

Supplementary information for

Annual 10-m fine-resolution cropland maps for Southeast Asia since 2019 using AlphaEarth embeddings

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The supplementary materials include:

Table S1–S2

Bibliography

Supplementary Table (1–2)

Table S1. Definitions of spectral indices derived from Sentinel-2 imagery.

Index	Formula	Reference
Normalized Difference Vegetation Index (NDVI)	$(B8-B4)/(B8+B4)$	(Rouse et al., 1974)
Normalized Burn Ratio (NBR)	$(B8-B12)/(B8+B12)$	(García and Caselles, 1991)
Normalized Difference Red Edge Index 1 (NDRE1)	$(B8-B5)/(B8+B5)$	(Gitelson and Merzlyak, 1994)
Normalized Difference Red Edge Index 2 (NDRE2)	$(B8-B6)/(B8+B6)$	—
Normalized Difference Red Edge Index 3 (NDRE3)	$(B8-B7)/(B8+B7)$	—
Normalized Difference Built-up Index (NDBI)	$(B11-B8)/(B11+B8)$	(Zha et al., 2003)
Modified Normalized Difference Water Index (MNDWI)	$(B3-B11)/(B3+B11)$	(Xu, 2006)
Soil Adjusted Vegetation Index (SAVI)	$1.5 \times (B8-B4)/(B8+B4+0.5)$	(Huete, 1988)
Normalized Difference Soil Index (NDSI)	$(B11-B4)/(B11+B4)$	(Rogers and Kearney, 2004)

Note: B3, B4, B5, B6, B7, B8, B11, and B12 correspond to the Green, Red, Red Edge 1, Red Edge 2, Red Edge 3, NIR, SWIR1, and SWIR2 bands of Sentinel-2, respectively.

Table S2. Optimal hyperparameters for the Random Forest classifier identified through randomized cross-validation grid search.

Hyperparameter	Optimal Value	Description
<i>n_estimators</i>	1379	The total number of decision trees in the forest. A higher number generally improves model robustness but increases computation time.
<i>max_depth</i>	35	The maximum depth of each tree. Limiting depth helps prevent overfitting while allowing sufficient model complexity.
<i>max_features</i>	<i>sqrt</i>	All available features are considered when looking for the best split, allowing the model to fully capture feature interactions.
<i>min_samples_split</i>	2	The minimum number of samples required to split an internal node. Larger values make the model more conservative.
<i>min_samples_leaf</i>	1	The minimum number of samples required to form a leaf node. A value of 1 allows the model to capture fine-grained patterns.
<i>bootstrap</i>	<i>True</i>	Bootstrap sampling is used to build each tree, improving generalization by introducing randomness into the training process.

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