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> *"Uno dei grandi piaceri della vita sta nel fare quello che la gente dice che non riuscirai a fare."*
> *Walter Bagehot*

APPENDICI

Appendice 1: Fonti cartografiche

- *Zonazione Aree protette*

  Descrizione: perimetrazione delle zone dell'AMP di Capo Mortola, Bergeggi, Portofino, Cinque Terre e Portovenere

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/) – DISTAV/UNIGE

  Carta: Zonazione delle aree protette della Liguria – sc. 1:5000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Habitat marini*

  Descrizione: habitat marini della Liguria

  Fonte: Diviacco et al., 2020

  Carta: Atlante degli Habitat Marini della Liguria – sc. 1:10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Corpi idrici*

  Descrizione: 26 corpi idrici definiti da ARPAL e Regione Liguria per il monitoraggio della fascia costiera ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: P.TA. 2018 – Stato ecologico acque superficiali classificazione intermedia 2014-2016 – sc. 1:10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Temperatura dell'acqua marino costiera*

  Descrizione: temperatura dell'acqua marino costiera ligure

  Fonte: Giovanni Data System, NASA (www.giovanni.gsfc.nasa.gov)

  Formato del dato: raster

- *Tipo di costa*

  Descrizione: classificazione e localizzazione del tipo di costa in base al tipo di substrato (roccioso, sabbioso e ghiaioso)

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Linea di costa – sc. 1:5000

Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Esposizione dei versanti*

  Descrizione: esposizione della costa ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: DTM, Modello Digitale del Terreno – Liguria ed. 2007 – sc.1:5000

  Formato del dato: grid SR: WGS84 / UTM32N

- *Presenza di aree soggette a frane*

  Descrizione: localizzazione e perimetrazione di territori caratterizzati da fenomeni franosi, presenti lungo la costa ligure.

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Inventario dei Fenomeni Franosi – sc. 1:10000 – Progetto IFFI

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza di diversi tipi di strutture ricettive nei comuni costieri*

  Descrizione: localizzazione e descrizione delle strutture di ricettività turistica presenti nel territorio ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Strutture di ricettività turistica– sc. 1:5000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza ed estensione di spiagge balneabili*

  Descrizione: localizzazione ed estensione delle spiagge liguri nelle quali è consentita la balneazione

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/), ARPAL (www.arpal.liguria.it/homepage/acqua/acque-marino-costiere/balneazione.html)

  Carta: Uso del Suolo – sc- 1:10000 – ed.2019, P.T.A. 2018 - Stato ecologico acque superficiali classificazione intermedia 2014-2016 – sc.1: 10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Svolgimento di attività subacquea presso siti costieri*

  Descrizione: localizzazione dei siti costieri liguri nei quali viene svolta attività subacquea

  Fonte: Logbook Immersioni (https://www.logbookimmersioni.it/)

- *Presenza di ferrovie lungo costa*

  Descrizione: localizzazione delle ferrovie presenti lungo la fascia costiera ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Rete viaria regionale– sc. 1:5000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza di diversi tipi di impianti di allevamento*

  Descrizione: localizzazione, descrizione ed estensione di impianti di pesca, maricoltura e barriere di ripopolamento ittico della fascia costiera del litorale ligure.

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Impianti di pesca, maricoltura e barriere di ripopolamento ittico – sc. 1:10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza di diversi tipi di opere di difesa*

  Descrizione: localizzazione e descrizione delle opere di difesa costiera del territorio ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Opere di difesa costiera – sc. 1:5000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza di coste artificiali*

  Descrizione: localizzazione ed estensione di linea di costa caratterizzata dalla presenza di substrato artificiale

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Linea di Costa – sc. 1:5000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Opere di ripascimento in alcune spiagge*

  Descrizione: Localizzazione ed estensione delle opere di ripascimento stagionali e strutturali realizzate lungo la costa ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Ripascimenti 2003-2007– sc. 1:10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza di scarichi e condotte a mare*

  Descrizione: localizzazione degli scarichi civili e delle condotte di scarico sottomarine censite da

Regione, Arpal e dalle Province nell'ambito delle proprie attività istituzionali.

Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

Carta: Depuratori, scarichi civili ed industriali, condotte di scarico – sc. 1:5000

Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Densità di popolazione nei comuni costieri*

  Descrizione: calcolo della densità di popolazione dei comuni costieri

  Fonte: ISTAT (http://dati.istat.it)

- *Presenza di diversi tipi di tessuto urbano lungo la fascia costiera*

  Descrizione: localizzazione ed estensione dei vari tipi di tessuto urbano.

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: Uso del suolo – sc. 1:10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Presenza di zone di protezione marine e terrestri*

  Descrizione: localizzazione, descrizione e perimetrazione delle zone di protezione marine e terrestri presenti nel territorio ligure

  Fonte: geoportale della regione Liguria (https://geoportal.regione.liguria.it/)

  Carta: S.I.C. Terrestri e Marini – DGR n. 705/2012 e DGR n. 613/2012 con Z.S.C – DM MATTM 24/06/2015 – sc. 1:10000

  Formato del dato: vettoriale SR: WGS84 / UTM32N

- *Localizzazione di aree di divieto per la pesca e l'ancoraggio*

  Descrizione: localizzazione e perimetrazione delle aree di divieto per la pesca e l'ancoraggio

  Fonte: NAVIONICS (http://www.navionics.com/ita)

Appendice 2: Calcolo del valore di capitale naturale e flussi ambientali

a) Analisi trofodinamica

Capitale naturale

Produzione primaria totale richiesta

- Organismi bentonici

Macrogruppi	CYM	CYM E CAU	CYM-DENSA	CYM-MMP	CYM-POS	MMP	MOS	POS	POS E CAU	POS-ROC
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Fitoplancton	0,69	0,69	0,69	0,69	0,69	0,69	0,69	0,69	0,69	0,69
Microphytobenthos	23,81	23,81	23,81	23,81	23,81	23,81	23,81	23,81	23,81	23,81
Alghe	0,00	75,18	0,00	22,81	23,39	45,62	46,77	47,92	99,14	47,92
Cymodocea	262,28	131,34	262,28	131,14	131,14	0,00	0,00	0,00	0,20	0,00
Posidonia	0,00	0,00	0,00	0,00	130,12	0,00	260,23	520,47	260,23	520,47
Bryozoa	0,00	0,00	0,00	0,00	0,05	0,00	0,63	1,27	0,09	1,27
Porifera	0,00	0,00	0,00	0,00	0,06	0,00	0,86	1,73	0,12	1,73
Cnidaria	0,00	0,07	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,00
Ascidiacea	0,00	0,00	0,00	0,00	3,04	0,00	42,51	85,03	6,07	85,03
Foraminifera	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Echinodermata	0,00	9,74	0,00	16,87	1,35	35,11	20,71	2,26	74,25	2,26
Crustacea	0,21	274,44	0,21	1,14	9,68	2,19	20,47	43,07	351,59	43,07
Mollusca	1,19	206,73	1,19	4,03	72,92	7,81	181,89	369,33	468,78	369,33
Anellida	0,00	4,84	0,00	6,75	0,81	14,46	12,00	9,03	40,97	9,03
Sipunculida	0,00	0,00	0,00	1,29	0,01	2,76	1,43	0,00	0,00	0,00
Various	0,00	29,72	0,00	1,73	0,12	4,12	1,96	0,00	4,24	0,00

Tabella 1. Produzione primaria (gC m^{-2}) richiesta dal benthos negli habitat costituiti da piante marine

Macrogruppi	C	C-F	GR
	gC m^{-2}	gC m^{-2}	gC m^{-2}
Fitoplancton	0,69	0,69	0,69
Microphytobenthos	23,81	23,81	0,00
Alghe	18,66	9,33	0,00
Cymodocea	0,00	0,00	0,00
Posidonia	0,00	0,00	0,00
Bryozoa	58,89	4,21	49,17
Porifera	98,34	7,02	701,00
Cnidaria	1377,62	98,40	680,46
Ascidiacea	0,00	0,00	83,89
Foraminifera	0,00	0,00	0,04
Echinodermata	0,00	0,63	0,00
Crustacea	0,00	0,07	486,48
Mollusca	0,00	2,78	192,00

Anellida	0,00	0,11	380,96
Sipunculida	0,00	0,00	0,00
Various	0,00	0,04	291,39

Tabella 2. Produzione primaria (gC m^{-2}) richiesta dal benthos, negli habitat costituiti da coralligeno e grotte

Macrogruppi	**AF**	**AFA**	**AF-BR**	**ASC**	**ASI**	**CAU**	**CYL**
	gC m^{-2}	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**
Fitoplancton	0,69	0,69	0,69	0,69	0,69	0,69	0,69
Microphytobenthos	23,81	23,81	23,81	23,81	23,81	23,81	23,81
Alghe	88,57	88,57	88,57	55,87	48,50	150,36	150,36
Cymodocea	0,00	0,00	0,00	0,00	0,00	0,40	0,40
Posidonia	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Bryozoa	0,13	0,13	0,13	0,00	0,00	0,00	0,00
Porifera	9,75	9,75	9,75	0,00	0,00	0,00	0,00
Cnidaria	0,37	0,37	0,37	0,00	0,00	0,98	0,98
Ascidiacea	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foraminifera	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Echinodermata	0,00	0,00	0,00	1,32	2,70	188,23	188,23
Crustacea	27,08	27,08	27,08	1,33	1,49	649,25	649,25
Mollusca	0,00	0,00	0,00	102,77	60,39	579,91	579,91
Anellida	0,00	0,00	0,00	0,85	3,39	80,17	80,17
Sipunculida	0,00	0,00	0,00	0,01	0,14	0,00	0,00
Various	0,00	0,00	0,00	0,86	1,32	84,22	84,22

Tabella 3. Produzione primaria (gC m^{-2}) richiesta dal benthos, negli habitat costituiti da alghe

