

Supplementary Material:

Hyperspectral Reflectance Indices

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For the following hyperspectral reflectance indices, we have made the following identifications:

$$\begin{aligned} R_b &= R(440 \text{ nm}) \\ R_g &= R(550 \text{ nm}) \\ R_r &= R(650 \text{ nm}) \\ R_{nir} &= R(860 \text{ nm}). \end{aligned} \tag{1}$$

We also define $R_{far} = R(1009 \text{ nm})$ as the band representing the farthest infrared bin for our hyperspectral imager which we use instead of the usual SWIR band.

Table S 1: Spectral indices supplied as extra features to each ML model. For each index, R_λ denotes the reflectance at wavelength λ used to compute the index. R_b , R_g , etc are defined in Equation 1.

Spectral Index	Acronym	Formula
Difference Vegetation Index	DVI	$\frac{2.5(R_{nir} - R_r)}{R_{nir} + 6R_r - 7.5R_b + 1}$
Global Environmental Monitoring Index	GEMI*	$\text{eta}(1 - 0.25 \text{ eta}) - \frac{R_r - 1.125}{1 - R_r}$
Green Atmospherically Resistant Index	GARI**	$\frac{R_{nir} - (R_g - \gamma(R_b - R_r))}{R_{nir} + (R_g - \gamma(R_b - R_r))}$
Green Chlorophyll Index	GCI	$\frac{R_{nir}}{R_g} - 1$
Green Difference Vegetation Index	GDVI	$\frac{R_{nir} - R_g}{(R_g - R_r) + (R_g - R_b)}$
Green Leaf Index	GLI	$\frac{(R_g - R_r) + (R_g - R_b)}{2R_g + R_r + R_b}$

Spectral Index	Acronym	Formula
Green Normalized Difference Vegetation Index	GNDVI	$\frac{R_{nir} - R_g}{R_{nir} + R_g}$
Green Optimized Soil Adjusted Vegetation Index	GOSAVI	$\frac{R_{nir} - R_g}{R_{nir} + R_g + 0.16}$
Green Ratio Vegetation Index	GRVI	$\frac{R_{nir}}{R_g}$
Green Soil Adjusted Vegetation Index	GSAVI	$\frac{1.5(R_{nir} - R_g)}{R_{nir} + R_g + 0.5}$
Infrared Percentage Vegetation Index	IPVI	$\frac{R_{nir}}{R_{nir} + R_r}$
Leaf Area Index	LAI	$3.618 \left(\frac{2.5(R_{nir} - R_r)}{R_{nir} + 6R_{R_r} - 7.5R_b + 1} \right) - 0.118$
Modified Non-Linear Index	MNLI	$\frac{1.5(R_{nir}^2 - R_r)}{R_{nir}^2 + R_r + 0.5}$
Modified Soil Adjusted Vegetation Index 2	MSAVI2	$\frac{2R_{nir} + 1 - \sqrt{(2R_{nir} + 1)^2 - 8(R_{nir} - R_r)}}{2}$
Modified Simple Ratio	MSR	$\frac{R_{nir}/R_r - 1}{\sqrt{R_{nir}/R_r} + 1}$
Non-Linear Index	NLI	$\frac{R_{nir}^2 - R_r}{R_{nir}^2 + R_r}$
Normalized Difference Vegetation Index	NDVI	$\frac{R_{nir} - R_r}{R_{nir} + R_r}$
Normalized Pigment Chlorophyll Index	NPCI	$\frac{R_{680} - R_{430}}{R_{680} + R_{430}}$
Optimized Soil Adjusted Vegetation Index	OSAVI	$\frac{R_{nir} - R_r}{R_{nir} + R_r + 0.16}$
Renormalized Difference Vegetation Index	RDVI	$\frac{R_{nir} - R_r}{\sqrt{R_{nir} + R_r}}$
Soil Adjusted Vegetation Index	SAVI	$\frac{1.5(R_{nir} - R_r)}{R_{nir} + R_r + 0.5}$
Simple Ratio	SR	$\frac{R_{nir}}{R_r}$
Transformed Difference Vegetation Index	TDVI	$\frac{1.5R_{nir} - R_r}{\sqrt{R_{nir}^2 + R_r + 0.5}}$
Triangular Greenness Index	TGI	$\frac{(\lambda_r - \lambda_b)(R_r - R_g) - (\lambda_r - \lambda_g)(R_r - R_b)}{2}$

