

Guida ai suoli e ai terroir del Sangiovese nelle aziende della Summer school 2019

Podere Forte e Azienda Banfi

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fondazione banfi

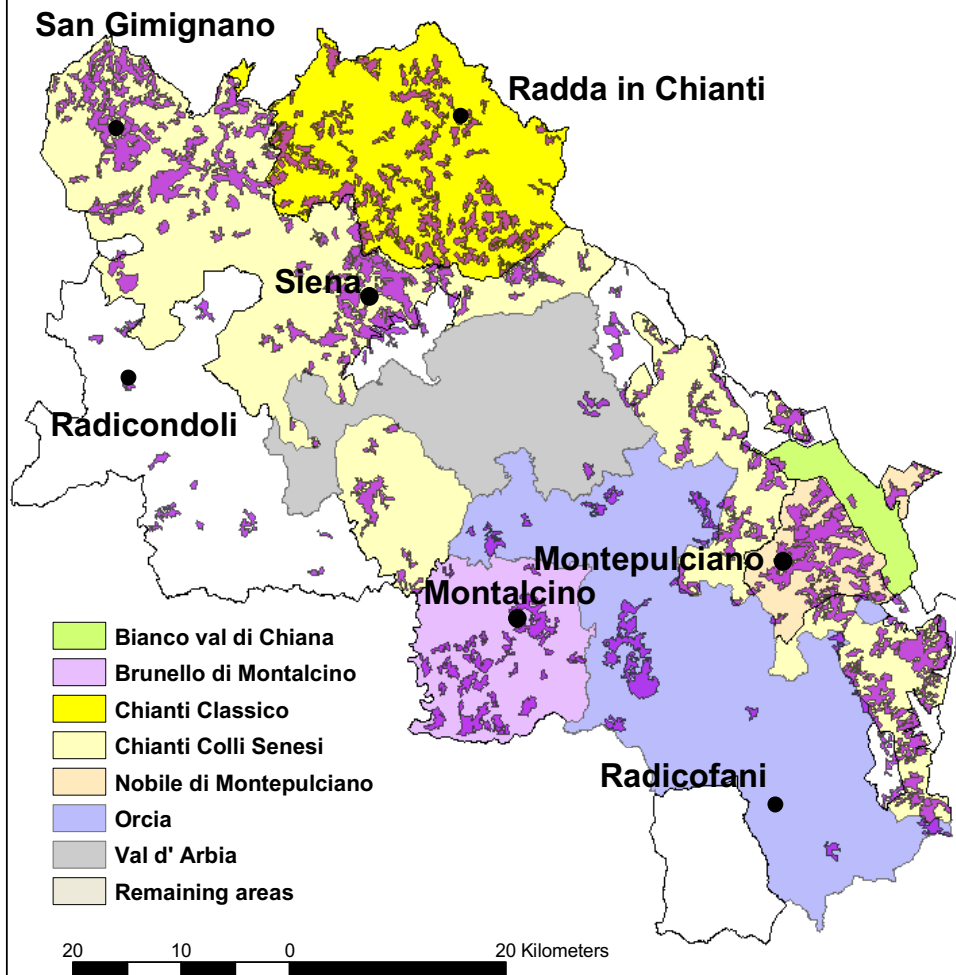
SANGUIS JOVIS
ALTA SCUOLA DEL SANGIOVESE