Macrogruppi	**DC**	**DI**	**F**	**RL**	**S**	**SGC**	**SGC-C**
	gC m^{-2}	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**	**gC m^{-2}**
Fitoplancton	0,69	0,69	0,69	0,69	0,69	0,69	0,69
Microphytobenthos	0,00	0,00	0,00	0,00	0,00	0,00	23,81
Alghe	0,00	0,00	0,00	0,00	0,00	0,00	6,22
Cymodocea	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Posidonia	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Bryozoa	0,00	0,00	0,00	0,00	0,00	0,00	1,47
Porifera	0,00	0,00	0,00	0,00	0,00	0,00	2,45
Cnidaria	0,00	0,00	0,00	0,00	0,00	0,00	34,29
Ascidiacea	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foraminifera	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Echinodermata	1,45	6,53	11,42	6,53	2,14	0,21	0,32
Crustacea	0,37	0,47	1,09	0,47	7,51	0,78	1,23
Mollusca	0,62	3,51	49,44	3,51	31,65	3,15	4,79
Anellida	11,15	0,80	1,86	0,80	19,23	5,00	3,15
Sipunculida	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Various	0,84	0,64	0,75	0,64	0,82	0,09	0,14

Tabella 4. Produzione primaria (gC m^{-2}) richiesta dal benthos, negli habitat costituiti da detrito, fanghi, roccia e sabbia

- Fauna ittica

Zone	CYM	CYM E CAU	CYM-DENSA	CYM-MMP	CYM-POS	MMP	MOS	POS	POS E CAU	POS-ROC
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	1,56E+03	3,20E+03	1,56E+03	1,56E+03	2,54E+03	1,76E+03	2,54E+03	3,18E+03	3,20E+03	3,19E+03
Capo Mortola	1,01E+03	1,46E+03	1,01E+03	1,01E+03	1,13E+03	1,10E+03	1,25E+03	1,92E+03	1,91E+03	1,84E+03
Bergeggi A	2,51E+03	3,13E+03	2,51E+03	2,51E+03	2,71E+03	2,53E+03	2,92E+03	3,96E+03	3,85E+03	3,78E+03
Bergeggi B-Isola	2,44E+03	2,70E+03	2,44E+03	2,44E+03	2,52E+03	2,69E+03	2,61E+03	3,48E+03	3,21E+03	2,96E+03
Bergeggi B-Predani	2,44E+03	2,70E+03	2,44E+03	2,44E+03	2,52E+03	2,69E+03	2,61E+03	3,48E+03	3,21E+03	2,96E+03
Bergeggi C	1,01E+03	1,46E+03	1,01E+03	1,01E+03	1,13E+03	1,10E+03	1,25E+03	1,92E+03	1,91E+03	1,84E+03
Portofino A	9,83E+02	2,60E+03	9,83E+02	9,83E+02	1,49E+03	9,75E+02	2,00E+03	4,22E+03	4,21E+03	4,23E+03
Portofino B	4,64E+02	1,04E+03	4,64E+02	4,64E+02	5,95E+02	5,82E+02	7,26E+02	1,76E+03	1,69E+03	1,76E+03
Portofino C ovest	3,29E+02	9,82E+02	3,29E+02	3,29E+02	5,76E+02	3,23E+02	8,23E+02	1,63E+03	1,63E+03	1,64E+03
Portofino C est	3,12E+02	7,69E+02	3,12E+02	3,12E+02	3,69E+02	3,09E+02	4,25E+02	1,24E+03	1,23E+03	1,25E+03
Cinque Terre A Mesco	5,40E+03	5,30E+03	5,40E+03	5,40E+03	5,47E+03	4,99E+03	5,54E+03	5,83E+03	5,51E+03	5,39E+03
Cinque Terre B Mesco	5,51E+03	5,36E+03	5,51E+03	5,51E+03	5,55E+03	5,88E+03	5,59E+03	6,65E+03	5,93E+03	5,80E+03
Cinque Terre A Montenero	1,14E+03	1,48E+03	1,14E+03	1,14E+03	1,17E+03	1,64E+03	1,21E+03	1,84E+03	1,83E+03	1,73E+03
Cinque Terre B Montenero	1,35E+03	1,69E+03	1,35E+03	1,35E+03	1,43E+03	1,61E+03	1,50E+03	2,03E+03	2,02E+03	1,31E+03
Cinque Terre C	2,39E+03	2,63E+03	2,39E+03	2,39E+03	2,44E+03	2,68E+03	2,50E+03	2,88E+03	2,87E+03	2,65E+03
Portovenere	1,01E+03	1,46E+03	1,01E+03	1,01E+03	1,13E+03	1,10E+03	1,25E+03	1,92E+03	1,91E+03	1,84E+03

Tabella 5. Produzione primaria (gC m^{-2}) richiesta dal comparto ittico, negli habitat costituiti da piante marine

Zona	C	C-F	GR
	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	2,93E+03	2,93E+03	2,67E+01
Capo Mortola	1,83E+03	9,50E+02	1,01E+02
Bergeggi A	3,73E+03	1,95E+03	3,22E+02
Bergeggi B-Isola	3,11E+03	1,65E+03	4,41E+02
Bergeggi B-Predani	3,11E+03	1,65E+03	4,41E+02
Bergeggi C	1,83E+03	9,50E+02	1,01E+02
Portofino A	4,29E+03	2,14E+03	6,77E-01
Portofino B	1,74E+03	8,71E+02	4,25E+01
Portofino C ovest	1,65E+03	8,26E+02	1,23E+00
Portofino C est	1,24E+03	6,32E+02	0,00E+00

Cinque Terre A Mesco	5,01E+03	2,60E+03	4,76E+02
Cinque Terre B Mesco	6,14E+03	3,28E+03	5,74E+02
Cinque Terre A Montenero	1,90E+03	1,10E+03	4,88E+02
Cinque Terre B Montenero	1,45E+03	7,84E+02	7,05E+02
Cinque Terre C	2,58E+03	1,39E+03	3,00E+02
Portovenere	1,83E+03	9,50E+02	1,01E+02

Tabella 6. Produzione primaria (gC m^{-2}) richiesta dal comparto ittico negli habitat costituiti da coralligeno e grotte

Zone	AF	AFA	AF-BR	ASC	ASI	CAU	CYL
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	2,03E+03	2,03E+03	2,03E+03	3,01E+03	3,00E+03	3,20E+03	3,20E+03
Capo Mortola	1,89E+03	1,89E+03	1,89E+03	1,84E+03	1,81E+03	1,91E+03	1,91E+03
Bergeggi A	4,29E+03	4,29E+03	4,29E+03	3,96E+03	3,82E+03	3,74E+03	3,74E+03
Bergeggi B-Isola	4,05E+03	4,05E+03	4,05E+03	3,19E+03	2,87E+03	2,95E+03	2,95E+03
Bergeggi B-Predani	4,05E+03	4,05E+03	4,05E+03	3,19E+03	2,87E+03	2,95E+03	2,95E+03
Bergeggi C	1,89E+03	1,89E+03	1,89E+03	1,84E+03	1,81E+03	1,91E+03	1,91E+03
Portofino A	3,43E+03	3,43E+03	3,43E+03	4,33E+03	4,33E+03	4,21E+03	4,21E+03
Portofino B	1,61E+03	1,61E+03	1,61E+03	1,75E+03	1,75E+03	1,61E+03	1,61E+03
Portofino C ovest	1,14E+03	1,14E+03	1,14E+03	1,66E+03	1,66E+03	1,63E+03	1,63E+03
Portofino C est	1,13E+03	1,13E+03	1,13E+03	1,28E+03	1,28E+03	1,22E+03	1,22E+03
Cinque Terre A Mesco	6,94E+03	6,94E+03	6,94E+03	5,65E+03	5,50E+03	5,19E+03	5,19E+03
Cinque Terre B Mesco	7,30E+03	7,30E+03	7,30E+03	6,36E+03	5,79E+03	5,22E+03	5,22E+03
Cinque Terre A Montenero	2,50E+03	2,50E+03	2,50E+03	1,91E+03	1,64E+03	1,82E+03	1,82E+03
Cinque Terre B Montenero	3,24E+03	3,24E+03	3,24E+03	1,45E+03	1,06E+03	2,02E+03	2,02E+03
Cinque Terre C	3,40E+03	3,40E+03	3,40E+03	2,60E+03	2,51E+03	2,86E+03	2,86E+03
Portovenere	1,89E+03	1,89E+03	1,89E+03	1,84E+03	1,81E+03	1,91E+03	1,91E+03

Tabella 7. Produzione primaria (gC m^{-2}) richiesta dal comparto ittico negli habitat costituiti da alghe

Zone	DC	DI	F	RL	S	SGC	SGC-C
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	2,08E+03	7,84E+02	0,00E+00	7,84E+02	5,02E+02	8,07E+02	3,14E+03
Capo Mortola	1,10E+03	6,17E+02	7,42E+01	6,17E+02	7,30E+02	4,78E+02	9,27E+02
Bergeggi A	2,48E+03	1,61E+03	1,67E+02	1,61E+03	1,77E+03	1,25E+03	2,07E+03
Bergeggi B-Isola	2,30E+03	1,78E+03	1,83E+02	1,78E+03	2,04E+03	1,03E+03	1,72E+03
Bergeggi B-Predani	2,30E+03	1,78E+03	1,83E+02	1,78E+03	2,04E+03	1,03E+03	1,72E+03
Bergeggi C	1,10E+03	6,17E+02	7,42E+01	6,17E+02	7,30E+02	4,78E+02	9,27E+02
Portofino A	1,35E+03	4,01E+02	0,00E+00	4,01E+02	9,23E+01	4,03E+02	1,70E+03

