

## Supplementary S1



**Figure S1.** Sectors (littoral cells) of the 12 physiographic units defined by Fontolan et al. [43] on which indices were applied.

**Table S1.** Modified indicators with the respect to Garcia-Lozano et al. [39].

<i>Sub-index</i>	<i>Original #</i>	<i>Original</i>	<i>Modified</i>
<i>StaDun</i>	9	Beach-dune system restricted plants according to Pinto et al. [79]	Beach-dune system restricted plants according to Acosta & Ercole [54]
	10	Invasive species	Invasive species according to Galasso et al. [55]
	11	Ruderal species	Ruderal species according to Del Vecchio et al. [56]
<i>BeaPot</i>	2	Evolution of the beach during the period 1995–2004 (m/y)	Evolution of the beach during the period 2004–2010 (m/y)
	8	Area of the beach covered in pebbles (%)	Sediment budget during the period 2004–2010 (m <sup>3</sup> /m)/y
<i>CoMan</i>	1	Human frequentation (m <sup>2</sup> /user)	Touristic use pressure (user/m <sup>2</sup> )
	6	Revegetation	<i>Omitted</i>
	8	Eradication of invasive species	<i>Omitted</i>
	9	Surface area occupied by seasonal services and amenities on or less than 5 m from the dunes	Surface area occupied by seasonal services on beach-dune system (%)
	10	Surface area occupied by car parks or other permanent services on or less than 5 m from the dunes	Surface area occupied by permanent services on beach-dune system (%)
	12	Degree of protection according to the IUCN classification [80]	<i>Omitted</i>

**Table S2.** Approach used to quantify the geomorphological and ecological status of dunes (StaDun).

<i>StaDun indicator</i>	<i>Explanation</i>	<i>Methodology and source</i>
1 <i>Types of dunes according to Garcia-Lozano and Pinto [52]</i>	The indicator assesses the presence and development of the dune system, recognising five classes whose value increases as the development of the system increases. Where dunes are absent (0), incipient forms may develop (1) and become coalescent to form a foredune (2). With time, this will favour the formation of semi-fixed dunes (3) and true dune fields (4).	The assessment was made through field trips and using digital orthophotos acquired in 2018 with a resolution of 20cm [81], in QuantumGIS 3.4.
2 <i>Surface area of the dune system</i>	Large dune systems have often a higher degree of development and consequently provide more, and more efficient ecosystem services.	Determined by creating polygons in GIS overlaid on orthophotos [81].
3 <i>Area occupied by the dunes in relation to the beach-dune system</i>	On equal areas, systems with more developed dunes are more efficient than those in which the beach is more developed than the dune.	The percentage ratio of dunes on beach was calculated by creating polygons in GIS on digital orthophotos [81]
4 <i>Maximum height of the foredune</i>	High dunes have a high amount of accumulated sediment and can respond to adverse phenomena more efficiently.	It was calculated by performing three transects orthogonal to the coastline for each analysed sector on the 1m resolution digital terrain model of Google Earth Pro 7.3.4.8248 software. The highest point corresponding to the foredune was then recorded.
5 <i>Incipient morphologies on the dune face</i>	The presence of incipient dunes indicated new sediment accumulations and the progression of the dune system towards the beach.	It was calculated as the ratio between the areas occupied by incipient dunes and the whole dune system through polygons created on orthophotos [81] in GIS.
6 <i>Evolution of the dune front since 1956</i>	Progradation or retreat of the dune system over the last decades allows to estimate possible conservation or degradation trends of dune systems.	It was calculated by comparing current orthophotos [81] with past aerial photographs of GAI 1954-1955 flight [82]
7 <i>Structural status of the foredune according to Hesp [53]</i>	The Hesp classification defines the structural integrity of coastal dunes. Starting from the lowest class, the structural integrity increases up to the condition of an unfragmented dune with no ongoing erosive processes.	The classes were assigned for each analysed sector by comparing orthophotos [81] with the models proposed in Hesp [53].
8 <i>Type III species on the dune front according to García-Mora et al. [51]</i>	The presence of Type III species <i>sensu</i> Garcia-Mora et al. [51] indicate possible growing process of coastal dunes.	They were defined according to the species listed in Garcia-Mora et al. [51] and counting the species found in the plots within each sector. A database of 1078 georeferenced plots x 208 species surveyed from 2010 to 2016 by the Plant Ecology research team of Ca' Foscari University, and published surveys from Filesi et al. [57] were analysed. For sectors without plots but with dune systems, data from adjacent sites were considered.
9 <i>Beach-dune system restricted plants</i>	Native and focal species were considered as beach-dune system restricted species, which indicates a condition of equilibrium and little disturbance, and are usually not found in environments other than dunes. On the contrary, ruderal and alien species can grow in many different environments and are proxies of human disturbance.	The list of restricted species of the dune-beach system was based on literature (Acosta & Ercole [54]; Buffa et al. [83]) as well as the list of invasive species (Galasso et al. [55]) and ruderal species (Del Vecchio et al. [56]). The number of beach-dune system restricted species, invasive, and ruderal species for each sector was retrieved from the georeferenced vegetation database of 1078 plots x 208 species and published surveys from Filesi et al. [57]. For sectors without plots but with dune systems, data from adjacent sites were considered.
10 <i>Invasive species</i>		
11 <i>Ruderal species</i>		