Spectral Index	Acronym	Formula
Visible Atmospherically Resistant Index	VARI	$\frac{R_g - R_r}{R_g + R_r - R_b}$
Wide Dynamic Range Vegetation Index	WDRVI	$\frac{0.2R_{nir} - R_r}{0.2 * R_{nir} + R_r}$
Atmospherically Resistant Vegetation Index	ARVI	$\frac{R_{800} - (R_{800} - 1(R_{450} - R_{680}))}{R_{800} + (R_{680} - 1(R_{450} - R_{680}))}$
Modified Chlorophyll Absorption Ratio Index	MCARI	$((R_{700} - R_{670}) - 2(R_{700} - R_{550})) \frac{R_{700}}{R_{670}}$
Modified Chlorophyll Absorption Ratio Index Improved	MCARI2	$\frac{1.5(2.5(R_{800} - R_{670}) - 1.3(R_{800} - R_{550}))}{\sqrt{(2R_{800} + 1)^2 - (6R_{800} - 5\sqrt{R_{670}}) - 0.5}}$
Modified Red Edge Normalized Difference Vegetation Index	MRENDVI	$\frac{R_{750} - R_{705}}{R_{750} + R_{705} - 2R_{445}}$
Modified Red Edge Simple Ratio	MRESR	$\frac{R_{750} - R_{445}}{R_{705} - R_{445}}$
Modified Triangular Vegetation Index	MTVI	$1.2(1.2(R_{800} - R_{550}) - 2.5(R_{670} - R_{550}))$
Red Edge Normalized Difference Vegetation Index	RENDVI	$\frac{R_{750} - R_{705}}{R_{750} + R_{705}}$
Transformed Chlorophyll Absorption Reflectance Index	TCARI	$3 \left((R_{700} - R_{670}) - 0.2(R_{700} - R_{550}) \frac{R_{700}}{R_{670}} \right)$
Triangular Vegetation Index	TVI	$0.5(120(R_{750} - R_{550}) - 200(R_{670} - R_{550}))$
Vogelmann Red Edge Index 1	VREI1	$\frac{R_{740}}{R_{720}}$
Vogelmann Red Edge Index 2	VREI2	$\frac{R_{734} - R_{747}}{R_{715} + R_{726}}$
Vogelmann Red Edge Index 3	VREI3	$\frac{R_{734} - R_{747}}{R_{715} + R_{720}}$
Photochemical Reflectance Index	PRI	$\frac{R_{531} - R_{570}}{R_{531} + R_{570}}$
Structure Insensitive Pigment Index	SIPI	$\frac{R_{800} - R_{445}}{R_{800} + R_{680}}$
Structure Independent Pigment Index	SIPI1	$\frac{R_{445} - R_{800}}{R_{670} - R_{800}}$
Plant Senescence Reflectance Index	PSRI	$\frac{R_{680} - R_{500}}{R_{750}}$
Anthocyanin Reflectance Index 1	ARI1	$\frac{1}{R_{550}} - \frac{1}{R_{700}}$
Anthocyanin Reflectance Index 2	ARI2	$\left(\frac{1}{R_{550}} - \frac{1}{R_{700}} \right) R_{800}$

Spectral Index	Acronym	Formula
Carotenoid Reflectance Index 1	CRI1	$\frac{1}{R_{510}} - \frac{1}{R_{550}}$
Carotenoid Reflectance Index 2	CRI2	$\frac{1}{R_{510}} - \frac{1}{R_{700}}$
Normalized Difference Water Index 1	NDWI1	$\frac{R_g - R_{nir}}{R_g + R_{nir}}$
Normalized Difference Water Index 2	NDWI2	$\frac{R_{nir} - R_{far}}{R_{nir} + R_{far}}$
Modified Normalized Difference Water Index	MNDWI	$\frac{R_g - R_{far}}{R_g + R_{far}}$
Water Band Index	WBI	$\frac{970}{900} R_g$
Anthocyanin Content Index	ACI	$\frac{R_{nir}}{R_{nir}}$
Chlorophyll Index Red Edge	CIre	$\frac{R_{705}}{R_{705}} - 1$
Modified Anthocyanin Reflectance Index	MARI	$\left(\frac{1}{R_{550}} - \frac{1}{R_{700}} \right) R_{nir}$
Moisture Stress Index	MSI	$\frac{R_{far}}{R_{nir}}$
MERIS Terrestrial Chlorophyll Index	MTCI	$\frac{R_{753.75} - R_{708.75}}{R_{708.75} - R_{681.25}}$
Normalzied Difference Infrared Index	NDII	$\frac{R_{nir} - R_{far}}{R_{nir} + R_{far}}$
Normalized Difference Red Edge	NDRE	$\frac{R_{790} - R_{720}}{R_{790} + R_{720}}$
Red Green Ratio Index	RGRI	$\frac{R_r}{R_g}$
Red Edge Vegetation Stress Index	RVSI	$\frac{R_{714} + R_{752}}{2} - R_{733}$