Table S1: The total Sentinel-2 imagery dataset. It shows for each Sentinel-2 image the month, day, platform (Sentinel-2A or Sentinel-2B), the hour of acquisition, the cloud percentage, the processing level (top of the atmosphere – 1C or bottom of the atmosphere – 2A), and the tiles (T33TTG for Lazio north, T33TUF for Lazio south).

Month	Day	Platform	Hour	Cloud (%)	Processing Level	Tiles
January	01	S2A	10.04	0.032	1C	T33TTG
January	01	S2A	10.04	0.778	1C	T33TUF
February	10	S2A	10.01	2.730	1C	T33TTG
February	10	S2A	10.01	5.734	1C	T33TUF
March	12	S2A	10.01	93.575	1C	T33TTG
March	12	S2A	10.00	44.321	1C	T33TUF
April	11	S2A	10.00	9.905	1C	T33TTG
April	11	S2A	10.00	12.132	1C	T33TUF
May	31	S2A	10.00	0.330	2A	T33TTG
May	31	S2A	10.00	1.107	2A	T33TUF
June	21	S2A	10.00	0.661	2A	T33TTG
June	21	S2A	10.00	0.254	2A	T33TUF
July	20	S2A	10.00	0.330	2A	T33TTG
July	20	S2A	10.00	1.107	2A	T33TUF
August	09	S2A	10.00	1.276	2A	T33TTG
August	09	S2A	10.00	3.267	2A	T33TUF
September	23	S2B	10.00	11.252	1C	T33TTG
September	23	S2B	10.00	13.598	1C	T33TUF
October	13	S2B	10.00	0.107	1C	T33TTG
October	13	S2B	10.00	0.488	1C	T33TUF
November	11	S2A	10.03	0.000	1C	T33TTG
November	11	S2A	10.03	2.636	1C	T33TUF
Dicember	22	S2B	10.04	0.459	2A	T33TTG
Dicember	22	S2B	10.04	0.565	2A	T33TUF

Table S2: Example of error matrix. It is a contingency table (k x k array, where k is the number of classes in the classification).

		Google maps attribution = j			Row total
		1	2	k	n_{i+}
Mapped Classes = i	1	n_{11}	n_{12}	n_{1k}	n_{1+}
	2	n_{21}	n_{22}	n_{2k}	n_{2+}
	k	n_{k1}	n_{k2}	n_{kk}	n_{k+}

Column total	n_{+j}	n_{+1}	n_{+2}	n_{+k}	n

Equation S1: Overall accuracy, defined as the total of the correctly classified checkpoints on the total number of the checkpoints where n_{ii} indicates the number of checkpoints classified in the same category both in the satellite mapped classes and the google earth reference data, in other words the elements of the major diagonal.

$$\text{Overall accuracy} = \frac{\sum_{i=1}^{k} n_{ii}}{n}$$

Equation S2: Producer's accuracy: fraction of correctly classified checkpoints in all checkpoints of the produced classification.

$$\text{Producer's accuracy} = \frac{n_{jj}}{n_{+j}}$$

Equation S3: User's accuracy: fraction of correctly classified checkpoints in all checkpoints of the reference data.

$$\text{User's accuracy} = \frac{n_{ii}}{n_{i+}}$$

Equation S4: Kappa statistic ($\widehat{K}$) computed as follows where n_{ij} is the number of observation in row i and column j, n_{i+} and n_{+j} are respectively the total number of observation of row, and the second total number of observation of column.

$$\widehat{\mathrm{K}} = \frac{\mathrm{n}\ \sum_{\mathrm{i}=1}^{\mathrm{k}} \mathrm{n_{ij}} - \sum_{\mathrm{i}=1}^{\mathrm{k}} \mathrm{n_{i+}} \mathrm{n_{+j}}}{n^2 - \sum_{\mathrm{i}=1}^{\mathrm{k}} \mathrm{n_{i+}} \mathrm{n_{+j}}} \qquad \text{(D)}$$

Table S3: Classes of Kappa statistic interpretation. The Kappa statistic is a measure of the difference between the actual agreement of real objects observable on google maps with resulted classes, and an agreement due to chance (where real objects are compared with a random classification). Kappa varies between 0 to 100, where values close to 0 represent a poor agreement, and values close to 100 are indicate as excellent level of agreement.

Kappa statistic ($\widehat{\mathrm{K}}$) %	**Agreement**
< 40	Poor agreement
41 – 80	Moderate agreement
81 – 100	Strong agreement

Figure S1: A subset of the photointerpreted vegetation map produced at 1:5000 scale by visual interpretation of aerial ortophotos, and a subset of the floristic field data classified according with the Habitats directive (92/43/EEC).