Portofino B	5,61E+02	3,67E+02	0,00E+00	3,67E+02	1,65E+02	2,56E+02	7,51E+02
Portofino C ovest	7,01E+02	1,34E+02	0,00E+00	1,34E+02	2,33E+01	1,38E+02	6,43E+02
Portofino C est	3,63E+02	1,89E+02	1,99E+01	1,89E+02	7,41E+01	2,11E+02	5,56E+02
Cinque Terre A Mesco	3,31E+03	2,49E+03	1,95E+02	2,49E+03	2,48E+03	1,73E+03	2,82E+03
Cinque Terre B Mesco	4,10E+03	3,25E+03	4,30E+02	3,25E+03	3,82E+03	1,97E+03	3,36E+03
Cinque Terre A Montenero	2,79E+03	1,92E+03	3,06E+02	1,92E+03	2,73E+03	1,61E+03	1,70E+03
Cinque Terre B Montenero	2,24E+03	1,73E+03	1,18E+02	1,73E+03	2,15E+03	8,49E+02	1,05E+03
Cinque Terre C	2,23E+03	1,53E+03	2,03E+02	1,53E+03	2,09E+03	1,08E+03	1,58E+03
Portovenere	1,10E+03	6,17E+02	7,42E+01	6,17E+02	7,30E+02	4,78E+02	9,27E+02

Tabella 8. Produzione primaria (gC m^{-2}) richiesta dal comparto ittico negli habitat costituiti da detrito, fanghi, roccia e sabbia

Flussi ambientali

Produzione primaria generata da autotrofi e richiesta eterotrofi

- Organismi bentonici

Macrogruppi	CYM	CYM E CAU	CYM-DENSA	CYM-MMP	CYM-POS	MMP	MOS	POS	POS E CAU	POS-ROC
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Alghe	0,00	81,19	0,00	24,63	25,26	49,27	50,51	51,76	107,07	51,76
Cymodocea	616,35	308,64	616,35	308,18	308,18	0,00	0,00	0,00	0,47	0,00
Posidonia	0,00	0,00	0,00	0,00	305,77	0,00	611,55	1223,10	611,55	1223,10
Bryozoa	0,00	0,00	0,00	0,00	0,07	0,00	1,04	2,08	0,15	2,08
Porifera	0,00	0,00	0,00	0,00	0,04	0,00	0,55	1,11	0,08	1,11
Cnidaria	0,00	0,06	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,00
Ascidiacea	0,00	0,00	0,00	0,00	2,82	0,00	39,48	78,95	5,64	78,95
Foraminifera	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Echinodermata	0,00	7,79	0,00	13,50	1,08	28,09	16,56	1,81	59,40	1,81
Crustacea	0,41	535,15	0,41	2,22	18,87	4,27	39,92	83,98	685,60	83,98
Mollusca	1,86	321,90	1,86	6,27	113,54	12,16	283,23	575,10	729,96	575,10
Anellida	0,00	7,50	0,00	10,47	1,25	22,41	18,61	14,00	63,50	14,00
Sipunculida	0,00	0,00	0,00	2,27	0,02	4,87	2,52	0,00	0,00	0,00
Various	0,01	76,44	0,01	4,44	0,30	10,59	5,03	0,00	10,91	0,00

Tabella 9. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi bentonici, negli habitat costituiti da piante marine

Macrogruppi	C	C-F	GR
	gC m^{-2}	gC m^{-2}	gC m^{-2}
Alghe	20,15	10,08	0,00
Cymodocea	0,00	0,00	0,00
Posidonia	0,00	0,00	0,00

Bryozoa	96,74	6,91	80,78
Porifera	63,22	4,52	450,64
Cnidaria	1151,30	82,24	568,67
Ascidiacea	0,00	0,00	77,90
Foraminifera	0,00	0,00	0,18
Echinodermata	0,00	0,51	0,00
Crustacea	0,00	0,13	948,64
Mollusca	0,00	4,33	298,96
Anellida	0,00	0,17	590,49
Sipunculida	0,00	0,00	0,00
Various	0,00	0,11	749,28

Tabella 10. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi bentonici, negli habitat costituiti da coralligeno e grotte

Macrogruppi	AF	AFA	AF-BR	ASC	ASI	CAU	CYL
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Alghe	95,66	95,66	95,66	60,34	52,38	162,39	162,39
Cymodocea	0,00	0,00	0,00	0,00	0,00	0,93	0,93
Posidonia	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Bryozoa	0,21	0,21	0,21	0,00	0,00	0,00	0,00
Porifera	6,27	6,27	6,27	0,00	0,00	0,00	0,00
Cnidaria	0,31	0,31	0,31	0,00	0,00	0,82	0,82
Ascidiacea	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foraminifera	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Echinodermata	0,00	0,00	0,00	1,06	2,16	150,58	150,58
Crustacea	52,81	52,81	52,81	2,59	2,91	1266,03	1266,03
Mollusca	0,00	0,00	0,00	160,03	94,04	903,00	903,00
Anellida	0,00	0,00	0,00	1,32	5,25	124,26	124,26
Sipunculida	0,00	0,00	0,00	0,03	0,24	0,00	0,00
Various	0,00	0,00	0,00	2,20	3,40	216,57	216,57

Tabella 11. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi bentonici, negli habitat costituiti da alghe

Macrogruppi	DC	DI	F	RL	S	SGC	SGC-C
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Alghe	0,00	0,00	0,00	0,00	0,00	0,00	6,72
Cymodocea	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Posidonia	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Bryozoa	0,00	0,00	0,00	0,00	0,00	0,00	2,41
Porifera	0,00	0,00	0,00	0,00	0,00	0,00	1,57
Cnidaria	0,00	0,00	0,00	0,00	0,00	0,00	28,66
Ascidiacea	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Foraminifera	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Echinodermata	1,16	5,23	9,13	5,23	1,72	0,17	0,26

Crustacea	0,72	0,91	2,13	0,91	14,65	1,52	2,40
Mollusca	0,97	5,47	76,98	5,47	49,28	4,91	7,47
Anellida	17,28	1,24	2,88	1,24	29,80	7,74	4,88
Sipunculida	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Various	2,15	1,65	1,94	1,65	2,10	0,24	0,35

Tabella 12. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi bentonici, negli habitat costituiti da detrito, fanghi, roccia e sabbia

- Fauna ittica

Zone	CYM	CYM E CAU	CYM-DENSA	CYM-MMP	CYM-POS	MMP	MOS	POS	POS E CAU	POS-ROC
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	2,68E+02	7,27E+02	2,68E+02	2,68E+02	7,27E+02	2,68E+02	7,27E+02	7,27E+02	7,27E+02	7,27E+02
Capo Mortola	3,18E+02	4,51E+02	3,18E+02	3,18E+02	3,52E+02	3,18E+02	3,86E+02	5,83E+02	5,83E+02	5,83E+02
Bergeggi A	1,34E+03	1,56E+03	1,34E+03	1,34E+03	1,37E+03	1,34E+03	1,39E+03	1,77E+03	1,77E+03	1,73E+03
Bergeggi B-Isola	1,00E+03	1,10E+03	1,00E+03	1,00E+03	1,00E+03	1,00E+03	1,00E+03	1,20E+03	1,20E+03	9,34E+02
Bergeggi B-Predani	1,00E+03	1,10E+03	1,00E+03	1,00E+03	1,00E+03	1,00E+03	1,00E+03	1,20E+03	1,20E+03	9,34E+02
Bergeggi C	3,18E+02	4,51E+02	3,18E+02	3,18E+02	3,52E+02	3,18E+02	3,86E+02	5,83E+02	5,83E+02	5,83E+02
Portofino A	4,66E+02	1,10E+03	4,66E+02	4,66E+02	5,28E+02	4,66E+02	5,90E+02	1,73E+03	1,73E+03	1,73E+03
Portofino B	1,76E+02	4,70E+02	1,76E+02	1,76E+02	1,76E+02	1,76E+02	1,76E+02	7,64E+02	7,64E+02	7,64E+02
Portofino C ovest	1,01E+02	3,69E+02	1,01E+02	1,01E+02	2,36E+02	1,01E+02	3,72E+02	6,37E+02	6,37E+02	6,37E+02
Portofino C est	1,15E+02	3,76E+02	1,15E+02	1,15E+02	1,15E+02	1,15E+02	1,15E+02	6,37E+02	6,37E+02	6,37E+02
Cinque Terre A Mesco	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03
Cinque Terre B Mesco	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,60E+03
Cinque Terre A Montenero	9,45E+02	9,45E+02	9,45E+02	9,45E+02	9,45E+02	9,45E+02	9,45E+02	9,45E+02	9,45E+02	8,25E+02
Cinque Terre B Montenero	1,10E+03	1,10E+03	1,10E+03	1,10E+03	1,10E+03	1,10E+03	1,10E+03	1,10E+03	1,10E+03	4,34E+02
Cinque Terre C	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03
Portovenere	3,18E+02	4,51E+02	3,18E+02	3,18E+02	3,52E+02	3,18E+02	3,86E+02	5,83E+02	5,83E+02	5,83E+02

Tabella 13. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi del comparto ittico, negli habitat costituiti da piante marine

Zone	C	C-F	GR
	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	7,27E+02	7,27E+02	1,89E+01
Capo Mortola	5,83E+02	3,13E+02	6,82E+01
Bergeggi A	1,73E+03	9,28E+02	2,90E+02
Bergeggi B-Isola	9,34E+02	5,38E+02	3,10E+02

Bergeggi B-Predani	9,34E+02	5,38E+02	3,10E+02
Bergeggi C	5,83E+02	3,13E+02	6,82E+01
Portofino A	1,73E+03	8,64E+02	4,80E-01
Portofino B	7,64E+02	3,82E+02	2,62E+01
Portofino C ovest	6,37E+02	3,18E+02	8,76E-01
Portofino C est	6,37E+02	3,27E+02	0,00E+00
Cinque Terre A Mesco	2,62E+03	1,39E+03	4,31E+02
Cinque Terre B Mesco	1,60E+03	9,70E+02	5,19E+02
Cinque Terre A Montenero	8,25E+02	5,31E+02	4,39E+02
Cinque Terre B Montenero	4,34E+02	2,63E+02	3,85E+02
Cinque Terre C	1,06E+03	6,07E+02	2,72E+02
Portovenere	5,83E+02	3,13E+02	6,82E+01

