

Table 12. Cont.

		Crop /Species ¹⁾	Model	R ²	RMSE	Model equation
II Optical Species*soil Covariance	Swh * sandy clay	2.6 (I)	0.764	282.3	$Y_b(\text{swhheat,clay}) = 6765.5 - 38407.0 \times \text{rf3}_{\text{ap}} - 14979.0 \times \text{rf4}_{\text{ap}} - 23698.0 \times \text{rf3}_{\text{bp}} + 9552.7 \times \text{rf4}_{\text{bp}} + 7261.4 \times \text{rf3}_{\text{cp}} - 22022.0 \times \text{rf4}_{\text{cp}}$	
	Brl * sandy clay	2.7 (I)	0.166	1382	$Y_b(\text{barley,clay}) = 7141.4 - 3842.1 \times \text{rf3}_{\text{ap}} - 2612.4 \times \text{rf4}_{\text{ap}} - 3032.1 \times \text{rf3}_{\text{bp}} - 11708.0 \times \text{rf4}_{\text{bp}} - 28637.0 \times \text{rf3}_{\text{cp}} - 1636.2 \times \text{rf4}_{\text{cp}}$	
III Optical Species* Cultivar Cov.	Swh* cv. Manu	3.1 (I)	0.089	1292	$Y_b(\text{cv. Manu*clay}) = 5696.5 + 2293.8 \times \text{rf3}_{\text{bp}} + 5387.9 \times \text{rf3}_{\text{cp}} - 736396.0 \times (\text{rf3}_{\text{bp}})^2$	
	Swh * cv. Satu	3.2 (I)	0.046	1031	$Y_b(\text{cv. Satu*clay}) = -9798.2 + 736440.0 \times \text{rf2}_{\text{bp}} - 9925014.0 \times (\text{rf2}_{\text{bp}})^2$	
	Brl * cv. Inari	3.3 (I)	0.144	1220	$Y_b(\text{cv. Inari*clay}) = 8336.8 - 71506.0 \times \text{rf3}_{\text{bp}} - 45627.0 \times (\text{rf3}_{\text{bp}})^2$	
IV Microwave SAR	Sensor	Cereal specie	Model ⁴⁾	R ²	RMSE	Model equation
	ERS SAR ⁽⁴⁾	Brl	4.1(III)	0.448	482.7	$Y_b(\text{brl, ERS2}) = 4345.7 + 109.4 \times \text{NDVI}_{\text{ap}} - 211.6 \times \text{NDVI}_{\text{bp}} - 983.3 \times \text{NDVI}_{\text{cp}} - 0.57 \times \text{VV}_{(5\text{GHz},\text{cp})} + 5.61 \times \text{VV}_{(5\text{GHz},\text{dp})}$
		Oats	4.2(III)	0.417	584.2	$Y_b(\text{oats, ERS2}) = 3739.5 + 108.9 \times \text{NDVI}_{\text{ap}} - 212.1 \times \text{NDVI}_{\text{bp}} - 938.8 \times \text{NDVI}_{\text{cp}} - 0.47 \times \text{VV}_{(5\text{GHz},\text{cp})} + 4.28 \times \text{VV}_{(5\text{GHz},\text{dp})}$
	Radarsat SAR ⁴⁾	Swh	5.1(III)	0.731	300.8	$Y_b(\text{swh, Radarsat}) = 4690.7 + 111.8 \times \text{NDVI}_{\text{ap}} - 213.4 \times \text{NDVI}_{\text{bp}} - 982.6 \times \text{NDVI}_{\text{cp}} - 2.69 \times \text{HH}_{(5\text{GHz},\text{cp})} + 3.9 \times \text{HH}_{(5\text{GHz},\text{dp})}$
		Brl	5.2(III)	0.702	322.8	$Y_b(\text{brl, Radarsat}) = 4430.1 + 109.4 \times \text{NDVI}_{\text{ap}} - 211.6 \times \text{NDVI}_{\text{bp}} - 983.3 \times \text{NDVI}_{\text{cp}} - 0.52 \times \text{HH}_{(5\text{GHz},\text{cp})} + 5.07 \times \text{HH}_{(5\text{GHz},\text{dp})}$
		Oats	5.3(III)	0.624	483.6	$Y_b(\text{oats, Radarsat}) = 3843.3 + 108.9 \times \text{NDVI}_{\text{ap}} - 212.1 \times \text{NDVI}_{\text{bp}} - 983.8 \times \text{NDVI}_{\text{cp}} - 0.47 \times \text{HH}_{(5\text{GHz},\text{cp})} + 4.03 \times \text{HH}_{(5\text{GHz},\text{dp})}$
	Envisat ASAR ⁽⁴⁾	Swh	6.1(III)	0.723	302.1	$Y_b(\text{swh, Envisat}) = 4701.1 + 108.2 \times \text{NDVI}_{\text{ap}} - 208.8 \times \text{NDVI}_{\text{bp}} - 983.1 \times \text{NDVI}_{\text{cp}} - 3.9 \times \text{VH}_{(5\text{GHz},\text{cp})} + 17.4 \times \text{VV}_{(5\text{GHz},\text{cp})} - 3.1 \times \text{VH}_{(5\text{GHz},\text{dp})} + 5.2 \times \text{VV}_{(5\text{GHz},\text{dp})}$