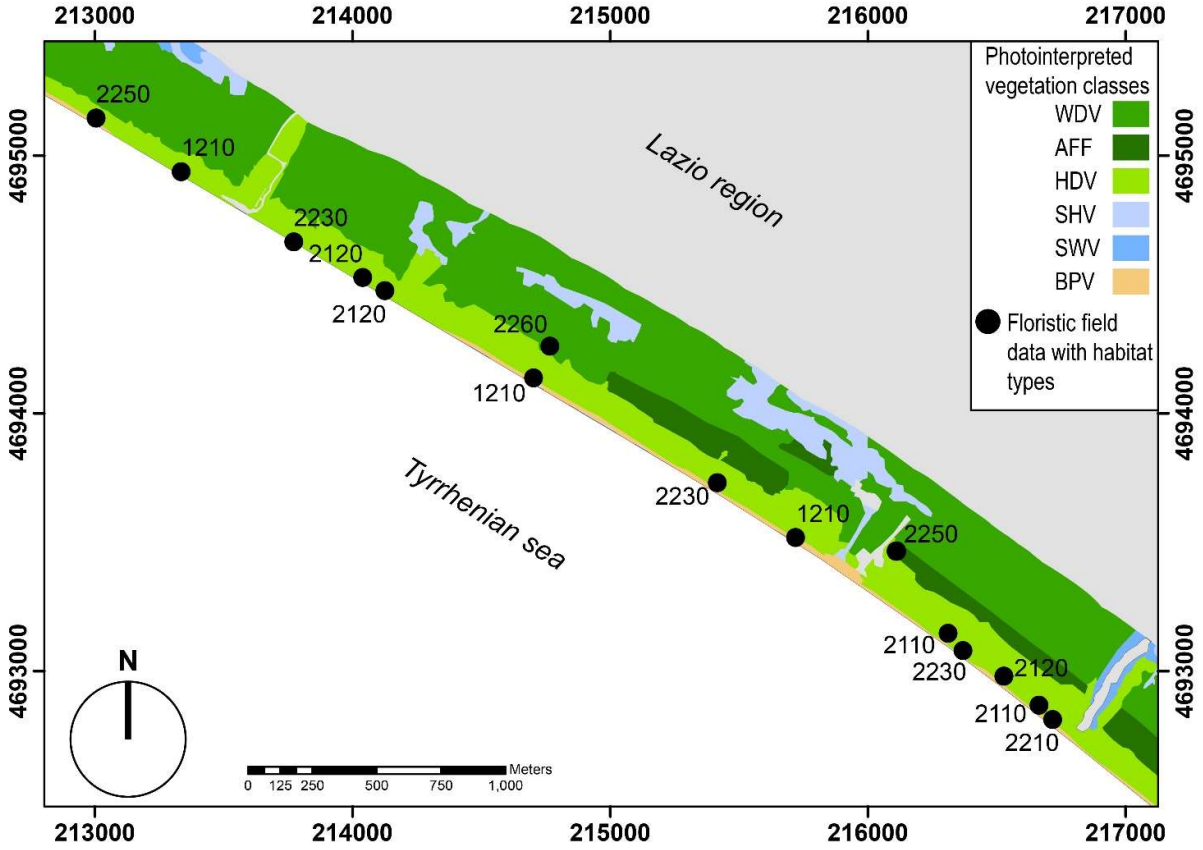

Table S4: Nomenclature homogenization between the produced phenology-based map and the vegetation map.

Vegetation classes (Malavasi, et al. 2016)	Abbreviation	Detailed description
Beach with pioneer annual vegetation	BPV	Annual, nitrophilus and ephemeral community, exposed to wind disturbance and flooding - Habitat type: 1210.
Herbaceous dune vegetation	HDV	Pioneer perennial and halophilous community, dominated by dune-forming plants with low vegetation cover and poor sandy substrate - Habitat type: 2110. Perennial herb community growing on mobile dunes, dominated by the rhizomatous tussock grass (*Ammophila arenaria*) – Habitat type: 2120. Perennial herbs community, partially sheltered from winds and dominated by chamaephytic species – Habitat types: 2210, 2230.
Semi-natural herbaceous ruderal vegetation	SHV	Semi-natural herbaceous vegetation, communities with different degrees of degradation or recolonization.

Semi-natural woody vegetation	SWV	Semi-natural woody vegetation: bushy vegetation with scattered trees.
Woody dune vegetation	WDV	Woody dune vegetation growing on fixed dunes. Scrubs with sparse junipers on coastal sand dunes, and evergreen *macchia* dominated by shrub species with high cover values and less exposed to the harsh coastal conditions – Habitat types: 2250, 2260.
Mediterranean Forest	BMF	Forests dominated by oaks and other broadleaf evergreens – Habitat types: 9340.
Afforestation	AFF	Wooded dunes with *Pinus pinea* and/or *Pinus pinaster* – Habitat type: 2270.

