

Species Distribution Model using Hyperspectral Data Application in Peatland, Central Kalimantan

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Abstract. Tumih / Parepat (*Combretocarpus-rotundatus* Mig. Dencer) of the family Anisophylleaceae and Meranti (*Shorea Belangerang*, *Shorea Teysmanniana* Dyer ex. Brandis) of Dipterocarpaceae are groups of species of vegetation that is modeled for the designation of its spread. Pioneer species are predicted as an indicator of ecosystem restoration succession of wet tropical peatland characteristic (*unique*) and very susceptible (*fragile*) in an endemic Sundaland hotspot. Projected climate change and conservation planning a topic of heated discussion, the analysis of alternative approaches and the development of a combination of search algorithm projection models within the fabric of the diffusion of the species to attain this through a geospatial information system technology. Model approach used to work out problems in research on this vegetation species level based machine learning is a method (hybrid), which is a combination of wavelet and neural network. Often the approach to field data into general use in the management of natural resources and biodiversity assessment. Expression of the hybrid models provides encouraging results, to decide the classification of the species Tumih / Parepat and Meranti through mapping of vegetation species that are backed up by the pattern of the spectral curve of the field spectrometer.

Keywords: species mapping, algorithms, hybrid models.

1. Introduction

Healthy peatland forest store huge amount of soil and biomass carbon. The composition florists peat land forests of Central Kalimantan, has a variety of flora species that come down into group family botanical endemic hotspot Sundaland, is a species Tumih / Parepat (*Combretocarpus-rotundatus* Mig. Dancer) of the family *Anisophylleaceae* and groups of species Meranti (*Shorea white, red and yellow, Shorea Belangerang, Shorea Teysmanniana* Dyer ex. Brandis) of *Dipterocarpaceae*. Both families are considered can be used as an indicator of the presence of peat burned and anthropogenic cause, with the approach of geospatial information through the vegetation cover.

Flora mapped resultant distribution enabled visualization of vegetation homogeneous, heterogeneous mix of dissimilar species of plants, without the demand for a unique spectral signature or characteristics of the data collection. Forest degradation in peatland forest is directed to correlate to dissolved organic carbon from artificial canals, poor growth vegetation, and forest disturbance.



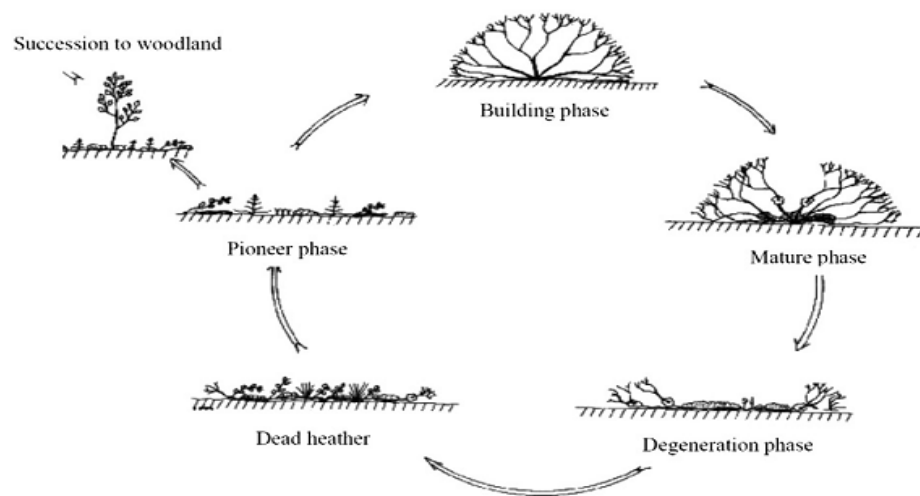


Figure 1. Phase difference vegetation species growing in peat land (Delalieux, *et al.*, 2012)

Groups of plant species and vegetation of peatlands are a pioneer species that develops when it is over peat fires. Floristic composition of wet tropical Peatland has a wealth of flora and biodiversity species to provide environmental services functions as a natural habitat with the ability of absorbing and storing carbon (*carbon sink*) from the atmosphere and is not found in other ecosystems [1].

These plants are beneficial to plants recovery peat soil adaptability to environmental conditions, because it contains fungus *Mikoriza Arbuskula*, which acts as an important factor for the ecosystem such as (*composition of the soil, plants, energy absorber*), and the effect is better than other types of plants [3]. Equally we recognize that the plan of attack to acquire geospatial information that has been carried out using a mixture of technologies multispectral imagery, but previous approaches did not offer detailed information classification in the instance of certain plant species level peatland forests.

In this inquiry, how potential hyperspectral data to assess and characterize forest degradation types, discrimination of plant/tree species (through biophysical parameteres), detection from spectral signature features extraction, soil types, etc. To development of algorithms to accept vantage of the availability of hyperspectral image (HyMap) and field spectral data collections (spectral library) for troubleshooting assessment of natural resource inventories. Our principal contribution of this inquiry is to map the vegetation species of peat based methods of machine learning the application of a hybrid model; wavelet and artificial neural networks, assess the relevance and accuracy of the classification of regular maps with maps hybrid design results. Calibration is performed by referring to a map correction measurement data library of spectral reflectance field to HyMap image correct.