**Table S3.** Approach used to quantify the potential of a beach to host dunes (BeaPot).

<i>BeaPot indicator</i>	<i>Explanation</i>	<i>Methodology and source</i>
1 <i>Slope of the beach</i>	The profile of the beach are descriptors of its morphodynamic state, e.g., slight slopes allow the transport and accumulation of sand useful for the formation and development of coastal dunes.	Three transects were drawn at random in each sector, and their average slope was retrieved from the Google Earth Pro digital terrain model at 1m resolution.
2 <i>Evolution of the beach during the period 2004-2010</i>	Recent variation of the shoreline allows to identify the growth or erosion of a beach and provide indication on positive or negative sediment budget.	Values were retrieved from Fontolan et al. [43] (Variazioni linea di riva - Media - Recente).
3 <i>Beach orientation in relation to the prevailing winds</i>	The direction of the prevailing wind is important for understanding the transport of sedimentary material. Beaches with a wind perpendicular to the shoreline are more likely to develop coastal dunes.	The prevailing wind direction was sourced from the Venice station of the "Rete Mareografica Nazionale" for the period between 01/01/2016 and 31/12/2020 [84] and then intersected with the shoreline direction of each sector in GIS environment.
4 <i>Average intensity of the wind</i>	Wind intensity is proportional to the capacity to transport sediment along the coast and to form aeolian deposits.	The quantification of wind speed is based on the annual average in 2020, from the ISMAR-CNR Platform in the northern Adriatic [85]. Data were assumed to be constant along the entire coast.
5 <i>Significant Wave Height</i>	The intensity of the waves determines the amount of sediment brought by the sea onto the emerged beach, but high energy waves can erode the beach and remove sediment useful for the formation of dune belts.	The quantification of the average significant wave height is based on the annual average in 2020, from the ISMAR-CNR Platform in the northern Adriatic [85]. Data were assumed to be constant along the entire coastline.
6 <i>Diameter of the sediment</i>	Sediment diameter is a useful indicator for understanding its suitability to be transported and form wind deposits. The smaller the size of the sandy sediment, the greater its suitability.	The determination of d50 (phi) was based on 53 sediment samples available within the study area surveyed in 2016 by the Plant Ecology research team of Ca' Foscari University. Since the sediment size did not significantly vary among the sites, the average-values of the was assigned to each site.
7 <i>Sands &lt;0.5mm</i>	The fine sand portion determines the proportion of sediment most involved in coastal dune formation. Sediments with a grain size greater than 0.5mm are more difficult for the wind to transport. In this way, beaches rich in fine sand are more prone to the formation and development of coastal dunes.	In order to determine the percentage of sediment <0.5 mm, 53 samples available within the study area surveyed in 2016 by the Plant Ecology research team of Ca' Foscari University were used, considering the percentage of fine sand (in Microsoft Office 14.2110.1311.0 - Excel Since the sediment size did not significantly vary among the sites, the average-values of the was assigned to each site.
8 <i>Sediment budget during the period 2004-2010</i>	The sediment budget of the area describes the real availability of sediment for the formation of new coastal morphologies. It is defined by the inputs and outputs that affect a coastal area governing its evolutionary dynamics, namely the accretion or erosion of the coastal system.	While Garcia-Lozano [39] used the percentage of pebbles on the beach surface, we used the sediment budget, because pebbles were absent along the investigated area. Data were sourced from Fontolan et al. [43] (Bilancio sedimentario - Totale - Recente).
9 <i>Width of dry beach</i>	The topographic characteristic of the shoreline such as width is of primary importance to understand the development potential of a coastal dune system. The greater its width, the greater its potential to host dunes, as the more sediment and space ensure the development of coastal processes.	It was determined by photointerpretation in GIS environment, by measuring the distance between the shoreline and the coastline of three transects randomly placed in each sector [81], taking care to consider only the portion of dry sand not affected by the tide.

**Table S4.** Approach used to quantify the impact of the beach-dune system management (CoMan).

<i>CoMan indicator</i>	<i>Explanation</i>	<i>Methodology and source</i>
1 <i>Touristic use pressure</i>	Tourist pressure is decisive in understanding the amount of human activity present in each context. High tourist pressure causes a strong alteration of the biotic and abiotic components of a dune system and favour its degradation.	Contrary to Garcia-Lozano et al. [39], the available data are expressed as the number of users per surface unit, instead of surface per user. Data were sourced from Fontolan et al. [43] ( <i>Pressione antropica - Pressione d'uso turistica</i> ).
2 <i>Information boards</i>	Information panels are an important communication system, whose presence contribute to aware beach users of the possible impacts on coastal dunes and the need to preserve them. However, their presence does not preclude possible negative effects on the system as they can be ignored.	Presence was determined through field trips and effectiveness was assessed through orthophotos in GIS environment: low effectiveness was assumed when unregulated paths were clearly visible.
3 <i>Managed paths</i>	The presence of regulated paths and accesses limits the impacts deriving from the random trampling of tourists going to the beach. In addition, the provision of regulated access paths in such a way that they interfere as little as possible with coastal dynamics is the least impactful solution.	The assessment of the presence and type of regulated path was carried out by means of field trips and orthophotos [81] investigated in QuantumGIS 3.4.
4 <i>Dune area with restricted access</i>	Fencing dune areas is deterrent to trample on them. Their presence and correct design can promote the natural evolutionary dynamics, also allowing the development and connectivity of animal and plant species.	The percentage of areas with restricted access was assessed through field surveys and quantified by calculating their surface in GIS environment [81].
5 <i>Sand traps</i>	In order to promote the accumulation of sediment and encourage the development of dune systems, artificial obstacles can be actively used.	The presence and effects of these structures were assessed through field surveys and orthophoto [81] assessments in QuantumGIS 3.4.
6 <i>Mechanical cleaning/levelling</i>	Large quantities of sediment are removed along with the removal of beached material though mechanical cleaning, while heavy vehicles compact the substrate and alters the natural dynamics. The greater the frequency of cleaning, the greater the negative influence on the formation and development of coastal dunes.	This information was collected through consultation of coastal managers.
7 <i>Surface area occupied by seasonal services on beach-dune system</i>	The presence of temporary structures on the beach-dune system interferes with natural coastal dynamics and especially with sediment transport. This results in a reduced sediment supply that limits the formation and development of coastal dunes.	The determination of the ratio was done by comparing in GIS environment the areas of the polygons corresponding to the temporary structures with those of the polygons of the whole beach-dune system within each sector by using digital orthophotos [81].
8 <i>Surface area occupied by permanent services on beach-dune system</i>	The presence of permanent structures on the beach-dune system interferes with the natural coastal dynamics, especially with the transport of sediment, even during the winter period. This results in a reduced sediment supply that limits the formation and development of coastal dunes.	The determination of the ratio was done by comparing in GIS environment the areas of the polygons corresponding to the permanent structures with those of the polygons of the whole beach-dune system within each sector by using digital orthophotos [81].
9 <i>Protection of the system and the immediate environment</i>	The guarding and the protection of natural areas through active control avoids disturbance of the dunes and promotes the sustainable use of coastal areas by tourists.	The data was obtained through consultation of coastal managers.

**Table S5.** Hypothesized measure for each considered CoMan Indicator and different class shift (different colours highlight different indicators of CoMan).

<i>CoMan Indicator</i>	<i>(Class shift)</i>	<i>Measure</i>
3	(-1)	At least regulated accesses to the beach-dune system
3	(-2)	Accesses at least delimited through the dune system
4	(-1)	At least a quarter of dune systems enclosed
4	(-2)	At least half of dune systems enclosed
4	(-3)	At least three quarter of dune systems enclosed
4	(-4)	Fully enclosed dune systems
5	(-2)	Sand traps that guarantee at least the stability of the dune
6	(-1)	Maximum frequency of beach cleaning up to weekly
6	(-2)	Maximum frequency of beach cleaning up to occasionally
7	(-1)	Portion of temporary structures reduced by 5% of the beach-dune system
7	(-2)	Portion of temporary structures reduced by 10% of the beach-dune system
8	(-1)	Portion of permanent structures reduced by 25% of the beach-dune system
9	(-2)	Surveillance of at least 50% of the dune system
9	(-4)	Surveillance of the entire dune system

**Table S6.** Scenarios of management improvement along the Venetian coast (*X* identifies measures considered in each hypothesis).

