J11.9 EXHAUSTING RELATIVE GREENNESS: AN INACCURATE FIRE POTENTIAL INDEX FOR FLORIDA?

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1. INTRODUCTION

Florida has a long history of fire, both natural and man-made. The devastating fire season in 1998 provided motivation to investigate whether any current predictors of wildland fire danger were correlated with the fire activity that was experienced. The Florida Division of Forestry (DOF) currently uses the Keetch-Byram drought index (KBDI; Keetch and Byram 1968) and the Atmospheric Dispersion Index (DI; Lavdas 1986) to indicate the potential for extreme fire behavior. The spread and buildup indices based on the 1964 National Fire Danger Rating System (NFDRS) are used to determine fire danger and set fire readiness levels. The goal of this study is to investigate the Fire Potential Index (FPI: Burgan et al. 1998), particularly the satellite derived relative greenness component, and its correlation to wildland fires in Florida.

2. BACKGROUND

The FPI was developed to incorporate both satellite and surface observations into an index that correlated well with fire occurrence and could be used to map fire potential from national to local scales through the use of geographic information systems (GIS). The primary reasons for developing such a model were to produce a method to depict fire potential at continental scale and at 1 km resolution and to provide a method of estimating fire potential that was simpler to operate than the current National Fire Danger Rating System (Burgan 1988).

The assumptions developed for calculation of the FPI were: 1) fire potential can be assessed if the moisture level of live and dead vegetation is reasonably represented, 2) vegetation greenness provides a useful parameterization of the quality of high moisture content live vegetation, 3) ten hour time lag fuel moisture should be used to represent the dead vegetation because the moisture content of small dead fuels is critical to determination of fire spread, and 4) wind should not be included in this model because it is so transitory. Thus, the inputs to the FPI are a 1-km resolution fuel model map, a satellite-derived relative greenness map, and a 10-hour time lag dead fuel moisture map (Burgan and Hartford 1993).

Experimental FPI maps are produced by the USDA Forest Service and are available on the Wildland Fire Assessment System (WFAS) website (http://www.fs.fed.us/land/wfas/experment.htm). Figure 1 shows an example of the national map of FPI as well as the relative greenness, 10-hour fuel moisture, and fire danger. The national scale fuel map used is very coarse and does not accurately represent the fuels found in Florida, particularly when compared to the state's 30 meter resolution fuels map. The map of fuel moisture is very coarse and not representative of the conditions across the state as there are very few sites within the state that report to WFAS.

The correlation of FPI to fire occurrence in California and Nevada was investigated and found to have good agreement with fires in these regions (Burgan et al. 1998). The relationship of the FPI to fires in other regions has not yet been shown to any degree. Rather than calculating the full FPI, this study will look at the relationship between satellite-derived relative greenness and fire history in Florida as a first step in evaluating the potential use of the FPI in the state.

3. DATA

Relative greenness is derived from the Normalized Difference Vegetation Index (NDVI; Goward et al. 1990). The NDVI is calculated from data obtained from the Advanced High Resolution Radiometer (AVHRR) on board the TIROS-N satellite. NDVI is related to the photosynthetic activities of living plants. The higher the NDVI value the greener the cover type. The NDVI increases as the quantity of green biomass increases.

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Historical maximum and minimum NDVI maps for the entire US are produced by extracting the largest and smallest values observed for each pixel from all bi-weekly NDVI values recorded over a 10-year period. Pixels that are affected by clouds and snow are excluded. These NDVI values are then composited into maximum and minimum maps and used with current bi-weekly NDVI maps to perform the relative greenness calculations.

Relative greenness (RG) is a percentage value expressing how green each pixel is compared to the maximum values obtained in the previous step. The RG is related to the quantity of live vegetation that has relatively high moisture content. The final RG images show the overall greenness content of Florida (see Fig. 2 for some examples).

4. ANALYSIS

Historical relative greenness values will be compared against historical fire occurrence data for Florida. The fire data will be broken down into acres and ignitions, with ignitions further broken down into all sources and lightning. The results will be evaluated on a statewide basis as well as looking at the performance of RG by fuel type.

