

**PEMODELAN SPATIAL MULTI CRITERIA EVALUATION (SMCE)  
TINGKAT RISIKO BENCANA *FROST* (EMBUN UPAS)  
PADA LAHAN PERTANIAN DI DATARAN TINGGI DIENG**

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**INTISARI**

Bencana *frost* terjadi di lahan pertanian Dataran Tinggi Dieng tepatnya di Sub DAS Tulis Hulu. *Frost* ditandai dengan kemunculan embun beku akibat suhu turun dibawah 0°C dan mengakibatkan kematian tanaman pertanian dan kerugian ekonomi. Penelitian ini bertujuan untuk: (1) Menganalisis tingkat bahaya *frost*, (2) Menilai tingkat kerentanan lahan pertanian, (3) Menilai tingkat kapasitas petani serta (4) Memodelkan skenario *Spatial Multi Criteria Evaluation* (SMCE) risiko dan kerugian bencana berdasarkan elemen risiko lahan pertanian. Penelitian ini dilakukan dengan memodelkan risiko melalui *Spatial Multi Criteria Evaluation* (SMCE) pada software ILWIS dan *Analytical Hierarchy Process* (AHP).

Penaksiran bahaya menggunakan parameter elevasi, kemiringan lereng, *curvature*, penggunaan lahan, *topographical wetness index* dan jarak dari badan air. Penaksiran kerentanan fisik melibatkan tipe dan usia komoditas serta luas lahan, kerentanan ekonomi melibatkan kerugian *frost*, jumlah produksi dan akses pinjaman, serta kerentanan sosial melibatkan keikutsertaan petani dalam kelompok tani dan penyuluhan *frost* serta status lahan. Penaksiran kapasitas didasarkan pada tipe kesiapsiagaan. Hasil penaksiran bahaya, kerentanan dan kapasitas menjadi dasar pemodelan risiko yang menghasilkan enam skenario berbeda. Model risiko kuantitatif dihitung dari indeks risiko dan elemen rentan (nilai ekonomi petak lahan), sehingga menghasilkan estimasi kerugian pada enam skenario.

Zona bahaya *frost* terdistribusi seluas 111,42 hektar di Sub DAS Tulis Hulu pada unit dataran aluvial dan dataran aluvial rawa. Zona bahaya rendah pada area seluas 42,07 hektar, zona bahaya sedang 42,78 hektar dan zona bahaya tinggi 26,75 hektar. Pembentukan *frost* didorong oleh pergerakan massa udara dingin dan pembentukan inversi udara malam hari saat musim kemarau. Kerentanan petani didominasi kelas kerentanan tinggi, pada kerentanan fisik risiko tinggi sebesar 96,34 persen, kerentanan ekonomi sebesar 95,59 persen dan kerentanan sosial sebesar 99,24 persen. Tingginya kerentanan dipengaruhi homogenitas pertanian karena dominasi pertanian kentang, tingginya kerugian *frost* serta rendahnya partisipasi petani dalam kelompok tani dan penyuluhan *frost*. Kapasitas petani didominasi jenis kapasitas tanpa proteksi sebanyak 47,52 persen karena banyak petani terkendala melakukan kesiapsiagaan.

Luasan tingkat risiko berubah pada berbagai skenario dengan dominasi pada risiko tinggi (*intolerable risk*). Skenario *worst case* pada Skenario III (risiko tinggi sebesar 95,67 persen, akumulasi kerugian petani sebesar Rp1.556.535.550) dan Skenario IV (98,34 persen, Rp1.499.374.550), skenario moderate pada Skenario II (96,67 persen, Rp1.339.189.350) dan Skenario VI (95,39 persen, Rp1.279.091.450). Skenario *safe mode* pada Skenario I (80,54 persen, Rp 819.806.000) dan Skenario V (85,4 persen, Rp973.293.350).

**Kata kunci : *Frost*, SMCE, Risiko, Kerugian Bencana, Pertanian**

## SPATIAL MULTI CRITERIA EVALUATION (SMCE) MODELING TOWARDS FROST (*EMBUN UPAS*) RISK IN AGRICULTURAL LAND, DIENG HIGHLAND

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### ABSTRACT

Frost disasters occur on the agricultural land in Dieng Highland precisely in the Upper Tulis Sub Watershed. Frost is characterized by the appearance of frozen dew, due to temperatures dropping below 0°C and resulting in crop death as well economic losses. This study aims to: (1) Analyze the hazard level of frost, (2) Assess the level of vulnerability of agricultural land, (3) Assess the level of farmer's capacity (4) Modelling SMCE scenarios of risks and loss level based on elements at risk on agricultural land. This research was conducted by modeling risk in ILWIS software through Spatial Multi Criteria Evaluation.

Hazard assessment uses parameters of elevation, slope, curvature, land use, topographical wetness index and distance from water bodies. The estimation of physical vulnerability involves the type and age of the commodities as well as total land area, economic vulnerability involving frost losses, total production and loan access, as well as social vulnerability involving the participation of farmers in farmer groups and frost socialization and land status. Capacity assessment is based on the type of preparedness. The results of hazard assessment, vulnerability and capacity form the basis of risk modeling which produces six different scenarios. Risk models are carried out quantitatively by calculating risk indices and element at risk from the economic value of land plots, resulting in a large estimated loss in six scenarios.

Frost hazard zone distributed in an area of 111.42 hectares in the Upper Tulis Sub Watershed in units of alluvial plains and alluvial swamp plains. Low hazard zones on 42.07 hectares, moderate hazard zones on 42.78 hectares and high hazard zones on 26.75 hectares. Formation of frost strongly driven by the movement of cold air masses and the formation of nighttime air inversion systems during the dry season. Farmers' vulnerability dominated by high vulnerability level, which in physical vulnerability dominated 96.34 percent, economic vulnerability dominated 95.59 percent and social vulnerability dominated 99.24 percent. High vulnerability strongly influenced by agricultural homogeneity, both the dominance of potato farming, the magnitude of frost loss and the low participation of farmers in farmer groups and socialization of frost. Capacity level dominated by do-nothing strategy up to 47.52 percent because many farmers constrained in making preparedness efforts.

Level of risk changes in various scenarios with dominance in high risk (intolerable risk). The worst case scenario in Scenario III (high risk 95.67 percent, accumulated losses of farmers amounting to Rp1.556.535.550) and Scenario IV (98.34 percent, Rp1.499.374.550), moderate scenario in Scenario II (96.67 percent, Rp1.339.189.350) and Scenario VI (95.39 percent, Rp1.279.091.450). Safe mode scenario in Scenario I (80.54 percent, Rp819.806.000) and Scenario V (85.4 percent, Rp973.293.350).

**Kata kunci : Frost, SMCE, Risk, Total Losses, Agriculture**