CoMan Indicator	3 (Managed paths)		4 (Dune area with restricted access)				5 (Sand traps)	6 (Mechanical cleaning/levelling)		7 (Surface area occupied by seasonal services on beach-dune system)		8 (Surface area occupied by permanent services on beach-dune system)		9 (Protection of the system and the immediate environment)	
	-1	-2	-1	-2	-3	-4	-2	-1	-2	-1	-2	-1	-2	-4	
<i>Hypothesis</i>															
0															
1	X														
2							X								
3								X							
4		X													
5									X						
6	X						X								
7	X						X	X							
8							X	X							
9	X						X	X							
10	X						X		X						
11		X					X	X							
12		X					X		X						
13			X												
14				X											
15					X										
16						X									
17	X		X				X	X							
18	X			X			X	X							
19	X				X		X	X							
20	X					X	X	X							
21	X						X	X		X					
22	X						X	X			X				
23	X						X	X				X			
24	X			X			X	X		X					
25	X			X			X	X			X				
26	X						X	X						X	
27	X						X	X							X
28	X			X			X	X						X	
29	X					X	X	X						X	
30	X			X			X	X							X
31	X					X	X	X							X
32														X	
33															X
34				X										X	
35						X									X

low effort measures

medium effort measures

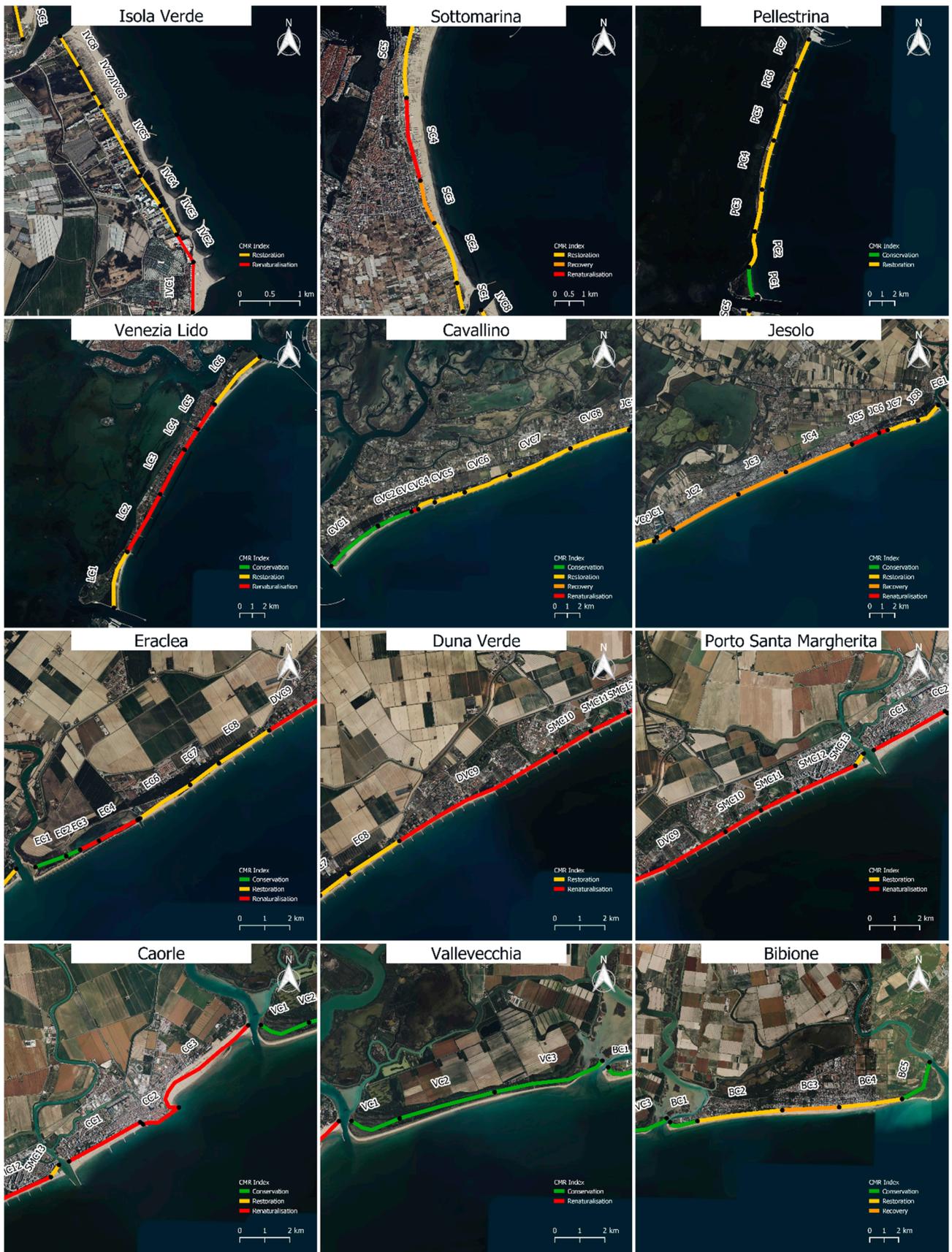
high effort measures

Supplementary S2

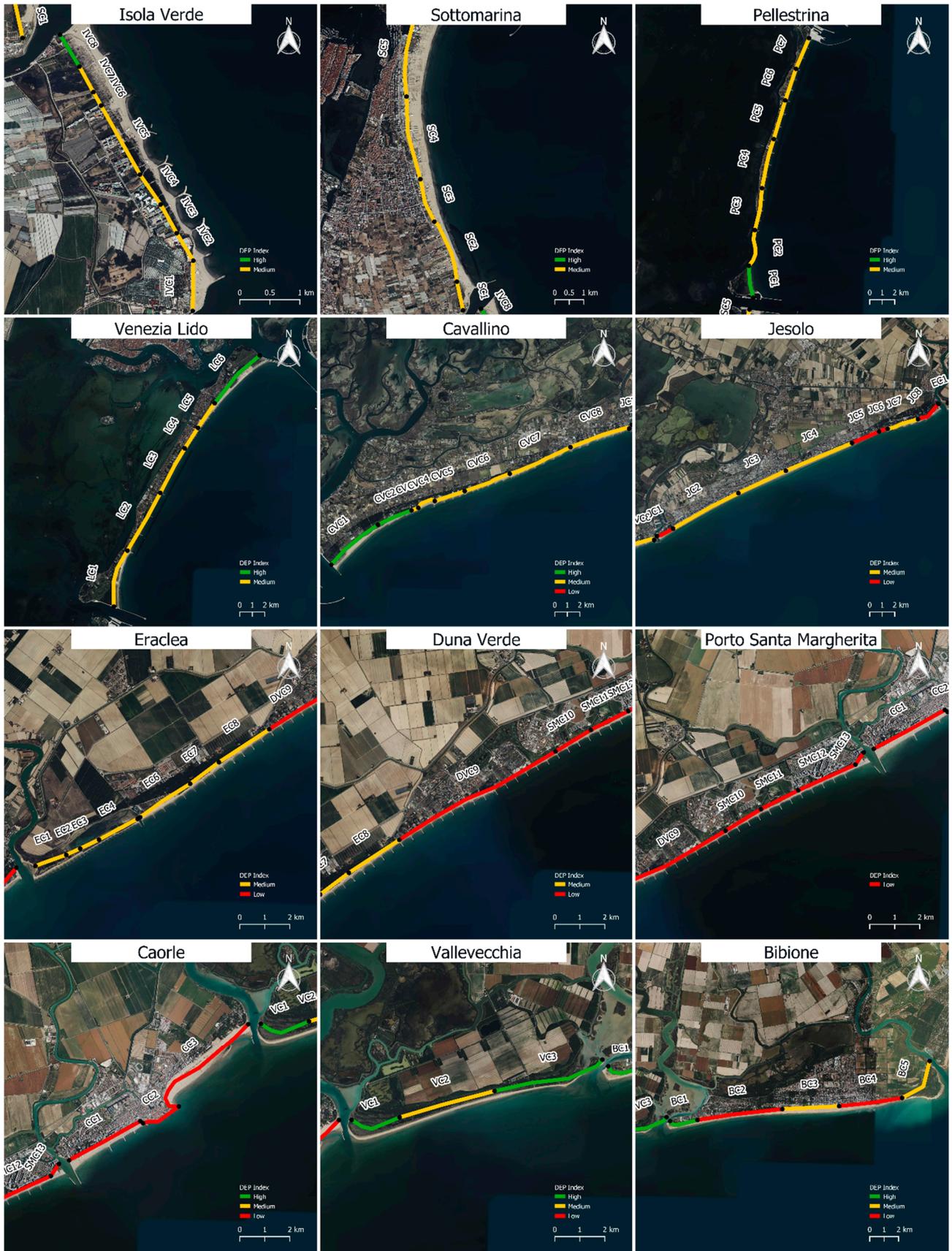
**Table S7.** Values of partial indices and assigned class of CMR (Coastal Management Requirement) and DEP (Dune Establishment Potential) for each sector (littoral cell) within the 12 investigated physiographic units.

<i>Physiographic unit</i>	<i>Cell</i>	<i>StaDun</i>	<i>BeaPot</i>	<i>CoMan</i>	<i>CMR</i>	<i>DEP</i>
<i>Isola Verde</i>	IVC1	0.00	0.78	0.64	Renaturalisation	Medium
	IVC2	0.00	0.75	0.64	Renaturalisation	Medium
	IVC3	0.36	0.75	0.58	Restoration	Medium
	IVC4	0.34	0.75	0.64	Restoration	Medium
	IVC5	0.36	0.69	0.64	Restoration	Medium
	IVC6	0.48	0.69	0.61	Restoration	Medium
	IVC7	0.48	0.78	0.53	Restoration	Medium
	IVC8	0.48	0.89	0.56	Restoration	High
<i>Sottomarina</i>	SC1	0.41	0.86	0.61	Restoration	Medium
	SC2	0.43	0.78	0.64	Restoration	Medium
	SC3	0.00	0.89	0.75	Recovery	Medium
	SC4	0.00	0.78	0.75	Renaturalisation	Medium
	SC5	0.45	0.92	0.78	Restoration	Medium
<i>Pellestrina</i>	PC1	0.66	0.89	0.31	Conservation	High
	PC2	0.43	0.64	0.53	Restoration	Medium
	PC3	0.39	0.69	0.56	Restoration	Medium
	PC4	0.41	0.75	0.56	Restoration	Medium
	PC5	0.41	0.81	0.53	Restoration	Medium