		Brl	6.2(III)	0.694	349.8	$Y_b(\text{brl, Envisat}) = 4261.4 + 109.4 \times \text{NDVI}_{\text{ap}} - 211.6 \times \text{NDVI}_{\text{bp}} - 983.3 \times \text{NDVI}_{\text{cp}} - 4.59 \times \text{VH}_{(5\text{GHz},\text{cp})} + 18.24 \times \text{VV}_{(5\text{GHz},\text{cp})} - 4.04 \times \text{VH}_{(5\text{GHz},\text{dp})} + 6.15 \times \text{VV}_{(5\text{GHz},\text{dp})}$
		Oats	6.3(III)	0.617	389.7	$Y_b(\text{oats, Envisat}) = 3635.7 + 108.9 \times \text{NDVI}_{\text{ap}} - 212.8 \times \text{NDVI}_{\text{bp}} - 983.8 \times \text{NDVI}_{\text{cp}} - 2.59 \times \text{VH}_{(5\text{GHz},\text{cp})} + 16.46 \times \text{VV}_{(5\text{GHz},\text{cp})} - 2.03 \times \text{VH}_{(5\text{GHz},\text{dp})} + 4.05 \times \text{VV}_{(5\text{GHz},\text{dp})}$
	HUTSCAT Scatterometer ^{(3),(4)}	Swh	7.1(III)	0.582	416.8	$Y_b(\text{swh, HUTSCAT}) = 4258.4 + 109.4 \times \text{NDVI}_{\text{ap}} - 198.2 \times \text{NDVI}_{\text{bp}} - 937.4 \times \text{NDVI}_{\text{cp}} + 5.2 \times \text{VV}_{(5\text{GHz},\text{cp})} + 18.4 \times \text{HH}_{(5\text{GHz},\text{cp})} - 2.9 \times \text{VH}_{(5\text{GHz},\text{cp})} - 16.4 \times \text{HV}_{(5\text{GHz},\text{cp})} + 4.4 \times \text{VV}_{(5\text{GHz},\text{dp})} + 12.4 \times \text{HH}_{(5\text{GHz},\text{dp})} - 2.3 \times \text{VH}_{(5\text{GHz},\text{dp})} - 14.4 \times \text{HV}_{(5\text{GHz},\text{dp})}$
		Brl	7.2(III)	0.518	490.1	$Y_b(\text{brl, HUTSCAT}) = 4294.2 + 107.2 \times \text{NDVI}_{\text{ap}} - 209.2 \times \text{NDVI}_{\text{bp}} - 928.2 \times \text{NDVI}_{\text{cp}} + 3.2 \times \text{VV}_{(5\text{GHz},\text{cp})} + 17.4 \times \text{HH}_{(5\text{GHz},\text{cp})} - 3.9 \times \text{VH}_{(5\text{GHz},\text{cp})} - 15.4 \times \text{HV}_{(5\text{GHz},\text{cp})} + 5.4 \times \text{VV}_{(5\text{GHz},\text{dp})} + 11.4 \times \text{HH}_{(5\text{GHz},\text{dp})} - 4.3 \times \text{VH}_{(5\text{GHz},\text{dp})} - 15.4 \times \text{HV}_{(5\text{GHz},\text{dp})}$
		Oats	7.3(III)	0.424	544.2	$Y_b(\text{oats, HUTSCAT}) = 3782.5 + 106.8 \times \text{NDVI}_{\text{ap}} - 207.2 \times \text{NDVI}_{\text{bp}} - 942.5 \times \text{NDVI}_{\text{cp}} + 4.2 \times \text{VV}_{(5\text{GHz},\text{cp})} + 15.2 \times \text{HH}_{(5\text{GHz},\text{cp})} - 5.9 \times \text{VH}_{(5\text{GHz},\text{cp})} - 17.1 \times \text{HV}_{(5\text{GHz},\text{cp})} + 4.8 \times \text{VV}_{(5\text{GHz},\text{dp})} + 11.8 \times \text{HH}_{(5\text{GHz},\text{dp})} - 4.3 \times \text{VH}_{(5\text{GHz},\text{dp})} - 12.2 \times \text{HV}_{(5\text{GHz},\text{dp})}$

⁽¹⁾ For abbreviations refer to Table 9 ⁽²⁾ Independent variables classified with SatPhenClass-algorithm (Figure 3a,b). ⁽³⁾ HUTSCAT used for calibration verification purposes only (helicopter mounted) ⁽⁴⁾ Only in Part I (SAR+Optical models) ⁽⁵⁾ Only in Part II (Optical models)

Appendix D. SatPhenClass Classification Algorithm for Satellite Data

Appendix figures and tables can be downloaded from the link:

<http://koti.arnas.fi/~hlaurila/download/Pb4>.

The SatPhenClass classification algorithm can be downloaded from the link:

<http://koti.arnas.fi/~hlaurila/download/Pb4> file: SatPhenClass-Appendix.pdf

© 2010 by the authors; licensee Molecular Diversity Preservation International, Basel, Switzerland. This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/3.0/>).