

Supplement A

Applicability of above-ground crop monitoring to identify soil compaction

Calculation of typical index values for living plants, soil, and water.

Typical values that a VI may adopt for spectra of interesting surfaces – especially plants – are seldom included in publications. Index values may also vary depending on plant/crop species, soil type, etc. To aid a visual interpretation of the VI values, we have calculated indices from published spectra of living plants, bare soils, and water surfaces. The spectra were digitized using the online tool “Starry Digitizer” (<https://app.digitizer.starrydata.org/>). For the calculation of the indices we derived the reflectance from the digitized spectra, using the central wavelength of the concerned spectral bands (MicaSense, 2017):

| Spectral band | central wavelength | range |
|---------------------|--------------------|--------|
| Green (G) | 560 nm | ±20 nm |
| Red (R) | 668 nm | ±10 nm |
| Red Edge | 717 nm | ±10 nm |
| Near Infrared (NIR) | 840 | ±40 nm |

We used 7 spectra for living plants/crops, 3 for bare soil, and 2 for water, in order to cover some of the range of potential index values. Note that these are not exhaustive and are only meant as a visual guidance to aid an interpretation.

| Category | Type | Reflectance | | | | Reference | Digitized Image (from reference) |
|----------|-------------|-------------|-------|----------|---------|----------------------------|--|
| | | Green | Red | Red Edge | Near IR | | |
| water | fresh water | 0.031 | 0.019 | 0.016 | 0.012 | (Mittenzwey et al., 1992) | Fig. 1 (tapwater) |
| water | sea water | 0.025 | 0.021 | 0.020 | 0.020 | (Kokaly et al., 2017) | Seawater_Open_Ocean SW2 lwch BECKa AREF |
| soil | sandy loam | 0.313 | 0.424 | 0.450 | 0.482 | (Post et al., 2000) | Fig. 2: (Stronghold, dry) |
| soil | silt loam | 0.024 | 0.030 | 0.037 | 0.052 | (Post et al., 2000) | Fig. 2: (Clover Springs, wet) |
| soil | - | 0.028 | 0.027 | 0.061 | 0.105 | (Gong et al., 2018) | Fig. 4 (wet soil) |
| plants | poplar | 0.176 | 0.072 | 0.364 | 0.502 | (Corbin et al., 2024) | Fig. 2 (average) |
| plants | olive | 0.134 | 0.085 | 0.300 | 0.561 | (Blekos et al., 2021) | Fig. 9 |
| plants | tobacco | 0.186 | 0.091 | 0.317 | 0.482 | (Li et al., 2023) | Fig. 1 (mean) |
| plants | rapeseed | 0.146 | 0.082 | 0.309 | 0.506 | (Gong et al., 2018) | Fig. 4 (sessile leaf) |
| plants | wheat | 0.110 | 0.055 | 0.250 | 0.468 | (Silva-Perez et al., 2018) | Fig. 1A (mean) |
| plants | maize | 0.273 | 0.119 | 0.504 | 0.839 | (Martinez and Ramos, 2015) | Fig. 1 (56 days after sowing) |
| plants | maize | 0.143 | 0.073 | 0.239 | 0.398 | (Schlemmer et al., 2005) | Fig. 4 (168 kg N ha ⁻¹ – HW) |

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