	PC6	0.43	0.81	0.53	Restoration	Medium
	PC7	0.41	0.64	0.53	Restoration	Medium
<i>Lido Venezia</i>	LC1	0.64	0.78	0.50	Restoration	Medium
	LC2	0.00	0.75	0.56	Renaturalisation	Medium
	LC3	0.00	0.75	0.56	Renaturalisation	Medium
	LC4	0.00	0.81	0.81	Renaturalisation	Medium
	LC5	0.00	0.81	0.75	Renaturalisation	Medium
	LC6	0.57	0.86	0.53	Restoration	High
<i>Cavallino</i>	CVC1	0.73	0.83	0.50	Conservation	High
	CVC2	0.66	0.75	0.42	Conservation	High
	CVC3	0.00	0.81	0.75	Renaturalisation	Medium
	CVC4	0.66	0.78	0.56	Restoration	Medium
	CVC5	0.48	0.83	0.72	Restoration	Medium
	CVC6	0.52	0.83	0.64	Restoration	Medium
	CVC7	0.52	0.75	0.75	Restoration	Medium
	CVC8	0.61	0.81	0.81	Restoration	Medium
<i>Jesolo</i>	JC1	0.00	0.81	0.83	Recovery	Low
	JC2	0.00	0.83	0.83	Recovery	Medium
	JC3	0.00	0.83	0.83	Recovery	Medium
	JC4	0.00	0.83	0.83	Recovery	Medium
	JC5	0.00	0.67	0.86	Renaturalisation	Low
	JC6	0.00	0.67	0.78	Renaturalisation	Low
	JC7	0.41	0.83	0.78	Restoration	Medium
	JC8	0.50	0.58	0.61	Restoration	Low
<i>Eraclea</i>	EC1	0.45	0.69	0.39	Conservation	Medium
	EC2	0.41	0.67	0.39	Conservation	Medium
	EC3	0.00	0.58	0.56	Renaturalisation	Medium
	EC4	0.00	0.58	0.56	Renaturalisation	Medium
	EC6	0.39	0.81	0.75	Restoration	Medium
	EC7	0.36	0.78	0.69	Restoration	Medium
	EC8	0.43	0.69	0.53	Restoration	Medium
	<i>Duna Verde</i>	DVC9	0.30	0.69	0.81	Renaturalisation

<i>Porto S. Margherita</i>	SMC10	0.00	0.58	0.72	<i>Renaturalisation</i>	<i>Low</i>
	SMC11	0.00	0.58	0.69	<i>Renaturalisation</i>	<i>Low</i>
	SMC12	0.00	0.58	0.83	<i>Renaturalisation</i>	<i>Low</i>
	SMC13	0.43	0.72	0.83	<i>Restoration</i>	<i>Low</i>
<i>Caorle</i>	CC1	0.00	0.78	0.83	<i>Renaturalisation</i>	<i>Low</i>
	CC2	0.00	0.00	0.56	<i>Renaturalisation</i>	<i>Low</i>
	CC3	0.00	0.72	0.75	<i>Renaturalisation</i>	<i>Low</i>
<i>Valle- vecchia</i>	VC1	0.66	0.67	0.31	<i>Conservation</i>	<i>High</i>
	VC2	0.55	0.61	0.31	<i>Conservation</i>	<i>Medium</i>
	VC3	0.59	0.69	0.33	<i>Conservation</i>	<i>High</i>
<i>Bibione</i>	BC1	0.52	0.78	0.42	<i>Conservation</i>	<i>High</i>
	BC2	0.48	0.75	0.83	<i>Restoration</i>	<i>Low</i>
	BC3	0.00	0.83	0.83	<i>Recovery</i>	<i>Medium</i>
	BC4	0.45	0.67	0.69	<i>Restoration</i>	<i>Low</i>
	BC5	0.52	0.67	0.39	<i>Conservation</i>	<i>Medium</i>



**Figure S2.** Results of the CMR (Coastal Management Requirement) index for each sector (littoral cell) of the 12 physiographic units of the Venetian coast.