2. Method

Technical information WANN methods below, is the integration of both the image data and Spectrometer HyMap field to compare the output with the regular distribution map distribution map design results in a hybrid model WANN (*Wavelet + Artificial Neural Networks*). The purpose of this mannequin was employed to examine the appropriateness and suitability of the input data set that is designed as an input data set for the distribution of 3 (three) classification of the vegetation species peatland type of dataset of species, namely: Tumih / Parepat (*Combretocarpus-rotundatus*), Meranti (*Shorea: White, Red, Yellow*), and the categorization is not peatlands.

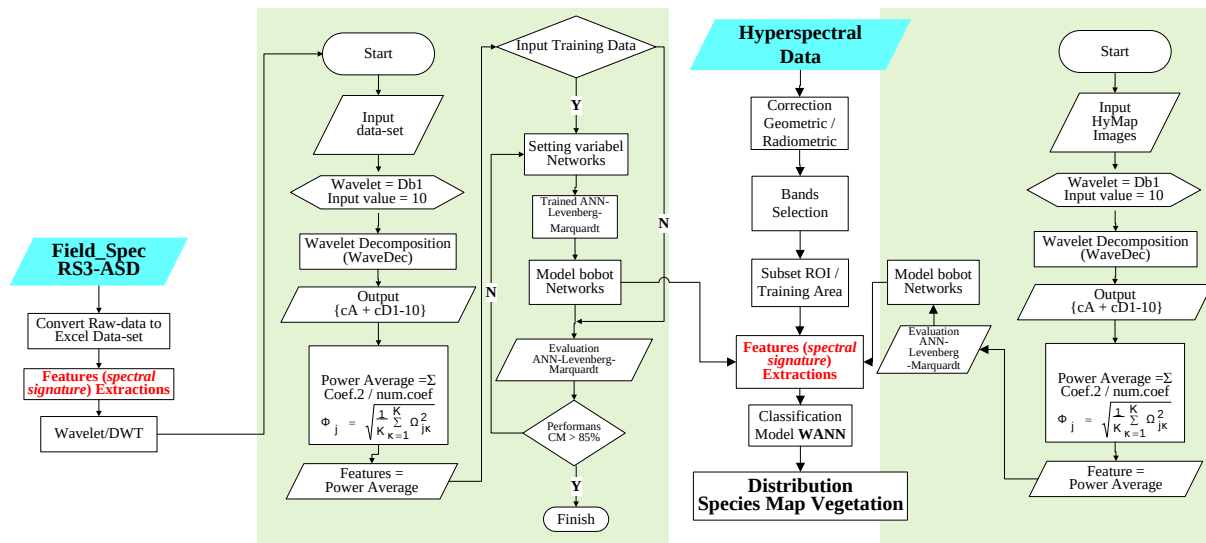


Figure 2. Integration classification WANN model for distribution map of vegetation species.

3. Results and Discussions

The effects of model validation design, distribution map design results in a hybrid model WANN (Wavelet + Artificial Neural Networks) with a regular distribution map output, as follows:

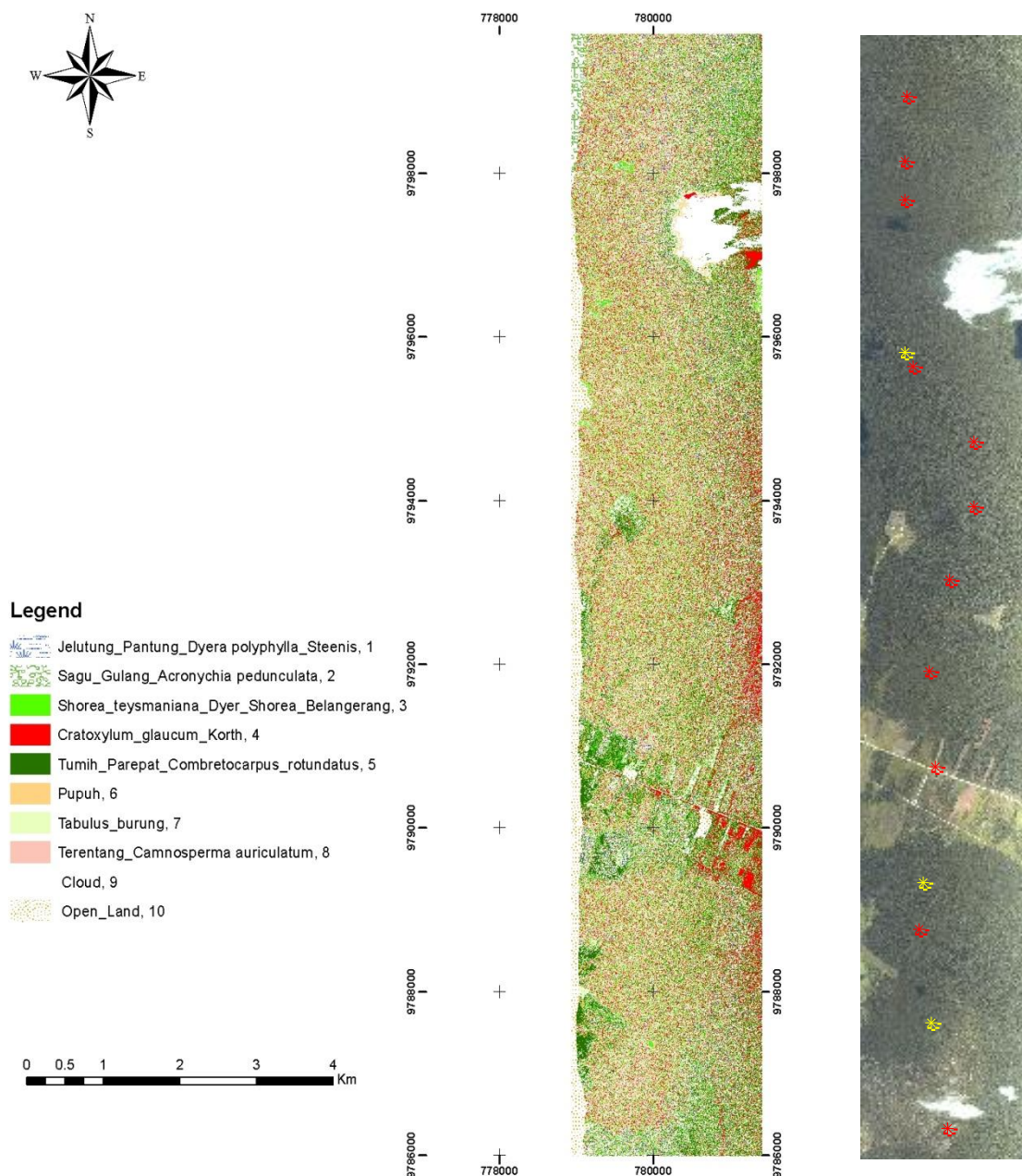


Figure 3. Distribution map of peatland species vegetation (left) and validation results using model WANN of (red dots: *Sagu gulang* and yellow dots: *Tumih/Parepat*) on Strip_HU01_04, HyMap Imagery (right).

Nevertheless, the successful mapping of the make-up of those species and plant in this model is dependent on how Peatland plant functional types are defined. The classification of species into existing well-recognized may not always be the most appropriate grouping from a remote sensing perspective and furthermore, the same definition of those species and plant may not be useful for elucidating all interaction effect landscape to the atmosphere cycling processes. But at least we will get some ideas in advance from this research and consequently, further work should focus on understanding how the Peatland vegetation function and ecological theory can be more effectively linked to optical properties behaviour of plant [2].

4. Conclusion and Recommendation

WANN hybrid method showed quite good results of calculations which show the value of MSE (*minimum square error*) is smaller than the ANN training data, which totaled performance MSE = 0.0837 and 0.0547. Method development of hyperspectral with programming in software MatLab-based hybrid method WANN (Wavelet + Artificial Neural Networks) at the location of sample point positions vegetation species Tumih / Parepat (*Combretocarpus rotundatus* Mig. *Dancer*) and Meranti (*Shorea white, red and yellow, Shorea Belangerang, Shorea Teysmanniana Dyer ex. Brandis*) in HyMap imagery target of this study, showing results quite accurate (precision) right after cross-marked by the placement of GPS Spectrometer sampling locations in the area. The validation level attained by the above computation results reaches an accuracy rate of 90% so that the computation can be trusted design algorithm development (*source code*) programming can be applied on other images that are either multispectral, hyperspectral imaging and also recording results drone.

5. Acknowledgements

I would like to thanks are conveyed on behalf of deceased our brother Mr. Muhammad Evri (Agency for the Assessment and Application of Technology, BPPT) who delivered previous talks and adviced me to this research and Mr. Hendrik Segah from the Faculty of Forestry, University of Palangkaraya (UNPAR) - Central Kalimantan, which has been willing to provide a means of handheld spectrometer measurements in the field. Which supply me of hiperspectral data (HyMap) images from cooperation projects between BPPT- UNPAR, Indonesia and JST-JICA Japan.

References

- [1] Arunarwati, B. 2015 Pendekatan Special Lahan Gambut [Presentasi Power Point] Retrieved from www.cifor.org/ipn-toolbox/
- [2] Harris, A., Charnock, R., & Lucas, R. M. 2015 Hyperspectral remote sensing of peatland floristic gradients *Remote Sensing of Environment* **162** 99–111 <http://doi.org/10.1016/j.rse.2015.01.029>
- [3] Suryadi, U. E. 2013 *Dampak Pembendungan Kanal Terhadap Watak Fisika dan Kimia Gambut Ombrogen dalam Usaha Pemulihan Lahan Terdegradasi* (Gadjah Mada Yogyakarta)