La provincia di Siena e i suoi vigneti

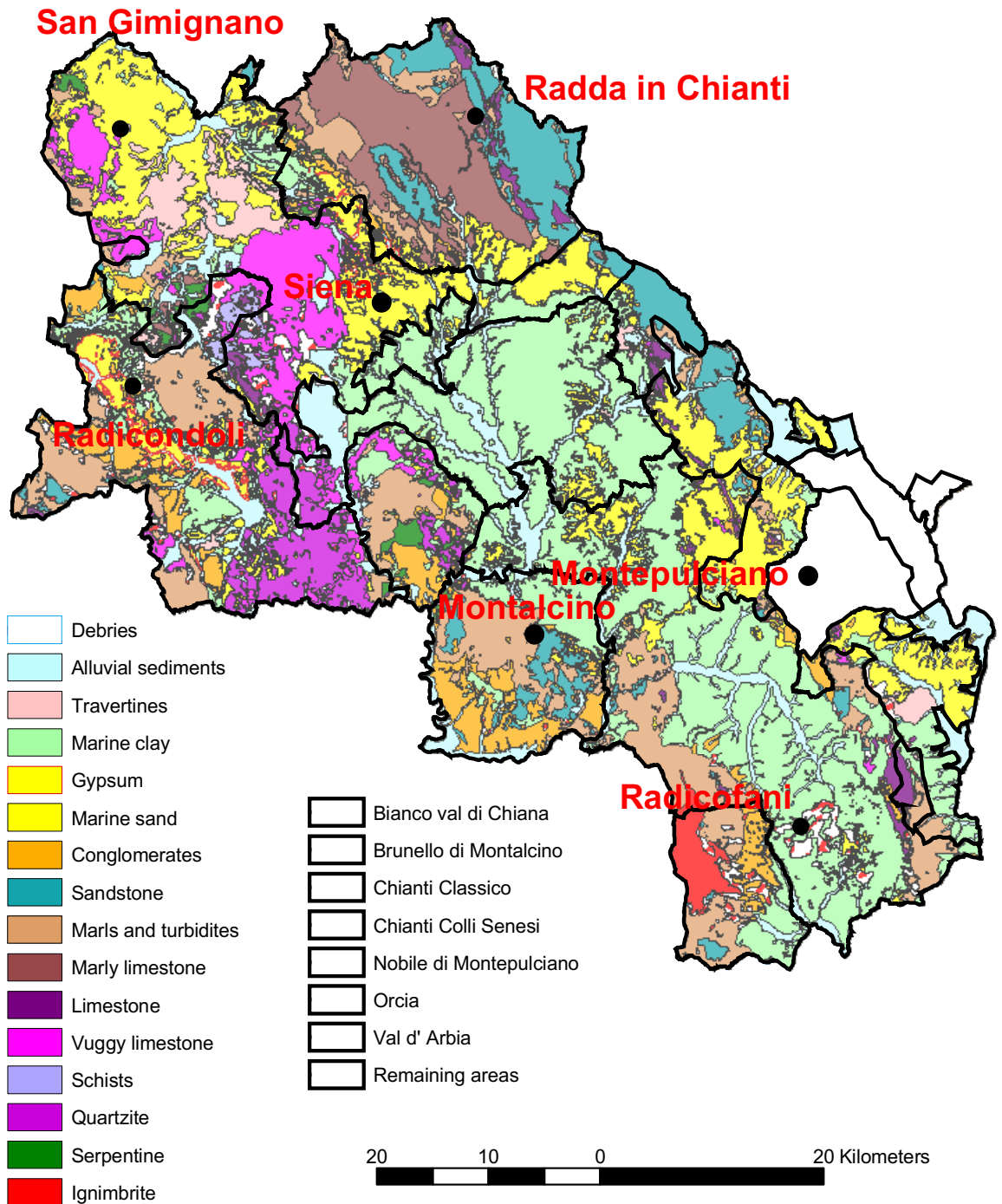


Vigneti specializzati: 14,410 ha
Aree con vigneti: 44,790 ha

**8 ACV: Chianti Classico,
Montepulciano,
Montalcino,
Chianti Colli Senesi,
Val d'Arbia,
Orcia,
Val di Chiana,
Rimanenti aree non DOC**



Geologia della provincia di Siena

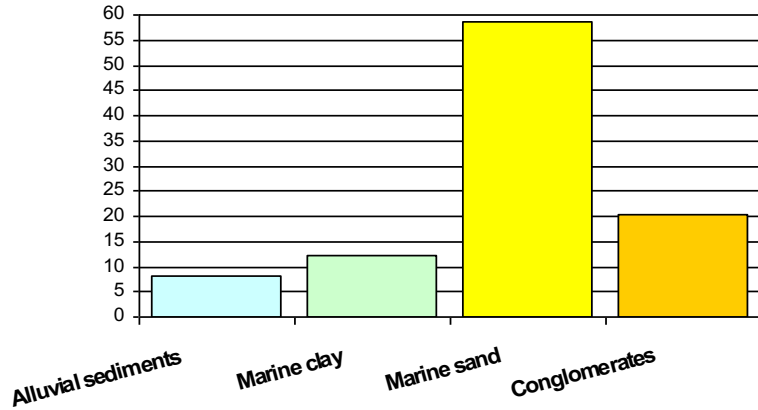


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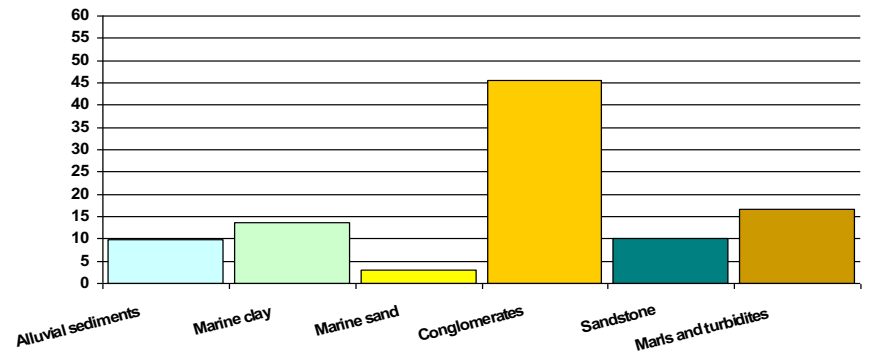
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Geologia dei vigneti