Tabella 14. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi del comparto ittico, negli habitat costituiti da coralligeno e grotte

Zone	AF	AFA	AF-BR	ASC	ASI	CAU	CYL
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	3,18E+02	3,18E+02	3,18E+02	7,27E+02	7,27E+02	7,27E+02	7,27E+02
Capo Mortola	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02
Bergeggi A	1,77E+03	1,77E+03	1,77E+03	1,73E+03	1,73E+03	1,77E+03	1,77E+03
Bergeggi B-Isola	1,20E+03	1,20E+03	1,20E+03	9,34E+02	9,34E+02	1,20E+03	1,20E+03
Bergeggi B-Predani	1,20E+03	1,20E+03	1,20E+03	9,34E+02	9,34E+02	1,20E+03	1,20E+03
Bergeggi C	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02
Portofino A	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03	1,73E+03
Portofino B	7,64E+02	7,64E+02	7,64E+02	7,64E+02	7,64E+02	7,64E+02	7,64E+02
Portofino C ovest	6,37E+02	6,37E+02	6,37E+02	6,37E+02	6,37E+02	6,37E+02	6,37E+02
Portofino C est	6,37E+02	6,37E+02	6,37E+02	6,37E+02	6,37E+02	6,37E+02	6,37E+02
Cinque Terre A Mesco	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03	2,62E+03
Cinque Terre B Mesco	1,73E+03	1,73E+03	1,73E+03	1,60E+03	1,60E+03	1,73E+03	1,73E+03
Cinque Terre A Montenero	9,45E+02	9,45E+02	9,45E+02	8,25E+02	8,25E+02	9,45E+02	9,45E+02
Cinque Terre B Montenero	1,10E+03	1,10E+03	1,10E+03	4,34E+02	4,34E+02	1,10E+03	1,10E+03
Cinque Terre C	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03	1,06E+03
Portovenere	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02	5,83E+02

Tabella 15. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi del comparto ittico, negli habitat costituiti da alghe

Zone	DC	DI	F	RL	S	SGC	SGC-C
	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}	gC m^{-2}
Esterno	7,27E+02	2,60E+02	0,00E+00	2,60E+02	2,02E+02	2,60E+02	7,27E+02
Capo Mortola	3,35E+02	2,66E+02	4,38E+01	2,66E+02	2,21E+02	1,99E+02	3,27E+02
Bergeggi A	9,01E+02	7,94E+02	1,30E+02	7,94E+02	7,21E+02	5,78E+02	9,60E+02
Bergeggi B-Isola	1,00E+03	1,00E+03	1,42E+02	1,00E+03	9,70E+02	4,67E+02	6,23E+02

Bergeggi B-Predani	1,00E+03	1,00E+03	1,42E+02	1,00E+03	9,70E+02	4,67E+02	6,23E+02
Bergeggi C	3,35E+02	2,66E+02	4,38E+01	2,66E+02	2,21E+02	1,99E+02	3,27E+02
Portofino A	5,90E+02	2,67E+02	0,00E+00	2,67E+02	4,95E+01	2,67E+02	7,55E+02
Portofino B	1,76E+02	1,76E+02	0,00E+00	1,76E+02	8,61E+01	1,76E+02	3,72E+02
Portofino C ovest	3,72E+02	9,71E+01	0,00E+00	9,71E+01	1,47E+01	9,71E+01	2,77E+02
Portofino C est	1,15E+02	1,15E+02	1,75E+01	1,15E+02	1,94E+01	1,15E+02	2,89E+02
Cinque Terre A Mesco	1,17E+03	1,17E+03	1,52E+02	1,17E+03	1,17E+03	6,41E+02	1,30E+03
Cinque Terre B Mesco	1,73E+03	1,73E+03	3,35E+02	1,73E+03	1,73E+03	7,92E+02	1,06E+03
Cinque Terre A Montenero	9,45E+02	9,45E+02	2,38E+02	9,45E+02	9,45E+02	8,25E+02	8,25E+02
Cinque Terre B Montenero	1,10E+03	1,10E+03	9,22E+01	1,10E+03	1,10E+03	4,34E+02	4,34E+02
Cinque Terre C	8,51E+02	8,51E+02	1,58E+02	8,51E+02	8,51E+02	5,82E+02	7,40E+02
Portovenere	3,35E+02	2,66E+02	4,38E+01	2,66E+02	2,21E+02	1,99E+02	3,27E+02

Tabella 16. Produzione primaria (gC m^{-2}) generata da autotrofi e richiesta da eterotrofi del comparto ittico, negli habitat costituiti da detrito, fanghi, roccia e sabbia

b) <u>Contabilità biofisica</u>

- Risorse naturali

Unità biomarina	Radiazione solare	Vento	Pioggia	Calore geotermico	Maree	Onde	Correnti	Potenziale chimico runoff
	J m^{-2} y	m s^{-1}	mm/anno	MW m^{-2}	m	m	m s^{-1}	J m^{-2}
1	5,22E+09	3,34E+00	8,92E+02	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
2	5,22E+09	3,34E+00	9,35E+02	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
3	5,22E+09	3,34E+00	9,19E+02	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
4	5,20E+09	3,39E+00	1,63E+03	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
5	5,19E+09	3,39E+00	8,00E+02	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
6	5,19E+09	3,39E+00	1,12E+03	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
7	5,19E+09	3,27E+00	1,17E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
8	5,19E+09	3,02E+00	1,27E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
9	5,19E+09	3,01E+00	1,20E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
10	5,12E+09	3,01E+00	1,64E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
11	5,14E+09	3,11E+00	1,82E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
12	5,16E+09	3,13E+00	2,17E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
13	5,12E+09	3,13E+00	1,87E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
14	5,08E+09	3,13E+00	1,87E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
15	5,08E+09	3,13E+00	1,87E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
16	5,08E+09	3,13E+00	1,48E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
17	5,08E+09	3,13E+00	1,65E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
18	5,08E+09	3,13E+00	1,45E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
19	5,10E+09	3,13E+00	1,44E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
20	5,12E+09	3,13E+00	1,35E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
21	5,12E+09	2,26E+00	1,24E+03	2,26E+06	1,84E-01	5,11E-01	6,30E-01	1,86E+07
22	5,12E+09	2,09E+00	1,27E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
24	5,11E+09	1,94E+00	1,39E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07

25	5,12E+09	2,09E+00	1,91E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
26	5,12E+09	1,77E+00	2,17E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
01_cm_C	5,22E+09	3,34E+00	8,92E+02	2,05E+06	1,47E-01	5,11E-01	6,30E-01	1,86E+07
09_bg_A	5,19E+09	3,01E+00	1,20E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
09_bg_B Isola	5,19E+09	3,01E+00	1,20E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
09_bg_B Predani	5,19E+09	3,01E+00	1,20E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
09_bg_C	5,19E+09	3,01E+00	1,20E+03	2,05E+06	1,48E-01	5,11E-01	6,30E-01	1,86E+07
16_pf_C ovest	5,08E+09	3,13E+00	1,65E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
17_pf_A	5,08E+09	3,13E+00	1,65E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
17_pf_B	5,08E+09	3,13E+00	1,65E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
18_pf_C est	5,08E+09	3,13E+00	1,56E+03	2,05E+06	1,49E-01	5,11E-01	6,30E-01	1,86E+07
22_ct_A Mesco	5,12E+09	2,09E+00	1,27E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
22_ct_B Mesco	5,12E+09	2,09E+00	1,27E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
22_ct_C	5,12E+09	2,09E+00	1,27E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
23_ct_A Montenero	5,12E+09	2,26E+00	1,33E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
23_ct_B Montenero	5,12E+09	2,26E+00	1,33E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
23_ct_C	5,12E+09	1,94E+00	1,33E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
24_ct_C	5,12E+09	2,26E+00	1,39E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
24_pv_C	5,12E+09	2,09E+00	1,34E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07
25_pv_C	5,12E+09	2,09E+00	1,34E+03	2,36E+06	2,02E-01	5,11E-01	6,30E-01	1,86E+07

Tabella 17. Risorse naturali utilizzate nell'applicazione dell'analisi emergetica

