CONCLUSIONS

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- The study shows the importance of Hyperspectral data in understanding vegetation characteristics at species level. Hyperspectral imagery gave a better view to look into the differences of tropical forest vegetation. Tropical vegetation has unique features as compared to coniferous. Besides having larger diversity, the vegetal cover is not as uniform as is normally seen in coniferous. This makes the discrimination process more challenging. This study shows the advantages of using hyperspectral data of two different dates coming from different seasons. It reveals the usefulness of NASA's EO-I Hyperion data at species level discrimination of tropical vegetation at Shoolpaneshwar Wildlife Sanctuary (Gujarat, India) during dry season as well as at post wet season.

- Typical vegetation signal pattern is seen in post wet season where the tree species have showed pronounced chlorophyll absorption at 680nm, maximum reflectance at NIR and low ligno-cellulose absorption in SWIR region, while in dry-season species with different phenological conditions showed decreased chlorophyll absorption and increased ligno-cellulose absorption. This study concludes that phenological variation, size of canopy together with biochemical constituents alter the leaf reflectance. Species with different phenological conditions show different spectral signatures. Differences in leaf optical properties due to seasonality (wet/dry cycles) could be either beneficial or confusing to tree species identification. Temporal phenomena such as flowering, leaf flush, or senescence could also be looked into for developing spectral signatures.

- Study reaffirms the findings of earlier scientists where tree species showed distinct absorption features in VIS region and reflectance features in SWIR-I & SWIR-II region of the continuum removal spectra. Continuum removal spectra clearly showed the pronounced biochemical features in dry condition using Hyperion data. In this study the continuum removed spectra showed several distinguishable absorption features in two different data sets. Study concludes that

there is a considerable variation in the depth of absorption features which are likely due to differences in the chlorophyll concentration between selected species. Chlorophyll absorption features are stronger in wet season.

- Variations in the reflectance values of *Tectona* due to physiognomy of trees and also for topographic change were recorded. Different stages of senescence in dry season are responsible for larger variations in different girth classes of *Tectona* as compared to post wet season. This indicates the usefulness of Hyperion data in discriminating a tree species based on their size. ANOVA performed showed that the differences seen amongst reflectance spectra of different girth classes are significant (α=.01) for both the data sets. There is a negative correlation between girth of the *Tectona* tree and corresponding reflectance spectra from dry season imagery whereas there is a positive correlation in post wet season imagery.

- The study shows how to obtain a Descriptive spectrum from multiple observations of the same species. By comparing the Descriptive spectra of selected tree species using ANOVA and Distance measurements (D & θ) it is concluded that Hyperion data is useful for species level discrimination. REP values showed the influence of phenological variations in the red-edge region. The results indicate importance of derivative spectra in picking up the best bands for species discrimination. Supervised classification using maximum likelihood classification showed an overall accuracy of 60.7%, with a kappa statistic of 0.57. This shows bands from VIS and SWIR-I regions are useful in discrimination of tropical species using Hyperion data set. The study is useful for effective management of tropical forest in fast developing countries. Future work could include determining the spectral separability of other deciduous species. Accurately classifying tree species which will aid in efficient forest management, whether for commercial (e.g. inventory) or environmental (e.g. carbon sequestration) goals.

- Present study highlights the use of post wet season imagery to discriminate tropical tree species. Study shows the importance of Spectral Angle Mapper (SAM) to evaluate the spectral similarity of image spectra to the reference spectra. The study accentuates the use of Hyperion to classify tropical trees based on entire spectrum, spectrum partition analysis and spectra from MNF (Minimum Noise Fraction) bands using SAM (Spectral Angle Mapper) algorithm. MNF transformation followed by PPI enabled better endmember detection. SAM classification with 196bands (full-spectra) of Hyperion data gave 51% OAA for the 5 tropical trees selected. Obtained OAA is fairly valued looking at the pattern of vegetal cover and also of the sensor used. Partition analysis of the spectrum indicated superiority of VIS-NIR region for classification. VIS-NIR region of spectra is more appropriate for classifying tropical trees with thick canopy. SWIR-I & II did not fare well because of the biophysical state of vegetal cover. Spectra from MNF bands equally did better in feature extraction. With the reported densities for *Tectona* and *Dendrocalamus*, Hyperion is found to be an appropriate sensor for monitoring. Results showed that the higher accuracy using MNF band combination indicated the potential of MNF transformation to increase classification accuracy of tropical trees by reducing data dimensionality. Present study highlights the importance of Homogeneity of vegetal cover as a critical aspect for classification in tropical areas. This study concludes that SAM is an appropriate method for classifying Hyperion data of tropics. It would be beneficial for forest managers in mensuration studies, monitoring and management.

- Observations from floor cover studies showed the potential of Hyperion data in deciphering floor cover characteristics in dry season. Using this forest department can easily monitor changes in litter load on the forest floor. This is to evaluate the potential of forest fire occurrence largely due to dry deciduous vegetation. This helps in developing a prewarning system for the prevention of forest fire. This is a very encouraging result, because it is difficult to distinguish dry vegetation and soil where dry vegetation is a critical component of fuel. This indicates that Hyperion data can be useful to discriminate floor cover types in dry season. This kind of information is very useful for forest fire studies where dry cover plays a major role.