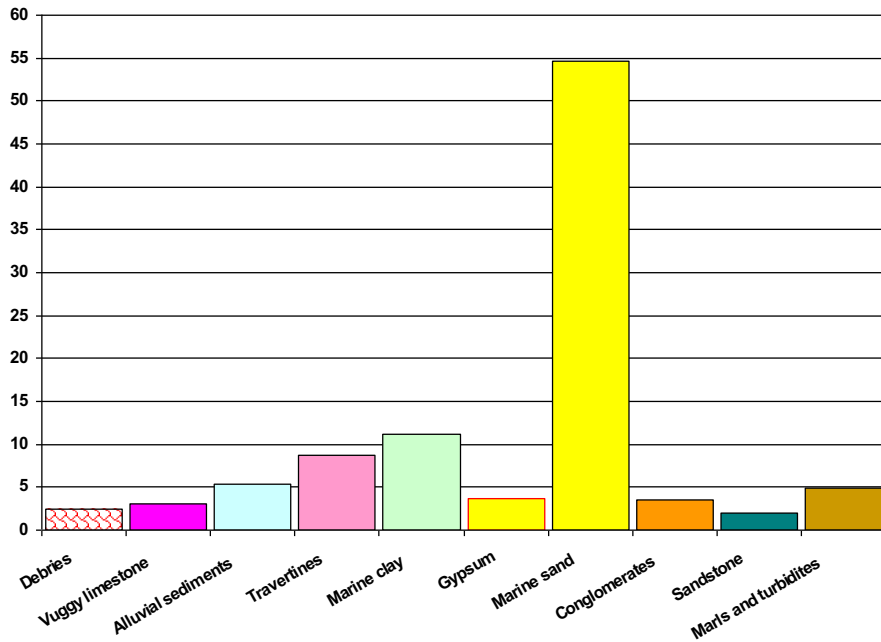
Nobile di Montepulciano



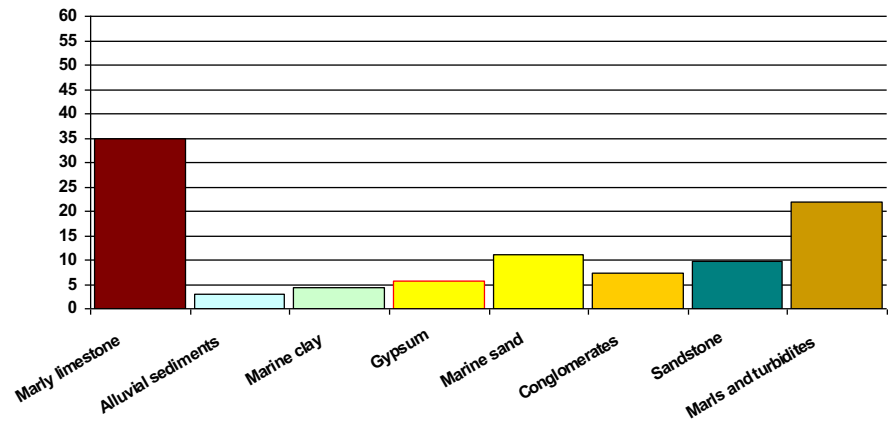
Brunello di Montalcino



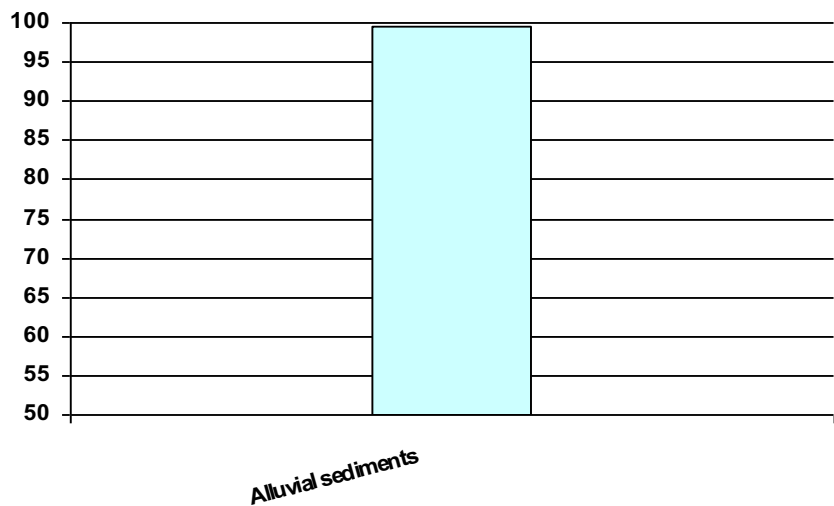
Chianti Colli Senesi



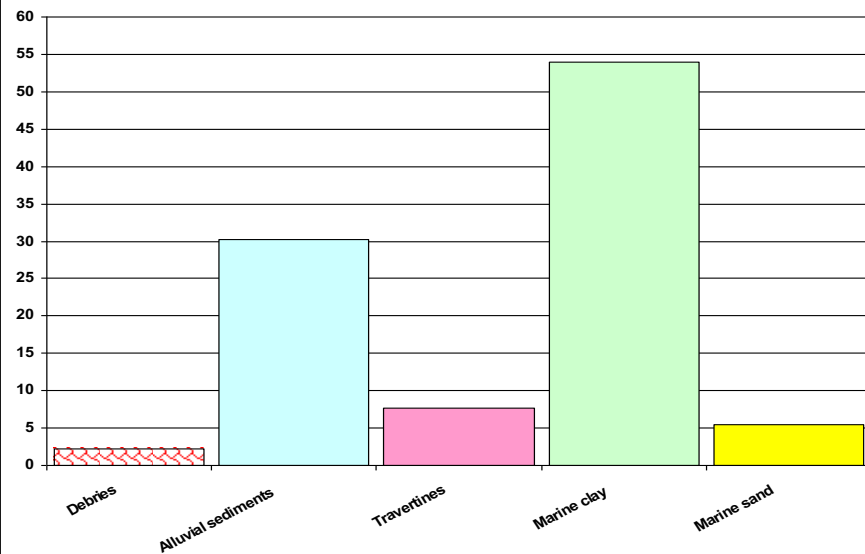
Chianti Classico



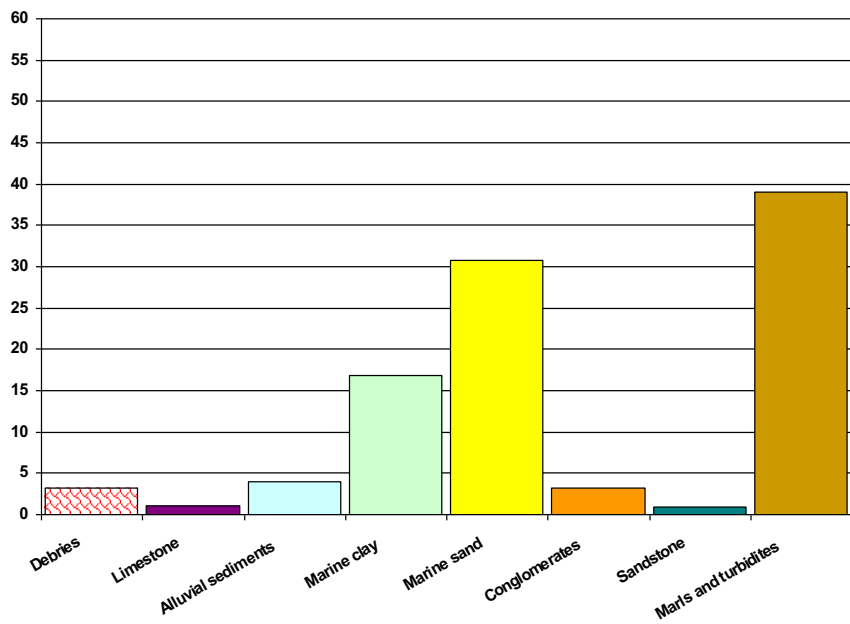
Val di Chiana



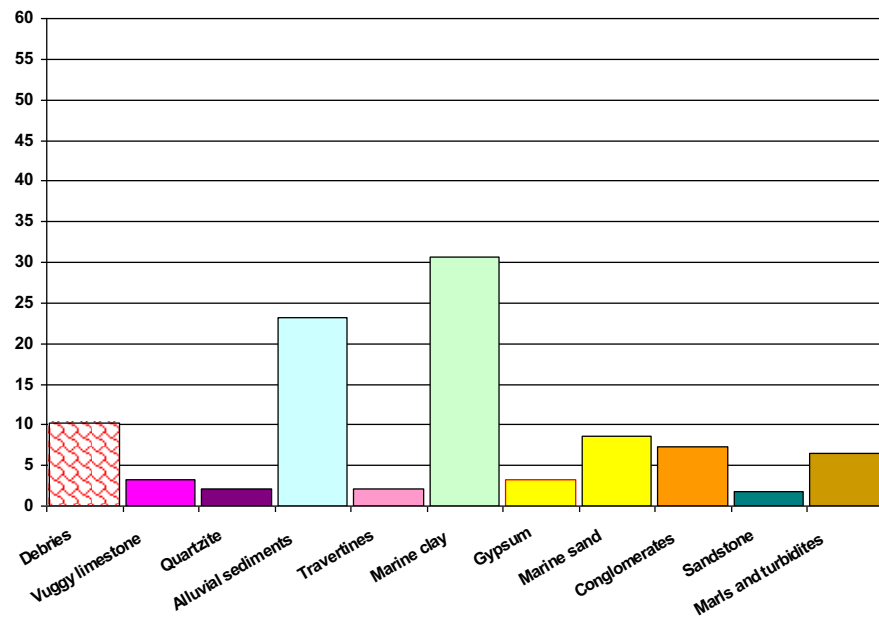
