To identify climatic, topographic and socio-economic variables associed to the forest fire ocurrence in Chihuahua and to represent spatially and temporarily the forest fire danger in the Chihuahua forest region.

3. METODOLOGY

Were analyzed the variables that contribute in the forest fire occurrence in Chihuahua. The most significant were integrated in a cartographic model developed to represent the potential forest fire danger of occurrence in the region. This model is conformed by a component of susceptibility of the vegetation to the fire ocurrence, a meteorological component integrated as well by temperature, humidity of the atmosphere, speed of wind and slope direction or aspect like a topographic variable; and finally, a cause component that considers like causal variables: the agricultural activity, populations and routes of communication proximity to the forest. Each variable was represented spatialy and integrated in the model by means of a procedure denominated "Evaluation Multicriterio" (Malczewski 1999; Eastman, 1999). Each component was obtained and evaluated through a decision rule, using a Weighed Linear Combination using the Arc/INFO® program. The Figure 1 shows the organization and integration of each variable in the components of the model of potencial forest fire danger.
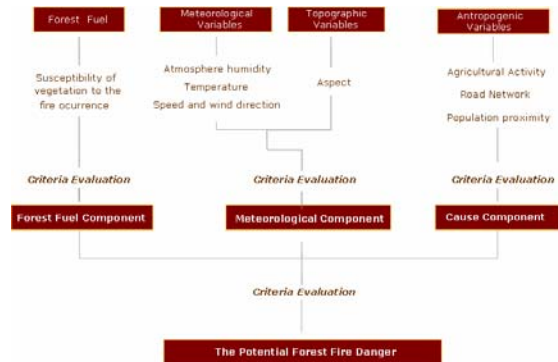

Figure 1.- Conceptual model of potential forest fire danger.

4. RESULTS

The criteria to define the category of susceptibility were the fire frequency and the capacity of recovery of each type of vegetation established in a workshop developed by CONABIO and verified in Chihuahua (CONABIO, 1998b). The Figure 2 shows the component of susceptibility of the vegetation to the fire occurrence.
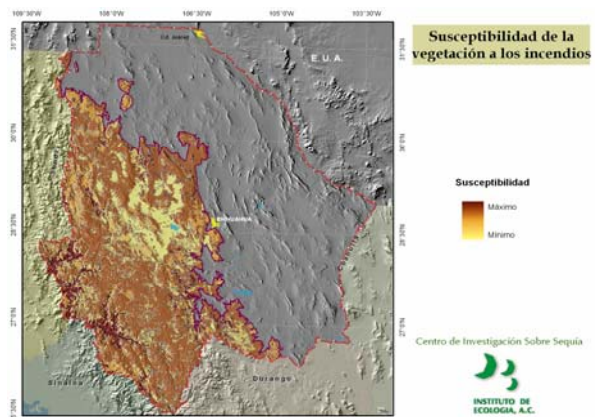

Figure 2.- Component of susceptibility of the vegetation to the fire ocurrence.

The meteorological component offers a temporary character to the model due to the change of the climatic conditions and it's conformed by slope direction like a topographic variable, temperature, humidity of the atmosphere, speed of wind obtained in real time. The model of this component is mathematically represented by the next equation.

$$CM_i = hr_i \cdot 0.5247 + t_i \cdot 0.333 + op \cdot 0.1416$$

were:
CM_i: it's the Meteorological Component for the *i* day
Hr_i: it's the humidity of the atmosphere for the *i* day
t_i: it's the teperaqture for the *i* day.
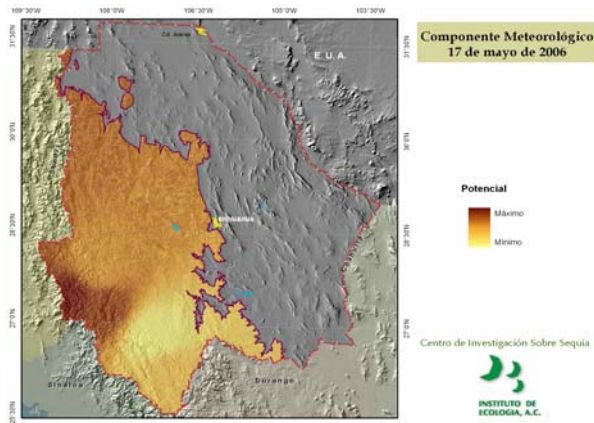op_i: It's the slope direction.