Level	**Vegetation classes (Malavasi, et al. 2016)**					
1°	BPV.	HDV, SHV, SWV, WDV, BMF, AFF.				
2°	BPV.	HDV, SHV.		SWV, WDV, BMF, AFF.		
3°	BPV.	HDV.	SHV.	WDV.	SWV, BMF, AFF.	

Table S5: Nomenclature homogenization of the EC habitats (92/43/EEC) types: 1210 (Annual vegetation of drift lines), 2110 (Embryonic shifting dunes), 2120 (Shifting dunes along the shoreline with *Ammophila arenaria*), 2210 (*Crucianellion maritimae* fixed beach dunes), 2230 (*Malcolmietalia* dune grasslands), 2250 (Coastal dunes with *Juniperus* spp.), 2260 (*Cisto-Lavanduletalia* dune sclerophyllous scrubs), 2270 (Wooded dunes with *Pinus pinea* and/or *P. pinaster*).

Level	**Natura 2000 habitat types**				
1°	1210, 2110.	2120, 2210, 2230, 2250, 2260, 2270.			
2°	1210, 2110.	2120, 2210, 2230.		2250, 2260, 2270.	
3°	1210, 2110.	2120, 2210.	2230.	2250.	2260, 2270.

Table S6: Results of the harmonization test (error matrix and Kappa statistic) between phenology-based classes in the first hierarchical level of classification and the photo–interpreted classification map.

		Vegetation classes (Malavasi et al. 2016)		
		BPV	HDV-SHV- SWV-WDV-BMR-AFF	User's accuracy (%)
Phenology-based classes	Open Sand	35	6	85
	Vegetation	5	199	98
	Producer's accuracy (%)	88	98	

Overall accuracy (%) = 95; $\breve{K}$ (%) = 83

Table S7: Results of the harmonization test (error matrix and Kappa statistic) between phenology-based classes and the photo–interpreted classification map in the second hierarchical level of classification.

		Vegetation classes (Malavasi et al. 2016)			
		BPV	HDV-SHV	SWV-WDV-BMR-AFF	User's accuracy (%)
Phenology-based classes	Open Sand	33	6	0	85
	Herbaceous vegetation	5	52	6	83
	Woody vegetation	0	32	109	77
	Producer's accuracy (%)	87	58	95	

Overall accuracy (%) = 80; $\breve{K}$ (%) = 67

Table S8: Results of the harmonization test (error matrix and Kappa statistic) between phenology-based classes in the third hierarchical level of classification and the photo–interpreted classification map.

		Vegetation classes (Malavasi et al. 2016)					
		BPV	HDV	SHV	WDV	SWV-AFF	BMR- User's accuracy (%)
Phenology-based classes	OS	34	6	1	0	1	94
	SHV	2	7	7	1	0	44
	DHVR	0	1	30	6	3	42
	SWV	0	2	21	11	8	33
	DWV	0	0	13	15	70	85
	Producer's accuracy (%)	81	41	75	26	71	

Overall accuracy (%) = 66; $\breve{K}$ (%) = 55

Table S9: Results of the harmonization test (error matrix and Kappa statistic) between phenology-based classes in the first hierarchical level of classification and habitats of conservation concern (Habitats Directive; 92/43/EEC; table 1) assigned on 2m floristic plots collected in the field.

		Complex of dune habitats		
		1210, 2110	2120, 2210, 2230, 2250, 2260, 2270	User's accuracy (%)
Phenology-based classes	Open Sand	26	6	81
	Vegetation	23	80	78
	Producer's accuracy (%)	53	93	

Overall accuracy (%) = 79; $\breve{K}$ (%) = 50

Table S10: Results of the harmonization test (error matrix and Kappa statistic) of between phenology-based classes in the second hierarchical level of classification and habitats of conservation concern (Habitats Directive; 92/43/EEC; table 1) assigned on 2m floristic plots collected in the field.

		Complex of dune habitats			
		1210, 2110	2120, 2210, 2230	2250, 2260, 2270	User's accuracy (%)
Phenology-based classes	Open sand	26	6	0	81
	Herbaceous vegetation	23	45	3	62
	Woody vegetation	0	5	27	90
	Producer's accuracy (%)	53	83	84	

Overall accuracy (%) =73; $\breve{K}$ (%) = 58

Table S11: Results of the harmonization test (error matrix and Kappa statistic) between phenology-based classes in the second hierarchical level of classification and habitats of conservation concern (Habitats Directive; 92/43/EEC; table 1) assigned on 2m floristic plots collected in the field.

		Complex of dune habitats					
		1210-2110	2120-2210	2230	2250	2260-2270	User's accuracy (%)
Phenology-based classes	OS	26	2	4	0	0	81
	SHV	21	16	11	1	1	32
	DHV-R	2	4	14	1	2	61
	SWV	0	0	2	1	6	11
	DWV	0	0	1	6	14	67
	Producer's accuracy (%)	53	73	44	11	61	

Overall accuracy (%) =53; $\breve{K}$ (%) = 43