Val d'Arbia



Orcia



Not DOC areas



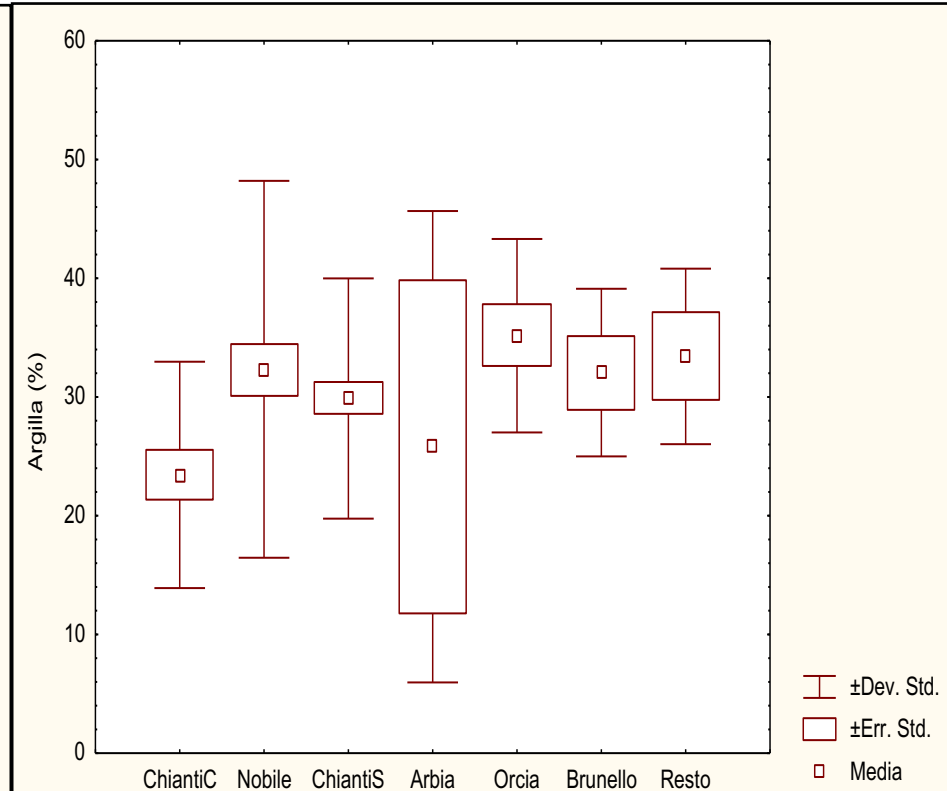
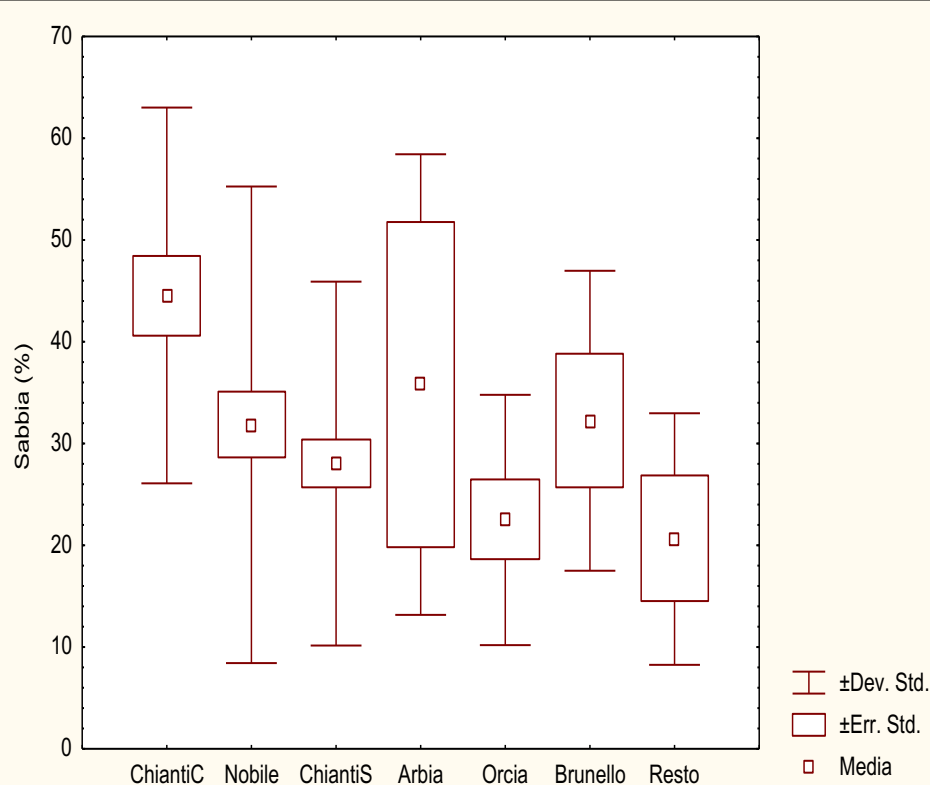
I suoli dei vigneti in provincia di Siena

**6 gruppi pedologici di riferimento
(IUSS-ISRIC-FAO-ISSDS 1999)**

- Cambisols
 - Calcaric 35,3 %
 - Stagnic 20,3 %
- Regosols
- Calcisols
- Luvisols
- Arenosols
- Vertisols

La dominanza dei Cambisols è conseguenza del ringiovanimento dei suoli causato dall'erosione superficiale dovuta a processi naturali ed all'azione dell'uomo. L'unità Calcaric è dovuta all'abbondanza di calcare nei materiali parentali, mentre le proprietà Stagniche sono conseguenza dell'abbondanza di argilla nel substrato ed alla povertà di struttura che determinano ristagni idrici periodici.