Capitale naturale

Unità biomarina	Carbonio	Azoto	Fosforo	Sole	Pot chimico pioggia	Vento	Corrente cinetica	Calore geotermico	Maree	Run off
	Sej	sej	sej	sej	sej	sej	sej	sej	sej	sej
1	6,83E+17	8,45E+18	4,67E+18	5,44E+16	1,45E+18	5,76E+17	5,66E+16	1,27E+18	2,42E+16	1,38E+19
2	6,02E+17	7,44E+18	4,11E+18	4,65E+16	1,30E+18	4,93E+17	4,84E+16	1,08E+18	2,07E+16	1,18E+19
3	4,33E+18	5,35E+19	2,96E+19	3,50E+17	9,59E+18	3,71E+18	3,64E+17	8,16E+18	1,56E+17	8,85E+19
4	4,34E+18	5,37E+19	2,97E+19	3,50E+17	1,71E+19	3,88E+18	3,65E+17	8,19E+18	1,56E+17	8,88E+19
5	5,21E+18	6,44E+19	3,56E+19	4,22E+17	1,01E+19	4,73E+18	4,42E+17	9,91E+18	1,89E+17	1,07E+20
6	2,97E+18	3,67E+19	2,03E+19	2,42E+17	8,09E+18	2,71E+18	2,53E+17	5,68E+18	1,09E+17	6,16E+19
7	2,85E+18	3,52E+19	1,95E+19	2,34E+17	8,23E+18	2,33E+18	2,45E+17	5,48E+18	1,06E+17	5,95E+19
8	3,61E+18	4,46E+19	2,47E+19	2,92E+17	1,11E+19	2,30E+18	3,06E+17	6,85E+18	1,32E+17	7,43E+19
9	1,06E+18	1,31E+19	7,23E+18	8,64E+16	3,09E+18	6,74E+17	9,04E+16	2,03E+18	3,90E+16	2,20E+19
10	1,33E+18	1,64E+19	9,06E+18	1,10E+17	5,46E+18	8,66E+17	1,16E+17	2,60E+18	5,01E+16	2,82E+19
11	1,24E+18	1,53E+19	8,45E+18	9,93E+16	5,49E+18	8,64E+17	1,05E+17	2,36E+18	4,54E+16	2,55E+19
12	1,43E+18	1,77E+19	9,79E+18	1,16E+17	7,59E+18	1,03E+18	1,22E+17	2,74E+18	5,31E+16	2,97E+19
13	5,86E+17	7,24E+18	4,00E+18	4,42E+16	2,51E+18	3,95E+17	4,69E+16	1,05E+18	2,04E+16	1,14E+19
14	5,60E+17	6,92E+18	3,83E+18	4,03E+16	2,31E+18	3,63E+17	4,31E+16	9,66E+17	1,88E+16	1,05E+19
15	4,45E+17	5,50E+18	3,04E+18	3,29E+16	1,88E+18	2,96E+17	3,52E+16	7,88E+17	1,53E+16	8,55E+18
16	7,81E+18	9,65E+19	5,33E+19	6,06E+17	2,75E+19	5,46E+18	6,48E+17	1,45E+19	2,82E+17	1,57E+20
17	9,52E+17	1,18E+19	6,51E+18	6,87E+16	3,47E+18	6,19E+17	7,34E+16	1,65E+18	3,20E+16	1,79E+19
18	8,26E+17	1,02E+19	5,64E+18	6,61E+16	2,94E+18	5,95E+17	7,06E+16	1,58E+18	3,08E+16	1,72E+19

19	1,29E+18	1,59E+19	8,80E+18	9,73E+16	4,28E+18	8,73E+17	1,04E+17	2,32E+18	4,52E+16	2,52E+19
20	9,28E+17	1,15E+19	6,34E+18	7,50E+16	3,07E+18	6,71E+17	7,96E+16	1,79E+18	3,47E+16	1,94E+19
21	2,14E+18	2,65E+19	1,46E+19	1,69E+17	6,35E+18	5,70E+17	1,79E+17	4,43E+18	1,20E+17	4,36E+19
22	2,13E+16	2,63E+17	1,46E+17	1,71E+15	6,62E+16	4,55E+15	1,82E+15	4,71E+16	1,46E+15	4,42E+17
24	6,41E+17	7,93E+18	4,38E+18	5,14E+16	2,17E+18	1,08E+17	5,46E+16	1,41E+18	4,39E+16	1,33E+19
25	1,25E+18	1,55E+19	8,57E+18	9,59E+16	5,56E+18	2,55E+17	1,02E+17	2,63E+18	8,19E+16	2,48E+19
26	3,69E+17	4,56E+18	2,52E+18	2,73E+16	1,80E+18	4,42E+16	2,90E+16	7,50E+17	2,33E+16	7,05E+18
01_cm_C	6,49E+17	8,02E+18	4,44E+18	5,41E+16	1,44E+18	5,72E+17	5,62E+16	1,26E+18	2,40E+16	1,37E+19
09_bg_A	1,15E+16	1,43E+17	7,89E+16	9,23E+14	3,30E+16	7,19E+15	9,65E+14	2,16E+16	4,17E+14	2,35E+17
09_bg_B Isola	3,55E+16	4,38E+17	2,42E+17	2,74E+15	9,80E+16	2,13E+16	2,86E+15	6,42E+16	1,24E+15	6,96E+17
09_bg_B Predani	7,70E+16	9,51E+17	5,26E+17	6,23E+15	2,23E+17	4,86E+16	6,52E+15	1,46E+17	2,81E+15	1,58E+18
09_bg_C	9,34E+16	1,15E+18	6,38E+17	7,77E+15	2,78E+17	6,06E+16	8,13E+15	1,82E+17	3,51E+15	1,98E+18
16_pf_C ovest	1,55E+17	1,92E+18	1,06E+18	1,40E+16	7,07E+17	1,26E+17	1,49E+16	3,35E+17	6,52E+15	3,63E+18
17_pf_A	3,08E+16	3,80E+17	2,10E+17	2,41E+15	1,22E+17	2,17E+16	2,58E+15	5,78E+16	1,12E+15	6,26E+17
17_pf_B	1,58E+17	1,95E+18	1,08E+18	1,32E+16	6,69E+17	1,19E+17	1,41E+16	3,17E+17	6,17E+15	3,44E+18
18_pf_C est	4,53E+16	5,59E+17	3,09E+17	4,24E+15	2,03E+17	3,82E+16	4,53E+15	1,02E+17	1,98E+15	1,10E+18
22_ct_A Mesco	1,89E+17	2,33E+18	1,29E+18	1,44E+16	5,56E+17	3,82E+16	1,53E+16	3,95E+17	1,23E+16	3,71E+18
22_ct_B Mesco	3,85E+17	4,76E+18	2,63E+18	2,89E+16	1,12E+18	7,68E+16	3,07E+16	7,95E+17	2,47E+16	7,47E+18
22_ct_C	1,63E+17	2,01E+18	1,11E+18	1,19E+16	4,59E+17	3,16E+16	1,26E+16	3,27E+17	1,01E+16	3,07E+18
23_ct_A Montenero	3,57E+16	4,42E+17	2,44E+17	2,73E+15	1,10E+17	9,21E+15	2,90E+15	7,50E+16	2,33E+15	7,05E+17
23_ct_B Montenero	1,84E+17	2,28E+18	1,26E+18	1,34E+16	5,43E+17	4,53E+16	1,43E+16	3,69E+17	1,15E+16	3,46E+18
23_ct_C	3,44E+18	4,25E+19	2,35E+19	2,53E+17	1,02E+19	5,33E+17	2,68E+17	6,94E+18	2,16E+17	6,52E+19
24_ct_C	3,93E+17	4,86E+18	2,69E+18	2,91E+16	1,23E+18	9,83E+16	3,09E+16	8,01E+17	2,49E+16	7,52E+18
24_pv_C	9,50E+16	1,17E+18	6,49E+17	8,35E+15	3,40E+17	2,22E+16	8,87E+15	2,29E+17	7,13E+15	2,16E+18
25_pv_C	1,02E+16	1,27E+17	7,00E+16	6,30E+14	2,57E+16	1,67E+15	6,68E+14	1,73E+16	5,37E+14	1,63E+17
Valori medi per unità biomarine	**1,25E+18**	**1,54E+19**	**8,52E+18**	**9,88E+16**	**3,98E+18**	**8,44E+17**	**1,04E+17**	**2,39E+18**	**5,09E+16**	**2,53E+19**

Tabella 18. Nutrienti e flussi naturali, convertiti in termini emergetici (sej) attraverso l'utilizzo delle UEV

Flussi ambientali

Unità biomarina	Carbonio	Azoto	Fosforo	Sole	Pot chimico pioggia	Vento	Corrente cinetica	Calore geotermico	Maree	Run off
	G	g	g	J	J	J	J	J	J	J
1	1,60E+09	2,73E+08	3,90E+07	3,03E+16	2,75E+13	1,33E+14	1,78E+09	1,28E+13	4,97E+11	1,16E+14
2	1,68E+09	2,87E+08	4,11E+07	4,53E+16	4,31E+13	1,99E+14	2,67E+09	1,91E+13	7,44E+11	1,73E+14
3	8,57E+09	1,46E+09	2,09E+08	1,02E+17	9,57E+13	4,49E+14	6,02E+09	4,31E+13	1,68E+12	3,91E+14
4	1,06E+10	1,81E+09	2,58E+08	1,99E+17	3,31E+14	9,13E+14	1,17E+10	8,41E+13	3,27E+12	7,62E+14
5	1,19E+10	2,02E+09	2,89E+08	2,01E+17	1,64E+14	9,31E+14	1,19E+10	8,52E+13	3,32E+12	7,72E+14
6	7,50E+09	1,28E+09	1,83E+08	1,55E+17	1,77E+14	7,19E+14	9,18E+09	6,58E+13	2,57E+12	5,97E+14
7	9,31E+09	1,59E+09	2,27E+08	2,49E+17	2,99E+14	1,03E+15	1,47E+10	1,06E+14	4,15E+12	9,57E+14
8	8,88E+09	1,52E+09	2,17E+08	1,72E+17	2,23E+14	5,59E+14	1,01E+10	7,27E+13	2,86E+12	6,59E+14
9	3,32E+09	5,66E+08	8,09E+07	8,61E+16	1,05E+14	2,78E+14	5,10E+09	3,65E+13	1,43E+12	3,31E+14
10	3,74E+09	6,38E+08	9,11E+07	8,89E+16	1,51E+14	2,91E+14	5,33E+09	3,82E+13	1,50E+12	3,46E+14
11	4,03E+09	6,89E+08	9,84E+07	1,14E+17	2,15E+14	4,11E+14	6,83E+09	4,89E+13	1,92E+12	4,44E+14