**Figure S3.** Results of the DEP (Dune Establishment Potential) index for each sector (littoral cell) of the 12 physiographic units of the Venetian coast.

**Table S8.1** Simulated DEP index for each sector of the Venetian coast under the 35 considered scenarios.

ID	Hypothesis Cell	0	1	2	3	4	5	6	7	8	9	10	11
		DEP											
1	IVC1	0.139	0.167	0.194	0.167	0.194	0.194	0.222	0.194	0.222	0.250	0.278	0.278
2	IVC2	0.111	0.139	0.167	0.139	0.167	0.167	0.194	0.167	0.194	0.222	0.250	0.250
3	IVC3	0.167	0.194	0.222	0.194	0.222	0.222	0.250	0.222	0.250	0.278	0.306	0.306
4	IVC4	0.111	0.139	0.167	0.139	0.167	0.167	0.194	0.167	0.194	0.222	0.250	0.250
5	IVC5	0.056	0.083	0.111	0.083	0.111	0.111	0.139	0.111	0.139	0.167	0.194	0.194
6	IVC6	0.083	0.111	0.083	0.111	0.139	0.139	0.111	0.139	0.111	0.139	0.167	0.222
7	IVC7	0.250	0.278	0.250	0.278	0.306	0.306	0.278	0.306	0.278	0.306	0.333	0.389
8	IVC8	0.333	0.361	0.333	0.361	0.389	0.389	0.361	0.389	0.361	0.389	0.417	0.417
9	SC1	0.250	0.278	0.250	0.278	0.306	0.306	0.278	0.306	0.278	0.306	0.333	0.333
10	SC2	0.139	0.167	0.139	0.167	0.194	0.194	0.167	0.194	0.167	0.194	0.222	0.222
11	SC3	0.139	0.167	0.194	0.167	0.194	0.194	0.222	0.194	0.222	0.250	0.278	0.278
12	SC4	0.028	0.056	0.083	0.056	0.083	0.083	0.111	0.083	0.111	0.139	0.167	0.167
13	SC5	0.139	0.167	0.194	0.167	0.194	0.194	0.222	0.194	0.222	0.250	0.278	0.278
14	PC1	0.583	0.611	0.583	0.583	0.639	0.583	0.611	0.611	0.583	0.611	0.611	0.639
15	PC2	0.111	0.028	0.056	0.028	0.056	0.028	0.083	0.056	0.083	0.111	0.111	0.167
16	PC3	0.139	0.139	0.167	0.111	0.167	0.111	0.194	0.139	0.167	0.194	0.194	0.250
17	PC4	0.194	0.222	0.250	0.194	0.250	0.194	0.278	0.222	0.250	0.278	0.278	0.333
18	PC5	0.278	0.306	0.333	0.278	0.333	0.278	0.361	0.306	0.333	0.361	0.361	0.417
19	PC6	0.278	0.306	0.333	0.278	0.333	0.278	0.361	0.306	0.333	0.361	0.361	0.417
20	PC7	0.111	0.139	0.167	0.111	0.167	0.111	0.194	0.139	0.167	0.194	0.194	0.250
21	LC1	0.278	0.306	0.278	0.306	0.333	0.306	0.306	0.333	0.306	0.333	0.333	0.417
22	LC2	0.194	0.222	0.250	0.194	0.250	0.194	0.278	0.222	0.250	0.278	0.278	0.361
23	LC3	0.194	0.222	0.250	0.194	0.250	0.194	0.278	0.222	0.250	0.278	0.278	0.361
24	LC4	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.194
25	LC5	0.056	0.083	0.111	0.083	0.111	0.111	0.139	0.111	0.139	0.167	0.194	0.250
26	LC6	0.333	0.361	0.333	0.361	0.389	0.361	0.361	0.389	0.361	0.389	0.389	0.417
27	CVC1	0.333	0.361	0.333	0.361	0.389	0.389	0.361	0.389	0.361	0.389	0.417	0.417
28	CVC2	0.333	0.361	0.333	0.361	0.389	0.389	0.361	0.389	0.361	0.389	0.417	0.417
29	CVC3	0.056	0.083	0.111	0.083	0.111	0.111	0.139	0.111	0.139	0.167	0.194	0.194
30	CVC4	0.222	0.250	0.222	0.250	0.278	0.278	0.250	0.278	0.250	0.278	0.306	0.306
31	CVC5	0.111	0.139	0.167	0.139	0.167	0.167	0.194	0.167	0.194	0.222	0.250	0.250
32	CVC6	0.194	0.222	0.250	0.222	0.250	0.250	0.278	0.250	0.278	0.306	0.333	0.333
33	CVC7	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.083
34	CVC8	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.083
35	JC1	-0.028	0.000	0.028	0.000	0.028	0.028	0.056	0.028	0.056	0.083	0.111	0.056
36	JC2	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.083
37	JC3	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.083
38	JC4	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.083
39	JC5	-0.194	-0.167	-0.139	-0.167	-0.139	-0.139	-0.111	-0.139	-0.111	-0.083	-0.056	-0.111
40	JC6	-0.111	-0.083	-0.056	-0.083	-0.056	-0.056	-0.028	-0.056	-0.028	0.000	0.028	-0.028
41	JC7	0.056	0.083	0.111	0.083	0.111	0.111	0.139	0.111	0.139	0.167	0.194	0.194
42	JC8	-0.028	0.000	-0.028	0.000	0.028	0.028	0.000	0.028	0.000	0.028	0.056	0.056
43	EC1	0.306	0.333	0.306	0.306	0.361	0.306	0.333	0.333	0.306	0.333	0.333	0.361
44	EC2	0.278	0.306	0.278	0.278	0.333	0.278	0.306	0.306	0.278	0.306	0.306	0.333
45	EC3	0.028	0.056	0.083	0.028	0.083	0.028	0.111	0.056	0.083	0.111	0.111	0.194
46	EC4	0.028	0.056	0.083	0.028	0.083	0.028	0.111	0.056	0.083	0.111	0.111	0.194
47	EC6	0.056	0.083	0.111	0.083	0.111	0.111	0.139	0.111	0.139	0.167	0.194	0.139
48	EC7	0.083	0.111	0.139	0.111	0.139	0.139	0.167	0.139	0.167	0.194	0.222	0.167
49	EC8	0.167	0.194	0.222	0.194	0.222	0.222	0.250	0.222	0.250	0.278	0.306	0.306
50	DVC9	-0.111	-0.083	-0.056	-0.083	-0.056	-0.056	-0.028	-0.056	-0.028	0.000	0.028	-0.028
51	SMC10	-0.139	-0.111	-0.083	-0.111	-0.083	-0.083	-0.056	-0.083	-0.056	-0.028	0.000	0.000
52	SMC11	-0.111	-0.083	-0.056	-0.083	-0.056	-0.056	-0.028	-0.056	-0.028	0.000	0.028	0.028
53	SMC12	-0.250	-0.222	-0.194	-0.222	-0.194	-0.194	-0.167	-0.194	-0.167	-0.139	-0.111	-0.167
54	SMC13	-0.111	-0.083	-0.056	-0.083	-0.056	-0.056	-0.028	-0.056	-0.028	0.000	0.028	-0.028
55	CC1	-0.056	-0.028	0.000	-0.028	0.000	0.000	0.028	0.000	0.028	0.056	0.083	0.028
56	CC2	-0.556	-0.528	-0.500	-0.556	-0.500	-0.556	-0.472	-0.528	-0.500	-0.472	-0.472	-0.389
57	CC3	-0.028	0.000	0.028	0.000	0.028	0.028	0.056	0.028	0.056	0.083	0.111	0.111
58	VC1	0.361	0.389	0.361	0.389	0.417	0.389	0.389	0.417	0.389	0.417	0.417	0.444
59	VC2	0.306	0.333	0.306	0.333	0.361	0.333	0.333	0.361	0.333	0.361	0.361	0.389
60	VC3	0.361	0.389	0.361	0.389	0.417	0.389	0.389	0.417	0.389	0.417	0.417	0.444
61	BC1	0.361	0.389	0.361	0.389	0.417	0.389	0.389	0.417	0.389	0.417	0.417	0.444
62	BC2	-0.083	-0.056	-0.028	-0.056	-0.028	-0.028	0.000	-0.028	0.000	0.028	0.056	0.000
63	BC3	0.000	0.028	0.056	0.028	0.056	0.056	0.083	0.056	0.083	0.111	0.139	0.083
64	BC4	-0.028	0.000	0.028	0.000	0.028	0.028	0.056	0.028	0.056	0.083	0.111	0.111
65	BC5	0.278	0.306	0.333	0.306	0.333	0.333	0.361	0.333	0.361	0.389	0.417	0.417