5. ACKNOWLEDGEMENTS

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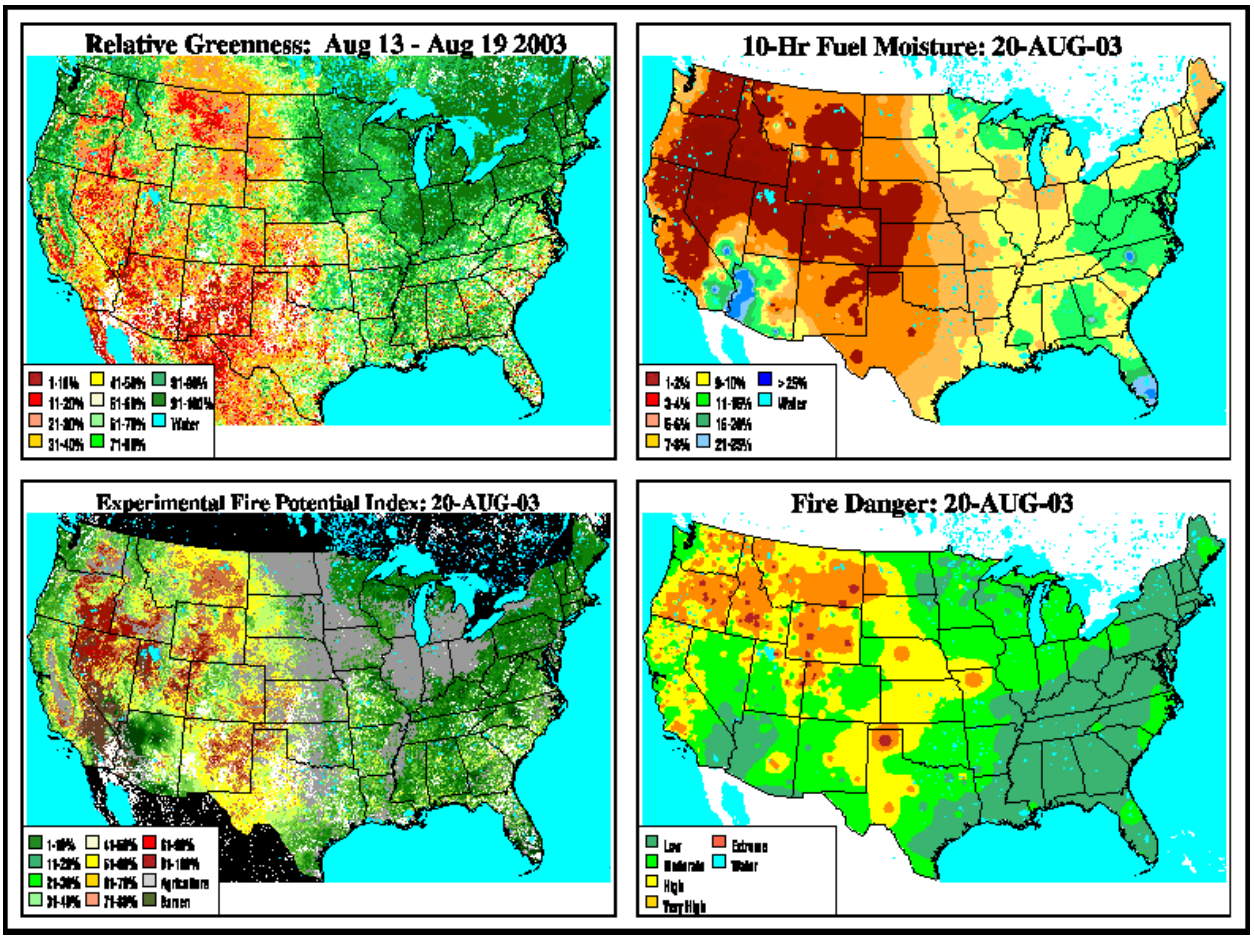

Figure 2. Example of the experimental fire potential index products available on the Wildland Fire Assessment System (WFAS) website (http://www.fs.fed.us/land/wfas/experment.htm).