12	4,00E+09	6,83E+08	9,75E+07	9,62E+16	2,14E+14	3,53E+14	5,72E+09	4,10E+13	1,62E+12	3,72E+14
13	2,43E+09	4,15E+08	5,92E+07	8,09E+16	1,57E+14	3,00E+14	4,86E+09	3,48E+13	1,38E+12	3,15E+14
14	2,58E+09	4,40E+08	6,28E+07	8,81E+16	1,72E+14	3,29E+14	5,33E+09	3,82E+13	1,51E+12	3,46E+14
15	1,68E+09	2,87E+08	4,10E+07	5,05E+16	9,86E+13	1,89E+14	3,06E+09	2,19E+13	8,69E+11	1,98E+14
16	1,85E+10	3,16E+09	4,52E+08	2,84E+17	4,41E+14	1,06E+15	1,72E+10	1,23E+14	4,88E+12	1,12E+15
17	3,48E+09	5,93E+08	8,48E+07	1,00E+17	1,73E+14	3,75E+14	6,07E+09	4,35E+13	1,73E+12	3,95E+14
18	3,30E+09	5,63E+08	8,04E+07	1,03E+17	1,56E+14	3,84E+14	6,22E+09	4,46E+13	1,77E+12	4,04E+14
19	5,22E+09	8,91E+08	1,27E+08	1,73E+17	2,60E+14	6,42E+14	1,04E+10	7,45E+13	2,96E+12	6,76E+14
20	2,91E+09	4,96E+08	7,09E+07	7,57E+16	1,06E+14	2,81E+14	4,55E+09	3,26E+13	1,29E+12	2,95E+14
21	7,45E+09	1,27E+09	1,82E+08	2,15E+17	2,76E+14	3,01E+14	1,29E+10	1,02E+14	5,64E+12	8,40E+14
22	8,55E+07	1,46E+07	2,08E+06	2,86E+15	3,77E+12	3,14E+12	1,72E+08	1,42E+12	9,01E+10	1,12E+13
24	3,26E+09	5,56E+08	7,94E+07	1,18E+17	1,70E+14	1,03E+14	7,06E+09	5,84E+13	3,70E+12	4,59E+14
25	6,17E+09	1,05E+09	1,51E+08	2,22E+17	4,39E+14	2,44E+14	1,33E+10	1,10E+14	6,98E+12	8,66E+14
26	1,94E+09	3,32E+08	4,74E+07	7,06E+16	1,59E+14	4,73E+13	4,25E+09	3,51E+13	2,23E+12	2,76E+14
01_cm_C	1,48E+09	2,52E+08	3,60E+07	2,01E+16	1,82E+13	8,80E+13	1,18E+09	8,46E+12	3,29E+11	7,67E+13
09_bg_A	4,47E+07	7,63E+06	1,09E+06	7,11E+14	8,69E+11	2,30E+12	4,21E+07	3,01E+11	1,18E+10	2,73E+12
09_bg_B Isola	1,32E+08	2,26E+07	3,23E+06	2,10E+15	2,57E+12	6,79E+12	1,24E+08	8,91E+11	3,50E+10	8,08E+12
09_bg_B Predani	2,51E+08	4,28E+07	6,12E+06	3,42E+15	4,18E+12	1,11E+13	2,02E+08	1,45E+12	5,70E+10	1,32E+13
09_bg_C	2,94E+08	5,01E+07	7,16E+06	7,32E+15	8,95E+12	2,37E+13	4,33E+08	3,10E+12	1,22E+11	2,81E+13
16_pf_C ovest	4,24E+08	7,25E+07	1,04E+07	3,80E+15	6,56E+12	1,42E+13	2,30E+08	1,65E+12	6,54E+10	1,49E+13
17_pf_A	1,24E+08	2,11E+07	3,01E+06	1,90E+15	3,29E+12	7,10E+12	1,15E+08	8,25E+11	3,27E+10	7,48E+12
17_pf_B	5,87E+08	1,00E+08	1,43E+07	1,24E+16	2,13E+13	4,61E+13	7,47E+08	5,35E+12	2,13E+11	4,85E+13
18_pf_C est	1,79E+08	3,05E+07	4,36E+06	3,52E+15	5,76E+12	1,31E+13	2,13E+08	1,53E+12	6,06E+10	1,38E+13
22_ct_A Mesco	7,78E+08	1,33E+08	1,90E+07	1,21E+16	1,60E+13	1,34E+13	7,30E+08	6,03E+12	3,82E+11	4,74E+13
22_ct_B Mesco	1,16E+09	1,98E+08	2,82E+07	1,48E+16	1,95E+13	1,63E+13	8,90E+08	7,35E+12	4,66E+11	5,78E+13
22_ct_C	8,45E+08	1,44E+08	2,06E+07	2,60E+16	3,43E+13	2,86E+13	1,56E+09	1,29E+13	8,19E+11	1,01E+14
23_ct_A Montenero	1,25E+08	2,14E+07	3,06E+06	2,11E+15	2,92E+12	2,95E+12	1,27E+08	1,05E+12	6,65E+10	8,24E+12
23_ct_B Montenero	8,72E+08	1,49E+08	2,13E+07	1,50E+16	2,08E+13	2,10E+13	9,04E+08	7,47E+12	4,74E+11	5,87E+13
23_ct_C	1,44E+10	2,46E+09	3,51E+08	3,07E+17	4,23E+14	2,68E+14	1,84E+10	1,52E+14	9,65E+12	1,20E+15
24_ct_C	1,72E+09	2,94E+08	4,20E+07	4,20E+16	6,05E+13	5,86E+13	2,52E+09	2,08E+13	1,32E+12	1,64E+14
24_pv_C	3,22E+08	5,49E+07	7,85E+06	7,47E+15	1,04E+13	8,22E+12	4,49E+08	3,71E+12	2,35E+11	2,92E+13
25_pv_C	1,68E+07	2,86E+06	4,09E+05	2,33E+14	3,24E+11	2,56E+11	1,40E+07	1,16E+11	7,34E+09	9,10E+11

Tabella 19. Nutrienti (g) assimilati e flussi naturali (J) che supportano la produzione di biomassa

Unità biomarina	Carbonio	Azoto	Fosforo	Sole	Pot chimico pioggia	Vento	Corrente cinetica	Calore geotermico	Maree	Run off
	Sej	sej	sej	sej	sej	sej	sej	sej	sej	sej
1	1,63E+17	2,02E+18	1,12E+18	3,03E+16	8,05E+17	3,21E+17	3,15E+16	7,06E+17	1,35E+16	7,66E+18
2	1,72E+17	2,13E+18	1,18E+18	4,53E+16	1,26E+18	4,8E+17	4,71E+16	1,06E+18	2,01E+16	1,15E+19
3	8,77E+17	1,08E+19	5,99E+18	1,02E+17	2,8E+18	1,08E+18	1,06E+17	2,39E+18	4,55E+16	2,59E+19
4	1,08E+18	1,34E+19	7,4E+18	1,99E+17	9,68E+18	2,2E+18	2,07E+17	4,65E+18	8,87E+16	5,04E+19
5	1,21E+18	1,5E+19	8,28E+18	2,01E+17	4,81E+18	2,25E+18	2,1E+17	4,71E+18	8,98E+16	5,11E+19
6	7,67E+17	9,48E+18	5,24E+18	1,55E+17	5,18E+18	1,74E+18	1,62E+17	3,64E+18	6,97E+16	3,95E+19