DEP	Number of cells											
Low	14	10	10	10	9	9	8	9	8	4	3	6
Medium	43	45	44	46	41	46	44	44	45	47	45	38
High	8	10	11	9	15	10	13	12	12	14	17	21
Percentage of decrease in the number of low DEP sites from hypothesis 0 (current state)												
0	28.57	28.57	28.57	35.71	35.71	42.86	35.71	42.86	71.43	78.57	57.14	

**Table S8.2** Simulated DEP index for each sector of the Venetian coast under the 35 considered scenarios.

ID	Hypothesis Cell	12	13	14	15	16	17	18	19	20	21	22	23
		DEP											
1	IVC1	0.306	0.167	0.194	0.222	0.250	0.278	0.306	0.333	0.361	0.278	0.306	0.278
2	IVC2	0.278	0.139	0.167	0.194	0.222	0.250	0.278	0.306	0.333	0.250	0.250	0.250
3	IVC3	0.333	0.167	0.167	0.167	0.167	0.278	0.278	0.278	0.278	0.306	0.333	0.306
4	IVC4	0.278	0.111	0.111	0.111	0.111	0.222	0.222	0.222	0.222	0.250	0.278	0.250
5	IVC5	0.222	0.056	0.056	0.056	0.056	0.167	0.167	0.167	0.167	0.194	0.222	0.194
6	IVC6	0.194	0.111	0.139	0.167	0.194	0.167	0.194	0.222	0.250	0.167	0.194	0.167
7	IVC7	0.361	0.278	0.306	0.333	0.361	0.333	0.361	0.389	0.417	0.306	0.306	0.306
8	IVC8	0.444	0.361	0.389	0.417	0.444	0.417	0.444	0.472	0.500	0.417	0.444	0.417
9	SC1	0.361	0.278	0.306	0.333	0.361	0.333	0.361	0.389	0.417	0.333	0.361	0.333
10	SC2	0.250	0.167	0.194	0.222	0.250	0.222	0.250	0.278	0.306	0.222	0.250	0.222
11	SC3	0.306	0.167	0.194	0.222	0.250	0.278	0.306	0.333	0.361	0.278	0.306	0.278
12	SC4	0.194	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.250	0.167	0.194	0.167
13	SC5	0.306	0.167	0.194	0.222	0.250	0.278	0.306	0.333	0.361	0.278	0.306	0.278
14	PC1	0.639	0.611	0.639	0.667	0.694	0.639	0.667	0.694	0.722	0.611	0.611	0.639
15	PC2	0.139	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.139	0.139
16	PC3	0.222	0.139	0.167	0.194	0.222	0.222	0.250	0.278	0.306	0.222	0.222	0.194
17	PC4	0.306	0.222	0.250	0.278	0.306	0.306	0.333	0.361	0.389	0.306	0.306	0.278
18	PC5	0.389	0.306	0.333	0.361	0.389	0.389	0.417	0.444	0.472	0.361	0.361	0.361
19	PC6	0.389	0.306	0.333	0.361	0.389	0.389	0.417	0.444	0.472	0.361	0.361	0.361
20	PC7	0.222	0.139	0.167	0.194	0.222	0.222	0.250	0.278	0.306	0.194	0.194	0.194
21	LC1	0.361	0.306	0.333	0.361	0.361	0.361	0.389	0.417	0.417	0.361	0.361	0.361
22	LC2	0.306	0.222	0.250	0.278	0.306	0.306	0.333	0.361	0.389	0.278	0.278	0.278
23	LC3	0.306	0.222	0.250	0.278	0.306	0.306	0.333	0.361	0.389	0.278	0.278	0.278
24	LC4	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
25	LC5	0.222	0.083	0.111	0.139	0.167	0.194	0.222	0.250	0.278	0.194	0.222	0.194
26	LC6	0.417	0.361	0.389	0.417	0.444	0.417	0.444	0.472	0.500	0.417	0.444	0.417
27	CVC1	0.444	0.361	0.361	0.361	0.361	0.417	0.417	0.417	0.417	0.417	0.417	0.417
28	CVC2	0.444	0.361	0.361	0.361	0.361	0.417	0.417	0.417	0.417	0.417	0.417	0.417
29	CVC3	0.222	0.083	0.111	0.139	0.167	0.194	0.222	0.250	0.278	0.194	0.194	0.194
30	CVC4	0.333	0.250	0.278	0.306	0.333	0.306	0.333	0.361	0.389	0.278	0.278	0.306
31	CVC5	0.278	0.139	0.167	0.194	0.222	0.250	0.278	0.306	0.333	0.250	0.250	0.250
32	CVC6	0.361	0.222	0.250	0.278	0.306	0.333	0.361	0.389	0.417	0.333	0.333	0.333
33	CVC7	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
34	CVC8	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
35	JC1	0.139	0.000	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.111	0.139	0.111
36	JC2	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
37	JC3	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
38	JC4	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
39	JC5	-0.028	-0.167	-0.139	-0.111	-0.083	-0.056	-0.028	0.000	0.028	-0.056	-0.028	-0.056
40	JC6	0.056	-0.083	-0.056	-0.028	0.000	0.028	0.056	0.083	0.111	0.028	0.028	0.028
41	JC7	0.222	0.083	0.111	0.139	0.167	0.194	0.222	0.250	0.278	0.194	0.222	0.194
42	JC8	0.083	0.000	0.028	0.056	0.083	0.056	0.083	0.111	0.139	0.056	0.056	0.056
43	EC1	0.361	0.333	0.361	0.389	0.417	0.361	0.389	0.417	0.444	0.333	0.333	0.333
44	EC2	0.333	0.306	0.333	0.361	0.389	0.333	0.361	0.389	0.417	0.306	0.306	0.306
45	EC3	0.139	0.056	0.083	0.111	0.139	0.139	0.167	0.194	0.222	0.111	0.111	0.111
46	EC4	0.139	0.056	0.083	0.111	0.139	0.139	0.167	0.194	0.222	0.111	0.111	0.111
47	EC6	0.222	0.083	0.111	0.139	0.139	0.194	0.222	0.250	0.250	0.194	0.194	0.194
48	EC7	0.250	0.111	0.139	0.167	0.194	0.222	0.250	0.278	0.306	0.222	0.250	0.222
49	EC8	0.333	0.194	0.222	0.250	0.278	0.306	0.333	0.361	0.389	0.278	0.278	0.306
50	DVC9	0.056	-0.083	-0.056	-0.028	0.000	0.028	0.056	0.083	0.111	0.028	0.056	0.028
51	SMC10	0.028	-0.111	-0.083	-0.056	-0.028	0.000	0.028	0.056	0.083	0.000	0.028	0.000
52	SMC11	0.056	-0.083	-0.056	-0.028	0.000	0.028	0.056	0.083	0.111	0.028	0.056	0.028
53	SMC12	-0.083	-0.222	-0.194	-0.167	-0.139	-0.111	-0.083	-0.056	-0.028	-0.111	-0.083	-0.111
54	SMC13	0.056	-0.083	-0.056	-0.028	0.000	0.028	0.056	0.083	0.111	0.028	0.056	0.028
55	CC1	0.111	-0.028	0.000	0.028	0.056	0.083	0.111	0.139	0.167	0.083	0.111	0.083
56	CC2	-0.444	-0.528	-0.500	-0.472	-0.444	-0.444	-0.417	-0.389	-0.361	-0.472	-0.472	-0.472
57	CC3	0.139	0.000	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.111	0.139	0.111
58	VC1	0.444	0.389	0.417	0.444	0.472	0.444	0.472	0.500	0.528	0.417	0.417	0.417
59	VC2	0.389	0.333	0.361	0.389	0.417	0.389	0.417	0.444	0.472	0.361	0.361	0.361
60	VC3	0.444	0.389	0.417	0.444	0.472	0.444	0.472	0.500	0.528	0.417	0.417	0.444
61	BC1	0.444	0.389	0.417	0.444	0.472	0.444	0.472	0.500	0.528	0.444	0.444	0.444
62	BC2	0.083	-0.056	-0.028	0.000	0.028	0.056	0.083	0.111	0.139	0.056	0.083	0.056
63	BC3	0.167	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.222	0.139	0.167	0.139
64	BC4	0.139	0.000	0.028	0.056	0.083	0.111	0.139	0.167	0.194	0.111	0.139	0.111
65	BC5	0.444	0.306	0.333	0.333	0.333	0.417	0.444	0.444	0.444	0.389	0.389	0.417

DEP	Number of cells											
Low	3	10	9	8	4	3	3	2	2	3	3	3
Medium	41	45	41	40	43	44	39	37	35	46	45	46
High	21	10	15	17	18	18	23	26	28	16	17	16
Percentage of decrease in the number of low DEP sites from hypothesis 0 (current state)												
	78.57	28.57	35.71	42.86	71.43	78.57	78.57	85.71	85.71	78.57	78.57	78.57