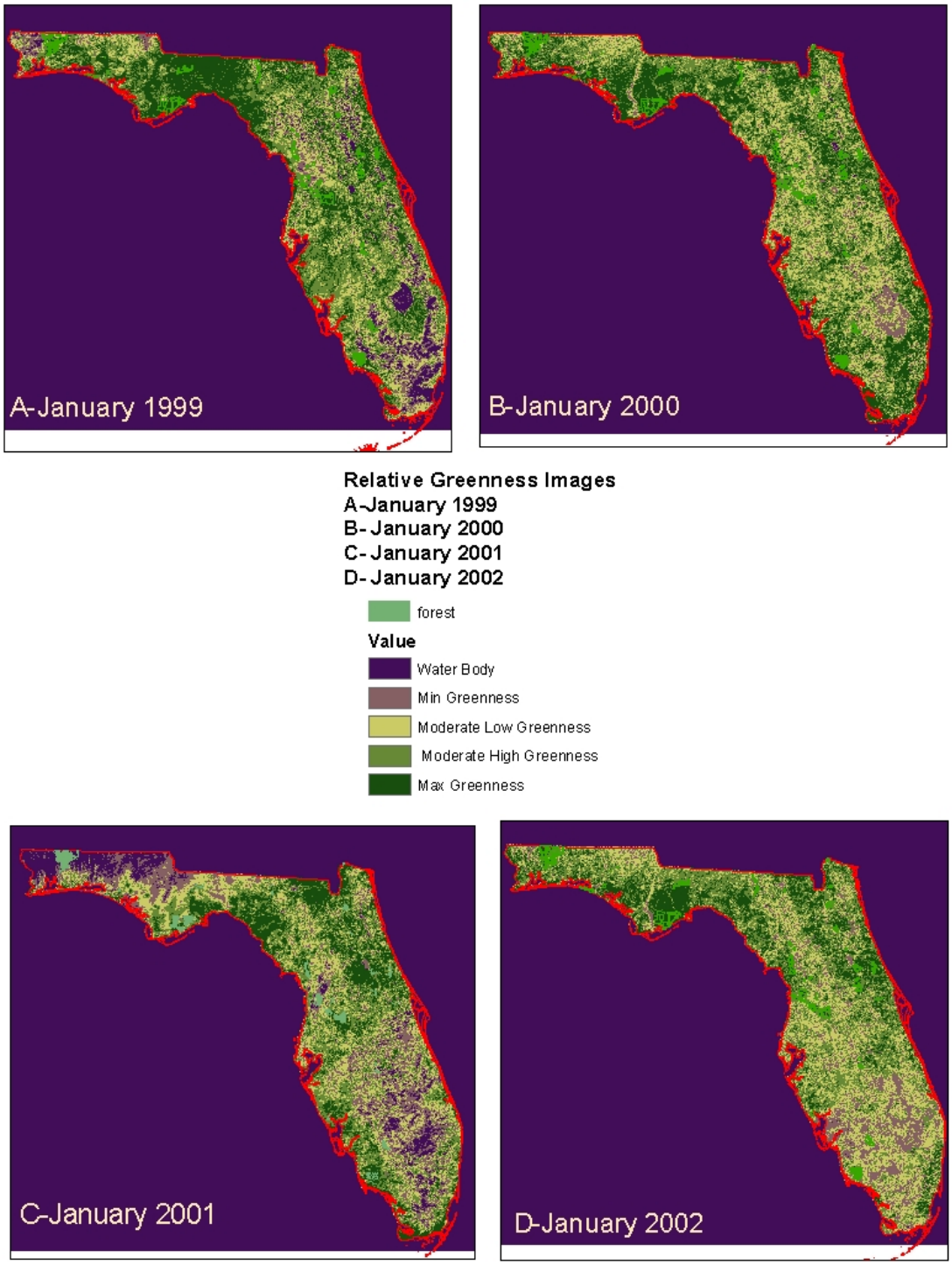

Figure 2. Examples of relative greenness maps for the State of Florida for January 1999-2002. Each image represents the same time span.