7	9,52E+17	1,18E+19	6,5E+18	2,49E+17	8,76E+18	2,48E+18	2,6E+17	5,84E+18	1,12E+17	6,33E+19
8	9,08E+17	1,12E+19	6,2E+18	1,72E+17	6,54E+18	1,35E+18	1,79E+17	4,02E+18	7,74E+16	4,36E+19
9	3,39E+17	4,19E+18	2,32E+18	8,61E+16	3,08E+18	6,72E+17	9E+16	2,02E+18	3,89E+16	2,19E+19
10	3,82E+17	4,72E+18	2,61E+18	8,89E+16	4,43E+18	7,03E+17	9,42E+16	2,11E+18	4,07E+16	2,29E+19
11	4,12E+17	5,1E+18	2,82E+18	1,14E+17	6,31E+18	9,93E+17	1,21E+17	2,71E+18	5,21E+16	2,93E+19
12	4,09E+17	5,05E+18	2,79E+18	9,62E+16	6,28E+18	8,52E+17	1,01E+17	2,27E+18	4,4E+16	2,46E+19
13	2,48E+17	3,07E+18	1,7E+18	8,09E+16	4,59E+18	7,23E+17	8,58E+16	1,92E+18	3,74E+16	2,09E+19
14	2,63E+17	3,25E+18	1,8E+18	8,81E+16	5,04E+18	7,93E+17	9,41E+16	2,11E+18	4,11E+16	2,29E+19
15	1,72E+17	2,12E+18	1,17E+18	5,05E+16	2,89E+18	4,55E+17	5,4E+16	1,21E+18	2,35E+16	1,31E+19
16	1,9E+18	2,34E+19	1,29E+19	2,84E+17	1,29E+19	2,56E+18	3,03E+17	6,8E+18	1,32E+17	7,38E+19
17	3,55E+17	4,39E+18	2,43E+18	1E+17	5,07E+18	9,04E+17	1,07E+17	2,41E+18	4,68E+16	2,61E+19
18	3,37E+17	4,17E+18	2,3E+18	1,03E+17	4,58E+18	9,27E+17	1,1E+17	2,47E+18	4,8E+16	2,67E+19
19	5,34E+17	6,6E+18	3,65E+18	1,73E+17	7,6E+18	1,55E+18	1,84E+17	4,12E+18	8,01E+16	4,47E+19
20	2,97E+17	3,67E+18	2,03E+18	7,57E+16	3,1E+18	6,77E+17	8,03E+16	1,8E+18	3,5E+16	1,95E+19
21	7,62E+17	9,41E+18	5,2E+18	2,15E+17	8,09E+18	7,26E+17	2,28E+17	5,65E+18	1,53E+17	5,55E+19
22	8,74E+15	1,08E+17	5,97E+16	2,86E+15	1,1E+17	7,59E+15	3,04E+15	7,85E+16	2,44E+15	7,38E+17
24	3,33E+17	4,12E+18	2,28E+18	1,18E+17	4,97E+18	2,48E+17	1,25E+17	3,23E+18	1E+17	3,03E+19
25	6,31E+17	7,8E+18	4,31E+18	2,22E+17	1,29E+19	5,89E+17	2,35E+17	6,09E+18	1,89E+17	5,72E+19
26	1,99E+17	2,45E+18	1,36E+18	7,06E+16	4,65E+18	1,14E+17	7,5E+16	1,94E+18	6,03E+16	1,82E+19
01_cm_C	1,51E+17	1,87E+18	1,03E+18	2,01E+16	5,33E+17	2,12E+17	2,09E+16	4,68E+17	8,92E+15	5,07E+18
09_bg_A	4,57E+15	5,65E+16	3,12E+16	7,11E+14	2,54E+16	5,55E+15	7,43E+14	1,67E+16	3,21E+14	1,81E+17
09_bg_B Isola	1,35E+16	1,67E+17	9,24E+16	2,1E+15	7,52E+16	1,64E+16	2,2E+15	4,93E+16	9,49E+14	5,34E+17
09_bg_B Predani	2,56E+16	3,17E+17	1,75E+17	3,42E+15	1,22E+17	2,67E+16	3,58E+15	8,02E+16	1,54E+15	8,7E+17
09_bg_C	3E+16	3,71E+17	2,05E+17	7,32E+15	2,62E+17	5,71E+16	7,65E+15	1,72E+17	3,31E+15	1,86E+18
16_pf_C ovest	4,34E+16	5,36E+17	2,96E+17	3,8E+15	1,92E+17	3,42E+16	4,06E+15	9,11E+16	1,77E+15	9,88E+17
17_pf_A	1,26E+16	1,56E+17	8,63E+16	1,9E+15	9,62E+16	1,71E+16	2,03E+15	4,56E+16	8,87E+14	4,95E+17
17_pf_B	6E+16	7,41E+17	4,1E+17	1,24E+16	6,24E+17	1,11E+17	1,32E+16	2,96E+17	5,76E+15	3,21E+18
18_pf_C est	1,83E+16	2,26E+17	1,25E+17	3,52E+15	1,69E+17	3,17E+16	3,77E+15	8,44E+16	1,64E+15	9,15E+17
22_ct_A Mesco	7,95E+16	9,83E+17	5,43E+17	1,21E+16	4,69E+17	3,22E+16	1,29E+16	3,33E+17	1,04E+16	3,13E+18
22_ct_B Mesco	1,18E+17	1,46E+18	8,09E+17	1,48E+16	5,72E+17	3,93E+16	1,57E+16	4,07E+17	1,26E+16	3,82E+18
22_ct_C	8,64E+16	1,07E+18	5,9E+17	2,6E+16	1E+18	6,9E+16	2,76E+16	7,14E+17	2,22E+16	6,71E+18
23_ct_A Montenero	1,28E+16	1,59E+17	8,77E+16	2,11E+15	8,54E+16	7,12E+15	2,24E+15	5,8E+16	1,8E+15	5,45E+17
23_ct_B Montenero	8,92E+16	1,1E+18	6,09E+17	1,5E+16	6,08E+17	5,07E+16	1,6E+16	4,13E+17	1,28E+16	3,88E+18
23_ct_C	1,47E+18	1,82E+19	1,01E+19	3,07E+17	1,24E+19	6,46E+17	3,25E+17	8,42E+18	2,62E+17	7,91E+19
24_ct_C	1,76E+17	2,17E+18	1,2E+18	4,2E+16	1,77E+18	1,41E+17	4,45E+16	1,15E+18	3,58E+16	1,08E+19
24_pv_C	3,29E+16	4,07E+17	2,25E+17	7,47E+15	3,05E+17	1,98E+16	7,93E+15	2,05E+17	6,38E+15	1,93E+18
25_pv_C	1,72E+15	2,12E+16	1,17E+16	2,33E+14	9,5E+15	6,19E+14	2,47E+14	6,4E+15	1,99E+14	6,02E+16
Valori medi per unità biomarine	**3,75E+17**	**4,64E+18**	**2,56E+18**	**8,38E+16**	**3,62E+18**	**6,26E+17**	**8,85E+16**	**2,07E+18**	**4,72E+16**	**2,15E+19**

Tabella 20. Nutrienti e flussi naturali convertiti in termini emergetici (sej)

Appendice 3: Script in R utilizzato per l'analisi di dipendenza (Random Forest)

#apertura del pacchetto Random Forest in R

```
library(randomForest)
```

#apertura file di lavoro

```
cnforz<-read.table("cnvsforzanti.csv",sep=";",header=TRUE,dec=",")
str(cnforz)
```

*#Applicazione dell'analisi di regressione tra il valore di **capitale naturale** calcolato (cn_em_emeurom2) e le forzanti selezionate*

```
reg_cap=randomForest(cn_em_emeurom2~temp+d_perc+m_perc+rock_perc+sand_perc+gravel_
perc+artificial_perc+rad_solare+pioggia+maree+vento+onde+correnti+incid_frane_unita+esp_me
dia+lat4326+long4326+densita_pop_unita+dens_alberghi+dens_bnb+dens_campeggi+dens_rifugi
+dens_tot_strut_ricettive+dens_n_imp_maricoltura+dens_n_imp_mitilicoltura+dens_n_bar_ripop
_ittico+dens_n_imp_pesca+dens_n_tot_imp+percarea_imp_maricoltura+percarea_imp_mitilicolt
ura+percarea_bar_ripop_ittico+percarea_imp_pesca+percdensita_area_tot_imp+dens_scarichi_u
nita+dens_condotteconscarico+densita_condotteconscarico_S+densita_condotteconscarico_N+de
ns_parallela+dens_aderente+dens_pennello+dens_setto+dens_isola+dens_tot_opdifesa+dens_sa
cchi+dens_massi+dens_calcestruzzo+dens_mista+dens_sommersa+dens_emersa+dens_secca+de
ns_grotta+dens_relitto+dens_non_specificato+dens_tot_im+perc_area_divanc+perc_area_divpe+
perc_sic_mar+incid_sic_ter+perc_rip+perc_lincosta_spiagge+perc_texurb_cont_den+perc_texurb
_cont_meddens+perc_texurb_disc_meddens+perc_texurb_disc_sp+perc_indust_artig+perc_tot_t
ex_urb+perc_tot_texurbindustr+perc_fer,importance=TRUE,ntree=1500,data=cnforz,na.action
=na.roughfix)
print(reg_cap)
varImpPlot(reg_cap)
partialPlot(reg_cap,cnforz,forzanti utilizzate)
```

#Analisi degli errori

```
reg_cap$predicted
plot(cnforz$cn_em_emeurom2,reg_cap$predicted)
errore=cnforz$cn_em_emeurom2-reg_cap$predicted
plot(cnforz$cn_em_emeurom2,errore)
identify(cnforz$cn_em_emeurom2,errore)
```

cnforz$unita_biom[no unità in cui presente l'errore]

#Sviluppo delle predizioni per i quattro scenari

Scenario 1:

```
nat<-read.table("cnforz_nat.csv",sep=";",header=TRUE,dec=",")
pred<-predict(reg_cap,nat)
write.table(pred, file="nat_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)
```

Scenario 2:

```
nat_antr<-read.table("cnforz_nat+antr.csv",sep=";",header=TRUE,dec=",")
pred<-predict(reg_cap,nat_antr)
write.table(pred, file="nat+antr_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)
```

Scenario 3:

```
nat_antrneg<-read.table("cnforz_nat+antr_neg.csv",sep=";",header=TRUE,dec=",")
pred<-predict(reg_cap,nat_antrneg)
write.table(pred, file="nat+antrneg_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)
```

Scenario 4:

```
nat_antrpos<-read.table("cnforz_nat+antr_pos.csv",sep=";",header=TRUE,dec=",")
pred<-predict(reg_cap,nat_antrpos)
write.table(pred, file="nat+antrpos_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)
```

*# Applicazione dell'analisi di regressione tra il valore di **flussi ambientali** calcolato (fl_em_emeurom2) e le forzanti selezionate*

```
reg_flu=randomForest(fl_em_emeurom2~temp+d_perc+m_perc+rock_perc+sand_perc+gravel_perc+artificial_perc+rad_solare+pioggia+maree+vento+onde+correnti+incid_frane_unita+esp_media+lat4326+long4326+densita_pop_unita+dens_alberghi+dens_bnb+dens_campeggi+dens_rifugi+dens_tot_strut_ricettive+dens_n_imp_maricoltura+dens_n_imp_mitilicoltura+dens_n_bar_ripop_itticco+dens_n_imp_pesca+dens_n_tot_imp+percarea_imp_maricoltura+percarea_imp_mitilicoltura+percarea_bar_ripop_ittico+percarea_imp_pesca+percdensita_area_tot_imp+dens_scarichi_unita+dens_condotteconscarico+densita_condotteconscarico_S+densita_condotteconscarico_N+dens_p
```

arallela+dens_aderente+dens_pennello+dens_setto+dens_isola+dens_tot_opdifesa+dens_sacchi+dens_massi+dens_calcestruzzo+dens_mista+dens_sommersa+dens_emersa+dens_secca+dens_grotta+dens_relitto+dens_non_specificato+dens_tot_im+perc_area_divanc+perc_area_divpe+perc_sic_mar+incid_sic_ter+perc_rip+perc_lincosta_spiagge+perc_texurb_cont_den+perc_texurb_cont_meddens+perc_texurb_disc_meddens+perc_texurb_disc_sp+perc_indust_artig+perc_tot_tex_urb+perc_tot_texurbindustr+perc_fer,importance=TRUE,ntree=1500,data=cnforz,na.action=na.roughfix)

print(reg_flu)

varImpPlot(reg_flu)

partialPlot(reg_flu,cnforz, forzanti utilizzate)

#Analisi degli errori

reg_flu$predicted

plot(cnforz$cn_em_emeurom2,reg_flu$predicted)

errore=cnforz$cn_em_emeurom2-reg_flu$predicted

plot(cnforz$cn_em_emeurom2,errore)

identify(cnforz$cn_em_emeurom2,errore)

cnforz$unita_biom[no unità in cui presente l'errore]

#Sviluppo delle predizioni per i quattro scenari

Scenario 1:

nat<-read.table("cnforz_nat.csv",sep=";",header=TRUE,dec=",")

pred<-predict(reg_flu,nat)

write.table(pred, file="nat_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)

Scenario 2:

nat_antr<-read.table("cnforz_nat+antr.csv",sep=";",header=TRUE,dec=",")

pred<-predict(reg_ flu,nat_antr)

write.table(pred, file="nat+antr_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)

Scenario 3:

nat_antrneg<-read.table("cnforz_nat+antr_neg.csv",sep=";",header=TRUE,dec=",")

pred<-predict(reg_ flu,nat_antrneg)

write.table(pred, file="nat+antrneg_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)

Scenario 4:

nat_antrpos<-read.table("cnforz_nat+antr_pos.csv",sep=";",header=TRUE,dec=",")

pred<-predict(reg_ flu,nat_antrpos)

write.table(pred, file="nat+antrpos_pred.csv", quote=F, sep=";", dec=",", na="", row.names=T, col.names=T)

Appendice 4: Questionario somministrato ad esperti per la valutazione dell'influenza delle forzanti

Quanto il capitale naturale marino della Liguria dipende da variabili presenti lungo costa?