**Table S8.3** Simulated DEP index for each sector of the Venetian coast under the 35 considered scenarios.

ID	Hypothesis Cell	24	25	26	27	28	29	30	31	32	33	34	35
		DEP											
1	IVC1	0.333	0.361	0.306	0.361	0.278	0.333	0.417	0.472	0.194	0.250	0.250	0.361
2	IVC2	0.306	0.306	0.278	0.333	0.278	0.333	0.389	0.444	0.167	0.222	0.222	0.333
3	IVC3	0.306	0.333	0.333	0.389	0.250	0.250	0.389	0.389	0.222	0.278	0.222	0.278
4	IVC4	0.250	0.278	0.278	0.333	0.194	0.194	0.333	0.333	0.167	0.222	0.167	0.222
5	IVC5	0.194	0.222	0.222	0.278	0.139	0.139	0.278	0.278	0.111	0.167	0.111	0.167
6	IVC6	0.222	0.250	0.194	0.250	0.167	0.222	0.306	0.361	0.139	0.194	0.194	0.306
7	IVC7	0.361	0.361	0.361	0.417	0.306	0.361	0.472	0.528	0.306	0.361	0.361	0.472
8	IVC8	0.472	0.500	0.444	0.500	0.417	0.472	0.556	0.611	0.389	0.444	0.444	0.556
9	SC1	0.389	0.417	0.361	0.417	0.333	0.389	0.472	0.528	0.306	0.361	0.361	0.472
10	SC2	0.278	0.306	0.250	0.306	0.222	0.278	0.361	0.417	0.194	0.250	0.250	0.361
11	SC3	0.333	0.361	0.306	0.361	0.278	0.333	0.417	0.472	0.194	0.250	0.250	0.361
12	SC4	0.222	0.250	0.194	0.250	0.167	0.222	0.306	0.361	0.083	0.139	0.139	0.250
13	SC5	0.333	0.361	0.306	0.361	0.306	0.361	0.417	0.472	0.194	0.250	0.250	0.361
14	PC1	0.667	0.667	0.667	0.722	0.639	0.694	0.778	0.833	0.639	0.694	0.694	0.806
15	PC2	0.194	0.194	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
16	PC3	0.278	0.278	0.250	0.306	0.194	0.250	0.361	0.417	0.167	0.222	0.222	0.333
17	PC4	0.361	0.361	0.333	0.389	0.278	0.333	0.444	0.500	0.250	0.306	0.306	0.417
18	PC5	0.417	0.417	0.417	0.472	0.361	0.417	0.528	0.583	0.333	0.389	0.389	0.500
19	PC6	0.417	0.417	0.417	0.472	0.361	0.417	0.528	0.583	0.333	0.389	0.389	0.500
20	PC7	0.250	0.250	0.250	0.306	0.194	0.250	0.361	0.417	0.167	0.222	0.222	0.333
21	LC1	0.417	0.417	0.389	0.444	0.361	0.389	0.500	0.528	0.333	0.389	0.389	0.472
22	LC2	0.333	0.333	0.333	0.389	0.278	0.333	0.444	0.500	0.250	0.306	0.306	0.417
23	LC3	0.333	0.333	0.333	0.389	0.278	0.333	0.444	0.500	0.250	0.306	0.306	0.417
24	LC4	0.194	0.222	0.167	0.222	0.167	0.222	0.278	0.333	0.056	0.111	0.111	0.222
25	LC5	0.250	0.278	0.222	0.278	0.194	0.250	0.333	0.389	0.111	0.167	0.167	0.278
26	LC6	0.472	0.500	0.444	0.500	0.417	0.472	0.556	0.611	0.389	0.444	0.444	0.556
27	CVC1	0.444	0.444	0.444	0.500	0.417	0.417	0.528	0.528	0.389	0.444	0.417	0.472
28	CVC2	0.444	0.444	0.444	0.500	0.444	0.444	0.528	0.528	0.389	0.444	0.417	0.472
29	CVC3	0.250	0.250	0.222	0.278	0.278	0.333	0.333	0.389	0.111	0.167	0.167	0.278
30	CVC4	0.333	0.333	0.333	0.389	0.333	0.389	0.444	0.500	0.278	0.333	0.333	0.444
31	CVC5	0.306	0.306	0.278	0.333	0.306	0.361	0.389	0.444	0.167	0.222	0.222	0.333
32	CVC6	0.389	0.389	0.361	0.417	0.361	0.417	0.472	0.528	0.250	0.306	0.306	0.417
33	CVC7	0.194	0.222	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
34	CVC8	0.194	0.222	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
