Hyperspectral analysis to detect and map tree decline at Ft. Benning, GA.

STARS — US Army Corps of Engineers®

CONTACTS: Dr. Susan Ustin slustin@ucdavis.edu   Maria J. Santos mjsantos@ucdavis.edu

The Department of Defense Legacy Resource Management Program has put forward considerable effort in their conservation program towards the integration of Endangered Species habitat requirements, mandated through the Endangered Species Act, and maximizing land, air and water training opportunities. One of the target species under this agreement is the red cockaded woodpecker (*Picoides borealis*). This species is a habitat specialist using mostly old growth pine forests, found in parts of Ft. Benning installation. Because some of the pre-existing habitat and mitigation habitat is facing tree decline, the DoD, has contacted the University of California, Davis, to undertake a pilot study to assess the suitability of hyperspectral imaging technology for monitoring declining tree health in this installation and extend the application to other installation with similar declining patterns.
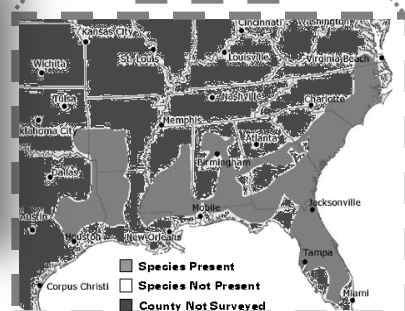
Georgia's population of pine species have been in decline due to multiple factors (drought, pathogens, herbivores and pests)

Adequate monitoring can help inform the areas most likely to be affected

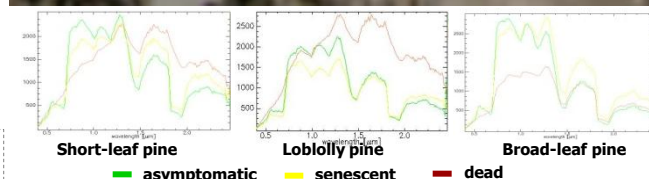Loblolly pine (*Pinus taeda*)   Longleaf pine (*Pinus palustris*)   Shortleaf pine (*Pinus echinata*)

www.mbr-pwrc.usgs.gov/county_birds/3950.gif

http://www.backfromthebrink.org/pop_up_slideshow.cfm?animalid=7&imgnum=0
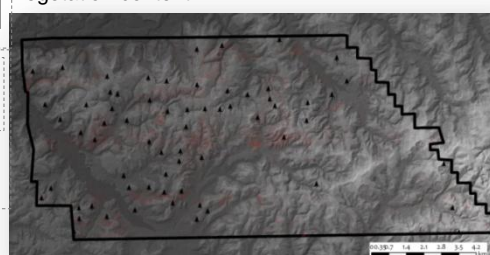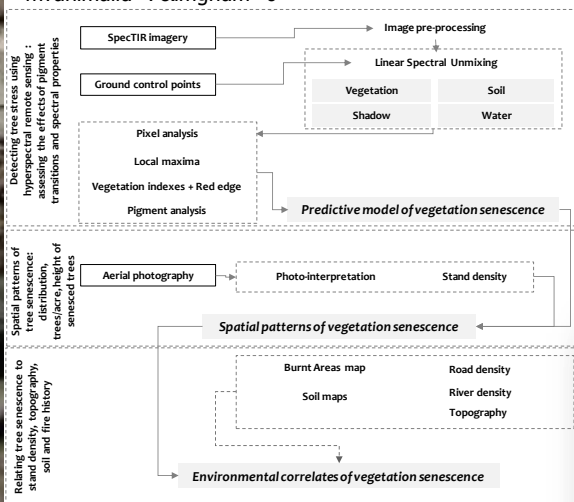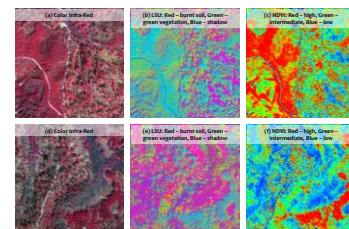
Species Present
Species Not Present
County Not Surveyed

Goal: Assess the suitability of hyperspectral imaging technology for detecting and monitoring tree health in Ft. Benning military installation.

Short-leaf pine   Loblolly pine   Broad-leaf pine
asymptomatic   **senescent**   **dead**

Linear spectral unmixing

The spatial patterns of the original imagery (CIR panels a and d) were well mimicked by LSU analysis (panels b and e) as well as NDVI (panels c and f) was used to estimate green vegetation content.

Detecting tree stress using hyperspectral remote sensing : assessing the effects of pigment transitions and spectral properties

SpecTIR imagery → Image pre-processing
Ground control points → Linear Spectral Unmixing
Vegetation | Soil
Shadow | Water

Pixel analysis
Local maxima
Vegetation indexes + Red edge
Pigment analysis
Predictive model of vegetation senescence

Spatial patterns of tree senescence: distribution, trees/acre, height of senesced trees

Aerial photography → Photo-interpretation | Stand density
Spatial patterns of vegetation senescence

Relating tree senescence to stand density, topography, soil and fire history

Burnt Areas map | Road density
Soil maps | River density
Topography
Environmental correlates of vegetation senescence

Classification and Regression Trees Senescence map

Pixels consistently classified have high likelihood of senescence.

UC DAVIS UNIVERSITY OF CALIFORNIA

Department of LAND, AIR AND WATER RESOURCES University of California, Davis
Climate Change • Sustainable Agriculture
Environmental Quality • Landscape Processes