Nel Primo Rapporto nel 2017, il Capitale Naturale è stato definito come: "l'intero stock di asset naturali (organismi viventi, aria, acqua, suolo e risorse geologiche) che contribuiscono a fornire beni e servizi di valore, diretto o indiretto, per l'uomo e che sono necessari per la sopravvivenza dell'ambiente stesso da cui sono generati". Dai processi naturali di interazione degli asset del capitale naturale all'interno degli ecosistemi si ottengono, dunque, flussi di servizi ecosistemici che contribuiscono al benessere dell'uomo e al mantenimento delle sue attività.
Tuttavia, a causa dell'interazione tra sistema socio-economico e sistema ambientale spesso si verificano alcune pressioni sugli ecosistemi che possono comportare variazioni sullo stato di conservazione del capitale naturale.
Lo scopo dello studio che sto attualmente realizzando è una valutazione della distribuzione spaziale del valore di capitale naturale marino costiero della Liguria, con lo scopo di analizzare le relazioni che intercorrono tra tale distribuzione e alcune variabili che possono influenzare la capacità del sistema naturale di stoccare capitale e fornire servizi.
A tal fine, attraverso il questionario proposto qui di seguito, vi chiedo di dedicare pochi minuti ad un'indagine che sarà funzionale per definire in quale modo le variabili riportate in elenco possano influenzare il valore del capitale naturale (influenza positiva o negativa) e con quale intensità (espressa mediante un punteggio da 1 a 7) condizionino la distribuzione di tale valore lungo la fascia costiera ligure.
Grazie per la collaborazione!

*Campo obbligatorio

1. Età

2. Genere

Contrassegna solo un ovale.

- ◯ Maschio
- ◯ Femmina

3. Specificare il ruolo ricoperto all'interno dell'università o presso altri enti.

Contrassegna solo un ovale.

- ◯ Personale docente (Ordinario, Associato, Ricercatore)
- ◯ Personale tecnico-amministrativo
- ◯ Personale non strutturato (Assegnista, Borsista, ecc.)
- ◯ Studente (Triennale, Specialistica, Master, Dottorato, ecc.)
- ◯ Dipendente presso Aree Protette
- ◯ Dipendente presso ente Regionale
- ◯ Altro:

4. Indicare se le seguenti variabili influenzino positivamente o negativamente il capitale naturale marino costiero. *

Contrassegna solo un ovale per riga.

	Positiva	Negativa
ferrovie lungo costa	◯	◯
divieti di ancoraggio	◯	◯
aree soggette a frane	◯	◯
temperatura dell'acqua	◯	◯
impianti di maricoltura	◯	◯
impianti di mitilicoltura	◯	◯
impianti di pesca	◯	◯
barriere di ripopolamento ittico	◯	◯
presenza di fondi duri	◯	◯
presenza di fondi molli	◯	◯
presenza di coste rocciose	◯	◯
presenza di coste sabbiose	◯	◯
presenza di coste ciottolose	◯	◯
intensità della radiazione solare	◯	◯
tessuto urbano residenziale continuo e denso	◯	◯
tessuto urbano residenziale continuo e mediamente denso	◯	◯
tessuto urbano residenziale discontinuo e mediamente denso	◯	◯
tessuto urbano residenziale discontinuo e sparso (case sparse)	◯	◯
aree industriali e artigianali	◯	◯
alberghi/ostelli/locande	◯	◯

bed & breakfast	○	○
campeggi/villaggi	○	○
rifugi escursionistici	○	○
quantità di pioggia caduta durante l'anno	○	○
opere di difesa parallele a costa	○	○
opere di difesa aderenti a costa	○	○
opere di difesa a pennello	○	○
opere di difesa a setto	○	○
opere di difesa sommerse	○	○
opere di difesa a isola	○	○
opere di difesa emerse	○	○
opere di difesa realizzate con sacchi	○	○
opere di difesa realizzate con massi	○	○
opere di difesa realizzate con calcestruzzo	○	○
opere di difesa realizzate con materiale misto	○	○
spiagge balneabili	○	○
intensità del vento	○	○
correnti	○	○
popolazione costiera	○	○
ripascimenti	○	○
SIC marini	○	○
SIC terrestri	○	○
attività subacquea su secche	○	○
attività subacquea in grotte	○	○
attività subacquea su relitto	○	○

esposizione dei versanti	○	○
latitudine	○	○
longitudine	○	○
fenomeni di maree	○	○
presenza di coste artificiali	○	○
scarichi costieri e fluviali	○	○
condotte con scarico a mare	○	○
divieti di pesca	○	○
moto ondoso	○	○

5. Sulla base delle risposte date precedentemente indicare, attraverso un punteggio da 1 (molto basso) a 7 (molto alto), quanto una variabile influenzi il capitale naturale marino costiero (es. la presenza di un porto turistico potrebbe influenzare negativamente il capitale marino costiero con intensità 6). *

Contrassegna solo un ovale per riga.

	1	2	3	4	5	6	7
ferrovie lungo costa	◯	◯	◯	◯	◯	◯	◯
divieti di ancoraggio	◯	◯	◯	◯	◯	◯	◯
aree soggette a frane	◯	◯	◯	◯	◯	◯	◯
temperatura dell'acqua	◯	◯	◯	◯	◯	◯	◯
impianti di maricoltura	◯	◯	◯	◯	◯	◯	◯
impianti di mitilicoltura	◯	◯	◯	◯	◯	◯	◯
impianti di pesca	◯	◯	◯	◯	◯	◯	◯
barriere di ripopolamento ittico	◯	◯	◯	◯	◯	◯	◯
presenza di fondi duri	◯	◯	◯	◯	◯	◯	◯
presenza di fondi molli	◯	◯	◯	◯	◯	◯	◯
presenza di coste rocciose	◯	◯	◯	◯	◯	◯	◯
presenza di coste sabbiose	◯	◯	◯	◯	◯	◯	◯
presenza di coste ciottolose	◯	◯	◯	◯	◯	◯	◯
intensità della radiazione solare	◯	◯	◯	◯	◯	◯	◯
tessuto urbano residenziale continuo e denso	◯	◯	◯	◯	◯	◯	◯
tessuto urbano residenziale continuo e mediamente denso	◯	◯	◯	◯	◯	◯	◯
tessuto urbano	◯	◯	◯	◯	◯	◯	◯

residenziale discontinuo e mediamente denso							
tessuto urbano residenziale discontinuo e sparso (case sparse)	○	○	○	○	○	○	○
aree industriali e artigianali	○	○	○	○	○	○	○
alberghi/ostelli/locande	○	○	○	○	○	○	○
bed & breakfast	○	○	○	○	○	○	○
campeggi/villaggi	○	○	○	○	○	○	○
rifugi escursionistici	○	○	○	○	○	○	○
quantità di pioggia caduta durante l'anno	○	○	○	○	○	○	○
opere di difesa parallele a costa	○	○	○	○	○	○	○
opere di difesa aderenti a costa	○	○	○	○	○	○	○
opere di difesa a pennello	○	○	○	○	○	○	○
opere di difesa a setto	○	○	○	○	○	○	○
opere di difesa sommerse	○	○	○	○	○	○	○
opere di difesa a isola	○	○	○	○	○	○	○
opere di difesa emerse	○	○	○	○	○	○	○
opere di difesa realizzate con sacchi	○	○	○	○	○	○	○
opere di difesa realizzate con massi	○	○	○	○	○	○	○
opere di difesa realizzate con calcestruzzo	○	○	○	○	○	○	○

opere di difesa realizzate con materiale misto	○	○	○	○	○	○	○
spiagge balneabili	○	○	○	○	○	○	○
intensità del vento	○	○	○	○	○	○	○
correnti	○	○	○	○	○	○	○
popolazione costiera	○	○	○	○	○	○	○
ripascimenti	○	○	○	○	○	○	○
SIC marini	○	○	○	○	○	○	○
SIC terrestri	○	○	○	○	○	○	○
attività subacquea su secche	○	○	○	○	○	○	○
attività subacquea in grotte	○	○	○	○	○	○	○
attività subacquea su relitto	○	○	○	○	○	○	○
esposizione dei versanti	○	○	○	○	○	○	○
latitudine	○	○	○	○	○	○	○
longitudine	○	○	○	○	○	○	○
fenomeni di maree	○	○	○	○	○	○	○
presenza di coste artificiali	○	○	○	○	○	○	○
scarichi costieri e fluviali	○	○	○	○	○	○	○
condotte con scarico a mare	○	○	○	○	○	○	○
divieti di pesca	○	○	○	○	○	○	○
moto ondoso	○	○	○	○	○	○	○