Caratteri pedologici nei vigneti: tessitura

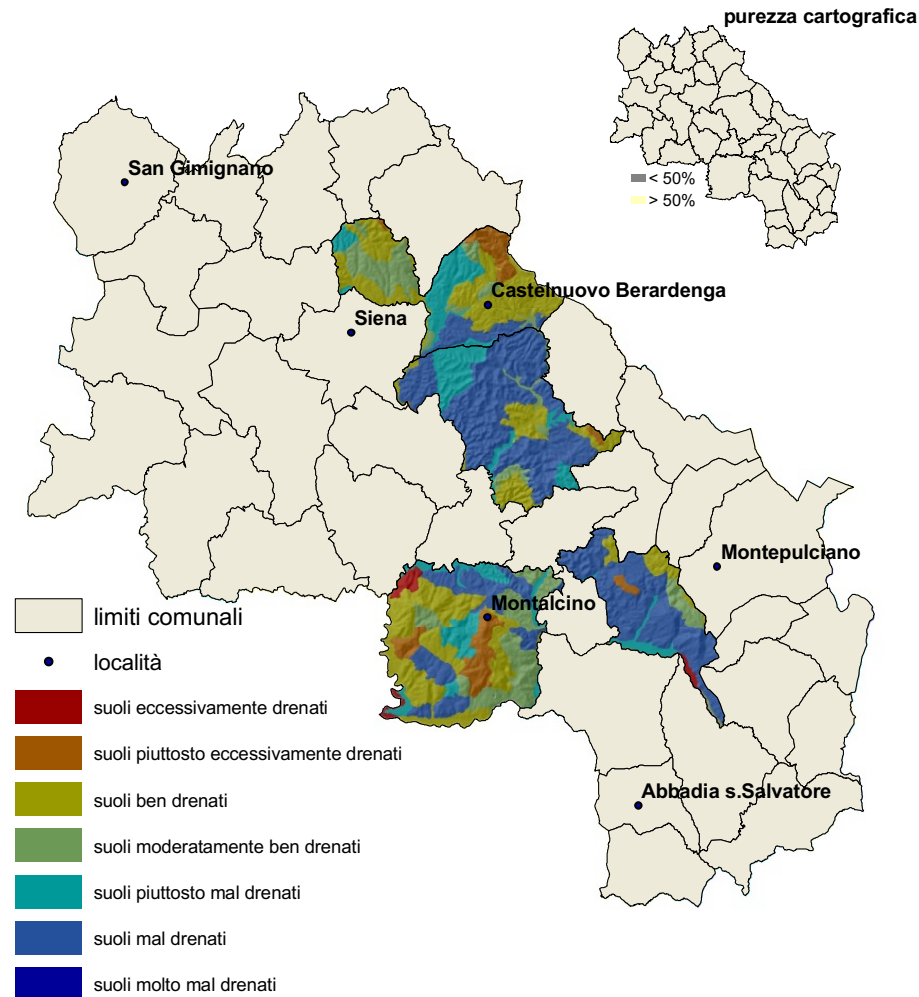
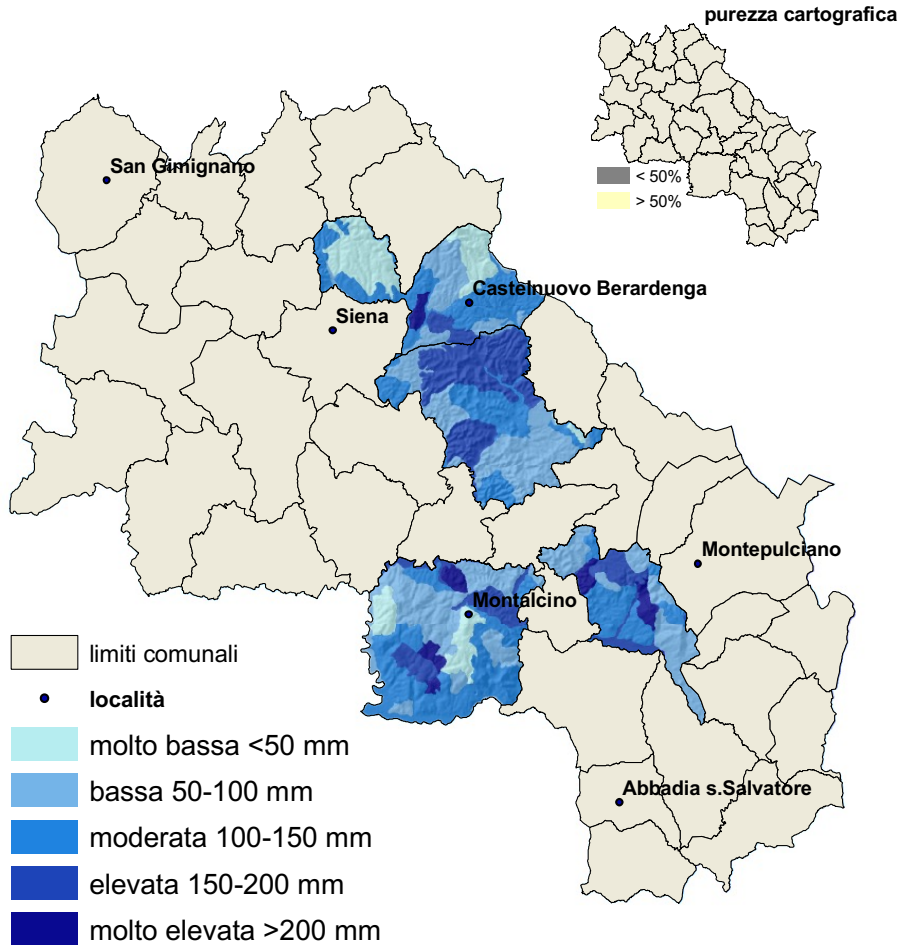


