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| This document is an extract from the PhD thesis entitled “Can satellites help organic crops certification?”, pages 38-40, Antoine DENIS, 2018, ULIEGE, <https://orbi.uliege.be/handle/2268/226209>.This extract presents a sub-section of the literature review dedicated to:3.3.2 Remote sensing of crop properties, **Table 2 - Spectral vegetation indices and their specificity**It is provided in Microsoft Office Word format in order to facilitate the copy of the content, in particular the **equations of the indices**.The text accompanying this table is provided at the same web address (<https://orbi.uliege.be/handle/2268/226209>), in the document “Remote sensing of crops - Literature review - SECTIONS.pdf” |

Table 2 : Spectral vegetation indices and their specificity

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| --- | --- | --- | --- | --- |
| **Spectral Vegetation Index (SVI)** | **Abbreviation** | **Equation** | **Reference\*** | **Specificity\*\*** |
| Ratio VISimple Ratio | RVISR |  | (Birth and McVey, 1968)(Jordan, 1969) | Vegetation color, LAI | Early green vegetation indices |
| Normalized Difference VI | NDVI |  | (Rouse, J.W. et al., 1973) | Vegetation greenness |
| Tasseled Cap green VIGreen VI | TCGVIGVI |  | (Kauth and Thomas, 1976) | Green vegetation |
| Difference VI | DVI |  | (Tucker, 1979) | Green leaf area and biomass, total and green biomass, leaf water content, chlorophyll content |
| Corrected Transformed VI | CTVI |  | (Perry and Lautenschlager, 1984) | Green vegetation |
| Ratio RE3/RE2 | RE3/RE2 |  | (Vogelmann et al., 1993) | Total chlorophyll content | Chlorophyll content |
| Red Edge Inflection Point | REIP | Red Edge Inflection Point | (Vogelmann et al., 1993) | Total chlorophyll content |
| Ratio of first derivative D715/D705 | D715/D705 |  | (Vogelmann et al., 1993) | Total chlorophyll content |
| Greenness I | G |  | (Zarco-Tejada et al., 2004) | Chlorophyll content |
| Green NDVI | GNDVI |  | (Gitelson et al., 1996) | Chlorophyll a contentMore sensitive to high chlorophyll a content than NDVI |
| Red Edge NDVI | RENDVI |  | (Gitelson and Merzlyak, 1994) | Chlorophyll a contentSensitive to high chlorophyll a content |
| MERIS Terrestrial Chlorophyll I | MTCI |  | (Dash and Curran, 2004) | Chlorophyll contentSensitive to high chlorophyll content |
| Simple Ratio VI |  |  | (Zarco-Tejada et al., 2001) | Chlorophyll contentMinimize effect of shadow and LAI variation |
| Modified Simple Ratio I | mSR705 |  | (Sims and Gamon, 2002) | Chlorophyll contentCompensate for high leaf surface (specular) reflectance |
| Modified Normalized Difference I | mND705 |  | (Sims and Gamon, 2002) | Chlorophyll contentCompensate for high leaf surface (specular) reflectance |
| Chlorophyll Absorption Ratio I | CARI |  | (Kim et al., 1994) | APAR, chlorophyll content,Minimize the effect ofnon-photosynthetic background |
| Renormalized Difference VI | RDVI |  | (Roujean and Breon, 1995) | fAPARMinimize soil background effect |
| Modified CARI | MCARI |  | (Daughtry et al., 2000) | Chlorophyll content |
| Transformed CARI | TCARI | 3 | (Haboudane et al., 2002) | Chlorophyll contentMinimize soil background effect |
| TCARI/OSAVI | TCARI/OSAVI | TCARI/OSAVI | (Haboudane et al., 2002) | Chlorophyll contentResistant to LAI variation, background and solar zenith angle |
| Red-edge Chlorophyll I | CIred-edge |  | (Clevers and Gitelson, 2013; Gitelson et al., 2003) | Chlorophyll and nitrogen content |
| Green chlorophyll I | CIgreen |  | (Clevers and Gitelson, 2013; Gitelson et al., 2003) | Chlorophyll and nitrogen content |
| Normalized Difference Nitrogen I | NDNI |  | (Serrano et al., 2002) | Nitrogen content |
| Simple Ratio VI |  |  | (Gitelson and Merzlyak, 1994) | Chlorophyll and other pigments for senescent leaves  |
| Normalized Phaeophytinization Quotient I | NPQI |  | (Peñuelas et al., 1995b) | Chlorophyll degradation  |
| Simple Ratio VI |  |  | (Carter, 1994) | Plant stress (herbicide induced) |

