

## PEMETAAN SPESIES INVASIF *ACACIA DECURRENS* MENGGUNAKAN CITRA HIPERSPEKTRAL PRISMA DAN *MULTIPLE ENDMEMBER SPECTRAL MIXTURE ANALYSIS* (MESMA) DI SEBAGIAN TAMAN NASIONAL GUNUNG MERAPI

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### INTISARI

*Invasive alien plant species* (IAPS) mengalami peningkatan penyebaran secara global dan menjadi salah satu ancaman terhadap penurunan biodiversitas ekosistem. Salah satu IAPS yang ditemukan di Taman Nasional Gunung Merapi (TNGM) adalah *Acacia decurrens* (*A. decurrens*) yang berasal dari New South Wales, Australia. Langkah awal dalam manajemen spesies ini dapat dilakukan dengan pemetaan untuk menyediakan informasi sebagai dasar pengambilan keputusan pengelolaan. Kombinasi antara citra hiperspektral PRISMA dan *multiple endmember spectral mixture analysis* (MESMA) dapat dimanfaatkan untuk melakukan pemetaan *A. decurrens* di TNGM. Oleh sebab itu, penelitian ini bertujuan untuk: (1) Membangun dan menganalisis perpustakaan spektral dari *A. decurrens* dan objek dominan di sebagian TNGM; (2) Memetakan *A. decurrens* di kawasan tersebut; serta (3) Menganalisis akurasi metode MESMA dalam pemetaan spesies *A. decurrens*.

Ekstraksi *endmember* dilakukan dengan *minimum noise fraction* (MNF) dan *pixel purity index* (PPI) serta perekaman langsung pada objek dengan spektrometer FieldSpec 4. Metode pemilihan *endmember* yang digunakan adalah *iterative endmember selection* (IES). Model MESMA dibangun dengan kompleksitas dari 3 *endmember model* (EM) hingga 7 EM, kemudian dibandingkan nilai akurasi terbaiknya. Pengujian akurasi estimasi fraksi dilakukan dengan *mean absolute error* (MAE), sementara hasil *hard classification* dari nilai fraksi dievaluasi dengan *confusion matrix*.

Penelitian ini berhasil membangun 150 kurva spektral dengan fitur serapan *A. decurrens* pada 684 nm, 1.147 nm, 1.976 nm, dan 2.305 nm. Berdasarkan model terbaik, sebaran *A. decurrens* teridentifikasi mendominasi di Resort Cangkringan, Kemalang, Musuk Cepogo, Selo, dan Srumbung. Akurasi model cenderung tinggi pada fraksi MESMA 7 EM yang mempunyai nilai MAE 90 m<sup>2</sup> pada kelas *A. decurrens*. Pada level piksel nilai OA terbaik diperoleh pada model 7 EM dengan nilai 44,32%, sementara model 3 EM mempunyai OA 18,05%; model 4 EM mempunyai OA 20,86%; model 5 EM mempunyai OA 24,85%; model 6 EM mempunyai OA 44,32%.

**Kata kunci:** *A. decurrens*, Hiperspektral PRISMA, IAPS, MESMA

## MAPPING OF INVASIVE SPECIES ACACIA DECURRENS USING HYPER SPECTRAL PRISMA IMAGERY AND MULTIPLE *ENDMEMBER* SPECTRAL MIXTURE ANALYSIS (MESMA) IN PART OF MOUNT MERAPI NATIONAL PARK

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### **ABSTRACT**

Invasive alien plant species (IAPS) are spreading globally and pose a threat to ecosystem biodiversity. One IAPS found in Mount Merapi National Park (TNGM) is *Acacia decurrens* (*A. decurrens*), which originates from New South Wales, Australia. Initial steps in managing this species can be taken through mapping to provide information as a basis for management decision-making. The combination of PRISMA hyperspectral imagery and multiple endmember spectral mixture analysis (MESMA) can be utilized to map *A. decurrens* in TNGM. Therefore, this study aims to: (1) Build and analyze a spectral library of *A. decurrens* and dominant objects in part of TNGM; (2) Map *A. decurrens* in the area; and (3) Analyze the accuracy of the MESMA method in mapping the *A. decurrens* species.

Endmember extraction was performed using minimum noise fraction (MNF) and pixel purity index (PPI), with direct recording on objects using the FieldSpec 4 spectrometer. The endmember selection method used was iterative endmember selection (IES). The MESMA model was constructed with complexity ranging from 3 endmember models (EM) to 7 EM, and the best accuracy values were compared. The accuracy of the fraction estimation was tested using mean absolute error (MAE), while the hard classification results of the fraction values were evaluated using a confusion matrix.

This study successfully constructed 150 spectral curves with *A. decurrens* absorption features at 684 nm, 1,147 nm, 1,976 nm, and 2,305 nm. Based on the best model, the distribution of *A. decurrens* was identified as dominant in Cangkringan, Kemalang, Musuk Cepogo, Selo, and Srumbung resorts. The model accuracy tended to be high in the MESMA 7 EM model fraction, which had an MAE value of 90 m<sup>2</sup> in the *A. decurrens* class. At the pixel level, the best OA value was obtained in the 7 EM model with a value of 44.32%, while the 3 EM model had an OA of 18.05%; the 4 EM model had an OA of 20.86%; the 5 EM model had an OA of 24.85%; and the 6 EM model had an OA of 44.32%.

**Keywords:** *A. decurrens*, Hyperspectral PRISMA, IAPS, MESMA