Caratteri fisici e chimici dei suoli di 3 DOCG

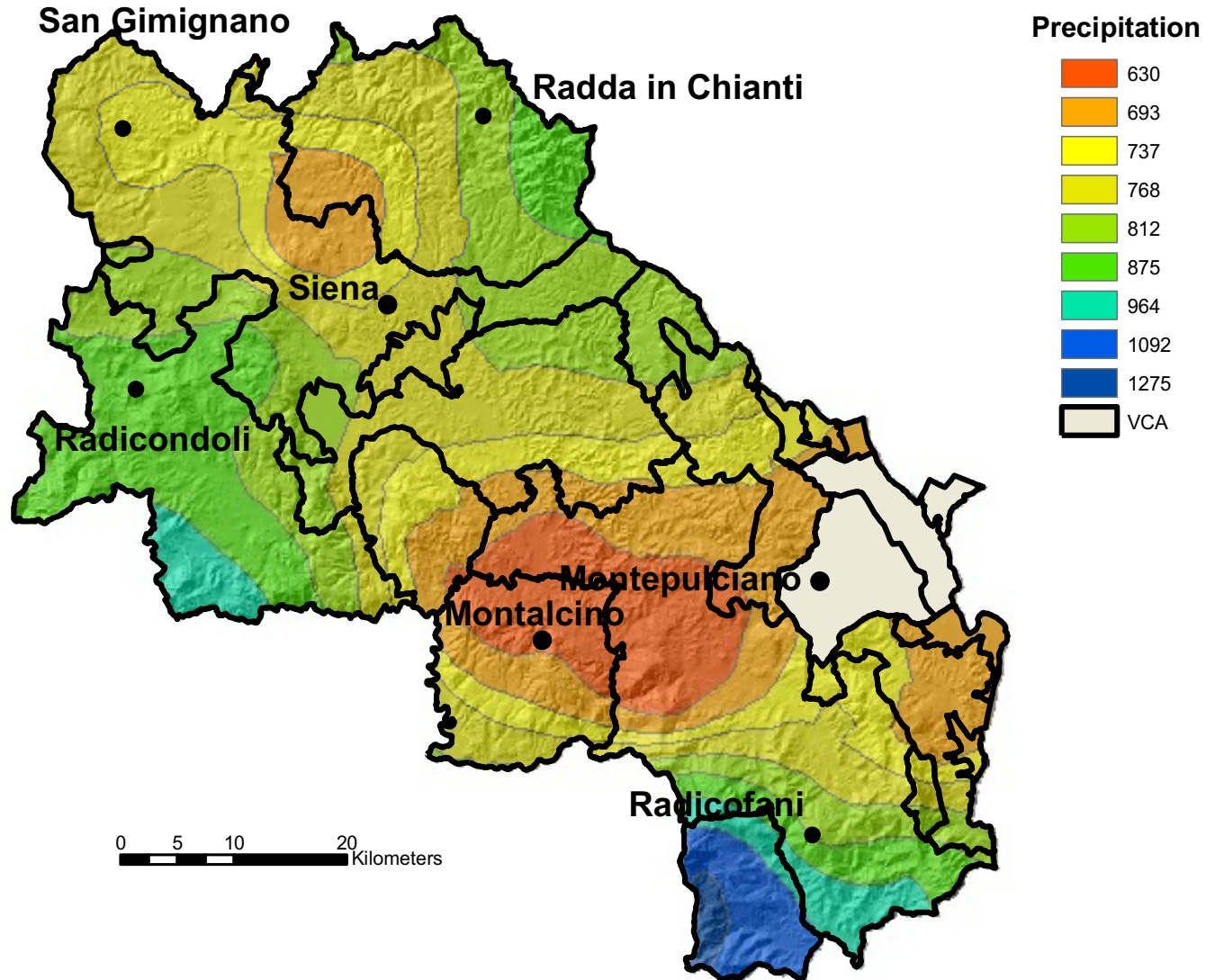
	Brunello di Montalcino	Chianti Classico	Chianti Colli Senesi
Pendenza (%)	7.3 b	13.9 a	8.2 b
Profondità utile per le radici (cm)	88 b	81 b	106 a
Pietrosità (% v/v)	8.1 a	10.6 a	2.8 b
Argilla (%)	32.1 a	23.4 b	29.9 a
Sabbia (%)	32.2 ab	44.6 a	28.0 b
Acqua disponibile AWC (mm m ⁻¹)	99 ab	92 b	121 a
Classi di drenaggio	5	4-5	3-4
Capacità di scambio cationico (meq 100 g ⁻¹)	20.5 a	14.9 b	16.7 ab
pH	7.7	7.9	7.8
Conducibilità elettrica (dS m ⁻¹)	0.23	0.22	0.19
CaCO ₃ totale (%)	23.1 a	17.0 ab	14.5 b
CaCO ₃ attivo (%)	4.3	4.1	4.6