Figure 3.- Meteorological component for May 17th

The Cause Component represents the influence of the human activities in the fire occurrence and it´s mathematically expressed by the next equation:

$$CC = dc \cdot 0.1411 + dp \cdot 0.3339 + aa \cdot 0.5250$$

were:
CC: it's the Cause Component.
dc: it's the proximity from ways to the forest.
dp: it's the proximity from populations to the forest
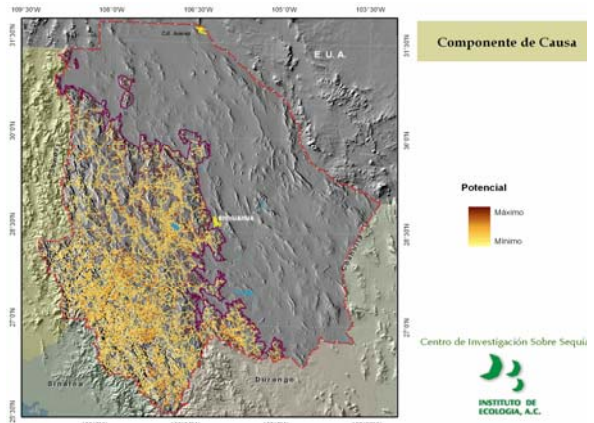*aa*: it's the proximity from agricultural activity to the forest.

Figure 4.- Cause component.

The Potential Forest Fire Danger model it was constructed from the importance values assigned to the components of susceptibility of the vegetation to fires, meteorological and of cause.

$$IPIF_i = CM_i \cdot 0.490 + CCF \cdot 0.198 + CC \cdot 0.312$$

were:
IPIF_i: Potential Forest Fire Danger Index for the *i* day
CM_i: Meteorological component for the *i* day
CCF: Forest Fuel Component
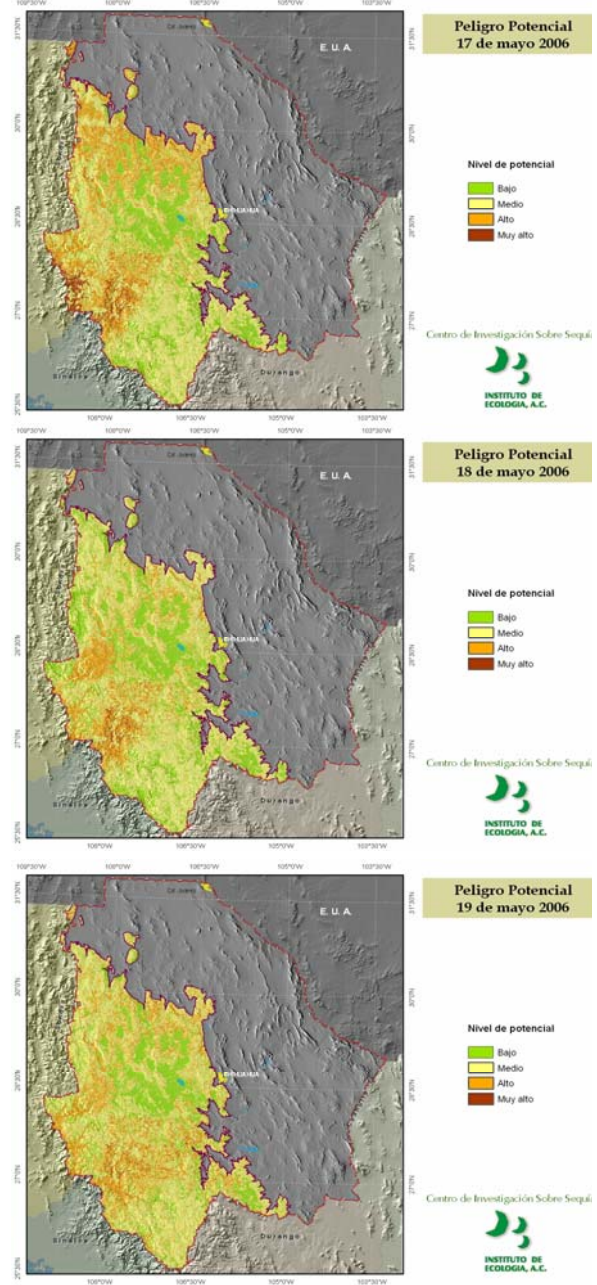*CC*: Cause Component.

Figure 5.- Potential forest fire danger for May 17th, 18th and 19th

The model validity was determined in function of the active fire detected during 2006. For each active fire, the potential forest fire danger value was obtained. In the Figure 6 can be observed that the highest frequency of the active fires, are located in the areas classified by the model like areas of high potential danger. This preliminarily indicates the validity of the modell
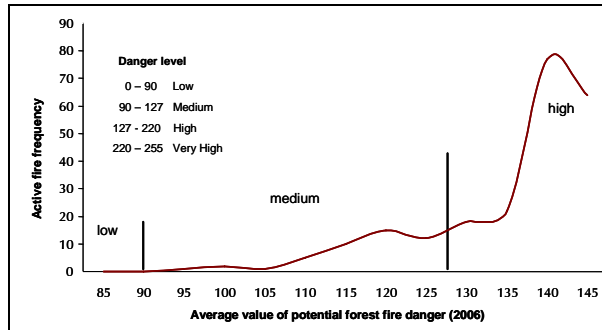
Figure 6.- Relationship between the fire active frequency and the potential forest fire danger.

5. CONCLUSIONS

The daily cartography of forest fire danger is very useful for to develop prevention strategies at regional and local level.

It´s necessary to include more automated climatologic stations to improve the representativeness of the meteorological component.

5. REFERENCES

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