35	JC1	0.167	0.194	0.139	0.194	0.111	0.167	0.250	0.306	0.028	0.083	0.083	0.194
36	JC2	0.194	0.222	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
37	JC3	0.194	0.222	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
38	JC4	0.194	0.222	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
39	JC5	0.000	0.028	-0.028	0.028	-0.028	0.028	0.083	0.139	-0.139	-0.083	-0.083	0.028
40	JC6	0.083	0.083	0.056	0.111	0.056	0.111	0.167	0.222	-0.056	0.000	0.000	0.111
41	JC7	0.250	0.278	0.222	0.278	0.278	0.333	0.333	0.389	0.111	0.167	0.167	0.278
42	JC8	0.111	0.111	0.083	0.139	0.111	0.167	0.194	0.250	0.028	0.083	0.083	0.194
43	EC1	0.389	0.389	0.389	0.444	0.333	0.389	0.500	0.556	0.361	0.417	0.417	0.528
44	EC2	0.361	0.361	0.361	0.417	0.306	0.361	0.472	0.528	0.333	0.389	0.389	0.500
45	EC3	0.167	0.167	0.167	0.222	0.111	0.167	0.278	0.333	0.083	0.139	0.139	0.250
46	EC4	0.167	0.167	0.167	0.222	0.111	0.167	0.278	0.333	0.083	0.139	0.139	0.250
47	EC6	0.250	0.250	0.222	0.278	0.222	0.250	0.333	0.361	0.111	0.167	0.167	0.250
48	EC7	0.278	0.306	0.250	0.306	0.250	0.306	0.361	0.417	0.139	0.194	0.194	0.306
49	EC8	0.333	0.333	0.333	0.389	0.306	0.361	0.444	0.500	0.222	0.278	0.278	0.389
50	DVC9	0.083	0.111	0.056	0.111	0.028	0.083	0.167	0.222	-0.056	0.000	0.000	0.111
51	SMC10	0.056	0.083	0.028	0.083	0.000	0.056	0.139	0.194	-0.083	-0.028	-0.028	0.083
52	SMC11	0.083	0.111	0.056	0.111	0.028	0.083	0.167	0.222	-0.056	0.000	0.000	0.111
53	SMC12	-0.056	-0.028	-0.083	-0.028	-0.111	-0.056	0.028	0.083	-0.194	-0.139	-0.139	-0.028
54	SMC13	0.083	0.111	0.056	0.111	0.028	0.083	0.167	0.222	-0.056	0.000	0.000	0.111
55	CC1	0.139	0.167	0.111	0.167	0.083	0.139	0.222	0.278	0.000	0.056	0.056	0.167
56	CC2	-0.417	-0.417	-0.417	-0.361	-0.472	-0.417	-0.306	-0.250	-0.500	-0.444	-0.444	-0.333
57	CC3	0.167	0.194	0.139	0.194	0.111	0.167	0.250	0.306	0.028	0.083	0.083	0.194
58	VC1	0.472	0.472	0.472	0.528	0.417	0.472	0.583	0.639	0.417	0.472	0.472	0.583
59	VC2	0.417	0.417	0.417	0.472	0.361	0.417	0.528	0.583	0.361	0.417	0.417	0.528
60	VC3	0.472	0.472	0.472	0.528	0.444	0.500	0.583	0.639	0.417	0.472	0.472	0.583
61	BC1	0.500	0.500	0.472	0.528	0.444	0.500	0.583	0.639	0.417	0.472	0.472	0.583
62	BC2	0.111	0.139	0.083	0.139	0.083	0.139	0.194	0.250	-0.028	0.028	0.028	0.139
63	BC3	0.194	0.222	0.167	0.222	0.139	0.194	0.278	0.333	0.056	0.111	0.111	0.222
64	BC4	0.167	0.194	0.139	0.194	0.111	0.167	0.250	0.306	0.028	0.083	0.083	0.194
65	BC5	0.444	0.444	0.444	0.500	0.417	0.417	0.556	0.556	0.333	0.389	0.389	0.444

DEP	Number of cells											
	Low	2	2	3	2	3	2	1	1	9	4	4
Medium	37	36	38	33	45	33	26	14	41	43	43	32
High	26	27	24	30	17	30	38	50	15	18	18	31
Percentage of decrease in the number of low DEP sites from hypothesis 0 (current state)												
	85.71	85.71	78.57	85.71	78.57	85.71	92.86	92.86	35.71	71.43	71.43	85.71