Table 2 (cont.) : Spectral vegetation indices and their specificity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Spectral Vegetation Index (SVI)** | **Abbreviation** | **Equation** | **Reference\*** | **Specificity\*\*** |
| Physiological or Photochemical Reflectance I | PRI |  | (Gamon et al., 1992)(Peñuelas et al., 1995a) | Photosynthetic efficiency, carotenoid | Pigments: carotenoid, chlorophyll, anthocyanin |
| Normalized total Pigment to Chlorophyll a ratio INormalized Difference Pigment I | NPCINDPI |  | (Peñuelas et al., 1993)(Peñuelas et al., 1995a) | Ratio pigment/chlorophyll aPhotosynthetic efficiency Affected by leaf structure |
| Simple Ratio Pigment I | SRPI |  | (Peñuelas et al., 1995a) | Ratio carotenoid/chlorophyll aAffected by leaf structure |
| Structure Independent Pigment I | SIPI |  | (Peñuelas et al., 1995a) | Ratio carotenoid/chlorophyll a Minimize leaf structure effect |
| Plant Senescence Reflectance I | PSRI |  | (Merzlyak et al., 1999) | Ratio carotenoid/chlorophyll change during leaf senescence |
| Red Green Ratio I | RGRI |  | (Gamon and Surfus, 1999) | Anthocyanin content |
| Specific Leaf Area VI | SLAVI |  | (Lymburner et al., 2000) | Specific leaf area | LAI |
| Wide-Dynamic Range VI | WDRVI |  | (Gitelson, 2004) | Vegetation fraction, LAIAlso sensitive to moderate to high vegetation density |
| Triangular VI | TVI |  | (Broge and Leblanc, 2001) | Green LAI and chlorophyll content |
| Modified TVI 1 | MTVI1 |  | (Haboudane et al., 2004) | Green LAIMinimize the effect of chlorophyll content | Green LAI - Minimize the effect of chlorophyll content |
| Modified TVI 2 | MTVI2 |  | (Haboudane et al., 2004) | Green LAIMinimize the effect of chlorophyll content |
| Modified CARI 1 | MCARI1 |  | (Haboudane et al., 2004) | Green LAIMinimize the effect of chlorophyll content |
| Modified CARI 2 | MCARI2 |  | (Haboudane et al., 2004) | Green LAIMinimize the effect of chlorophyll content |
| Perpendicular VI | PVI |  | (Richardson and Wiegand, 1977) | LAI(Uses the soil background line) | LAI - Minimize soil background effect |
| Soil Adjusted VI | SAVI |  | (Huete, 1988) | Green vegetation, LAIMinimize soil background effect |
| Weighted Difference Vegetation I | WDVI |  | (Clevers, 1989) | LAICorrecting soil background (particularly soil moisture) |
| Transformed SAVI | TSAVI |  | (Baret et al., 1989) | LAI, APARMinimize soil background effect |
| Modified SAVI 2 | MSAVI2 |  | (Qi et al., 1994) | Green vegetationMinimize soil background effect |
| Optimized SAVI | OSAVI |  | (Rondeaux et al., 1996) | Chlorophyll contentMinimize soil background effect |
| Soil Adjusted Total VI | SATVI |  | (Marsett et al., 2006) | Green and senescent vegetation coverMinimize soil background effect |
| Atmospherically Resistant VI | ARVI |  | (Kaufman and Tanre, 1992) | Green vegetationResistant to atmospheric effects | Green veg. - Resistant to atmospheric effects |
| Global Environmental Monitoring I | GEMI |  | (Pinty and Verstraete, 1992) | Green vegetation coverReduce atmospheric perturbations |
| Green Atmospherically Resistant VI | GARI |  | (Gitelson et al., 1996) | Wide range of chlorophyll content, photosynthesis rate, plant stressResistant to atmospheric effects |

Table 2 (cont.) : Spectral vegetation indices and their specificity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Spectral Vegetation Index (SVI)** | **Abbreviation** | **Equation** | **Reference\*** | **Specificity\*\*** |
| Soil Adjusted and Atmospherically Resistant VI | SARVI |  | (Huete et al., 1994) | Green vegetationMinimize soil and atmospheric noise | Green veg. - Minimize soil and atmospheric noise |
| Enhance VI | EVI |  | (Huete et al., 1999) | Green vegetationImproved sensitivity into high biomassMinimize soil and atmospheric noise |
| 2-band Enhanced VI | EVI2 |  | (Jiang et al., 2008) | Green vegetationMinimize soil and atmospheric noise without blue bandEVI without blue band |
| Infrared INormalized Difference II | IINDII |  | (Hardisky et al., 1983) | Canopy water content | Canopy water content |
| Moisture Stress I | MSI |  | (Hunt Jr and Rock, 1989) | Canopy water content |
| Normalized Difference Water I | NDWI |  | (Gao, 1996) | Canopy water contentFor closed green canopy |
| Water IWater Band I | WIWBI |  | (Peñelas et al., 1993; Peñuelas et al., 1997; Strachan et al., 2002) | Canopy water contentFor closed canopy and constant LAI |
| Floating-position WBI | fWBI |  | (Strachan et al., 2002) | Canopy water content |
| Normalized Multi-band Drought I | NMDI |  | (Wang and Qu, 2007) | Canopy water contentFor LAI ≥ 2 |

**Color code** identifies group of indices with similar specificity (last header column).

**VI** = Vegetation Index; **I**= Index; **Rxxx**= reflectance in a given wavelength expressed in nanometers; **NIR** = near infrared; **SWIR**= shortwave infrared; **CAR**= Chlorophyll Absorption in Reflectance (~depth of the chlorophyll absorption at 670 nm); **a**, **b**, **L**, **η**, **λ**, **γ**, **G**, **C1**, **C2** : confer original papers.

\* **Reference**: generally, reference of the first paper mentioning the index.

\*\* **Specificity**: specificity of the index as mentioned in the reference paper (Confer \*): the vegetation biochemical or/and biophysical property(-ies) for the assessment of which they were initially developed for and other specificities.

\*\*\* Reflectances with prior correction for molecular scattering and ozone absorption.

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