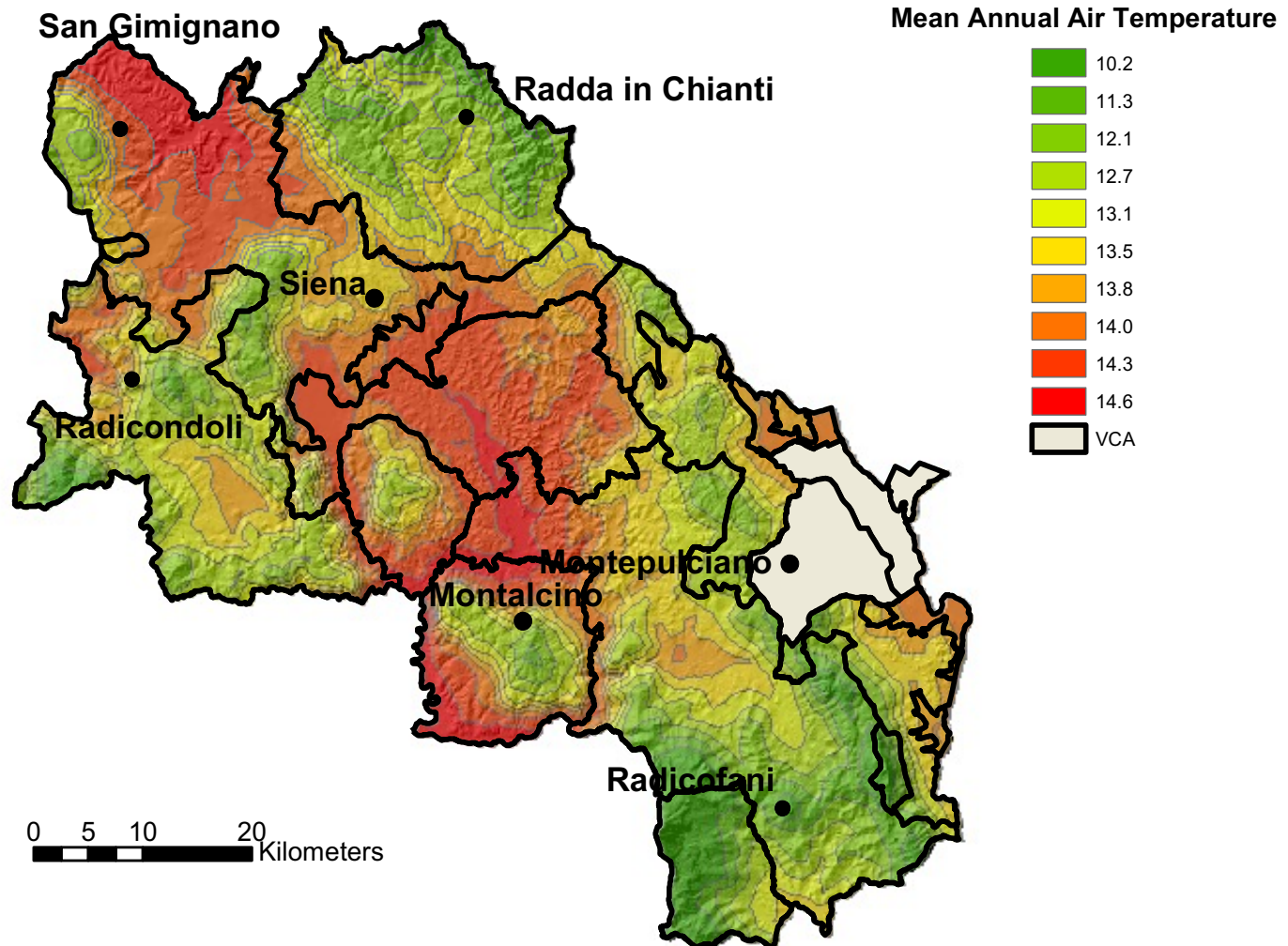
Acqua disponibile e drenaggio



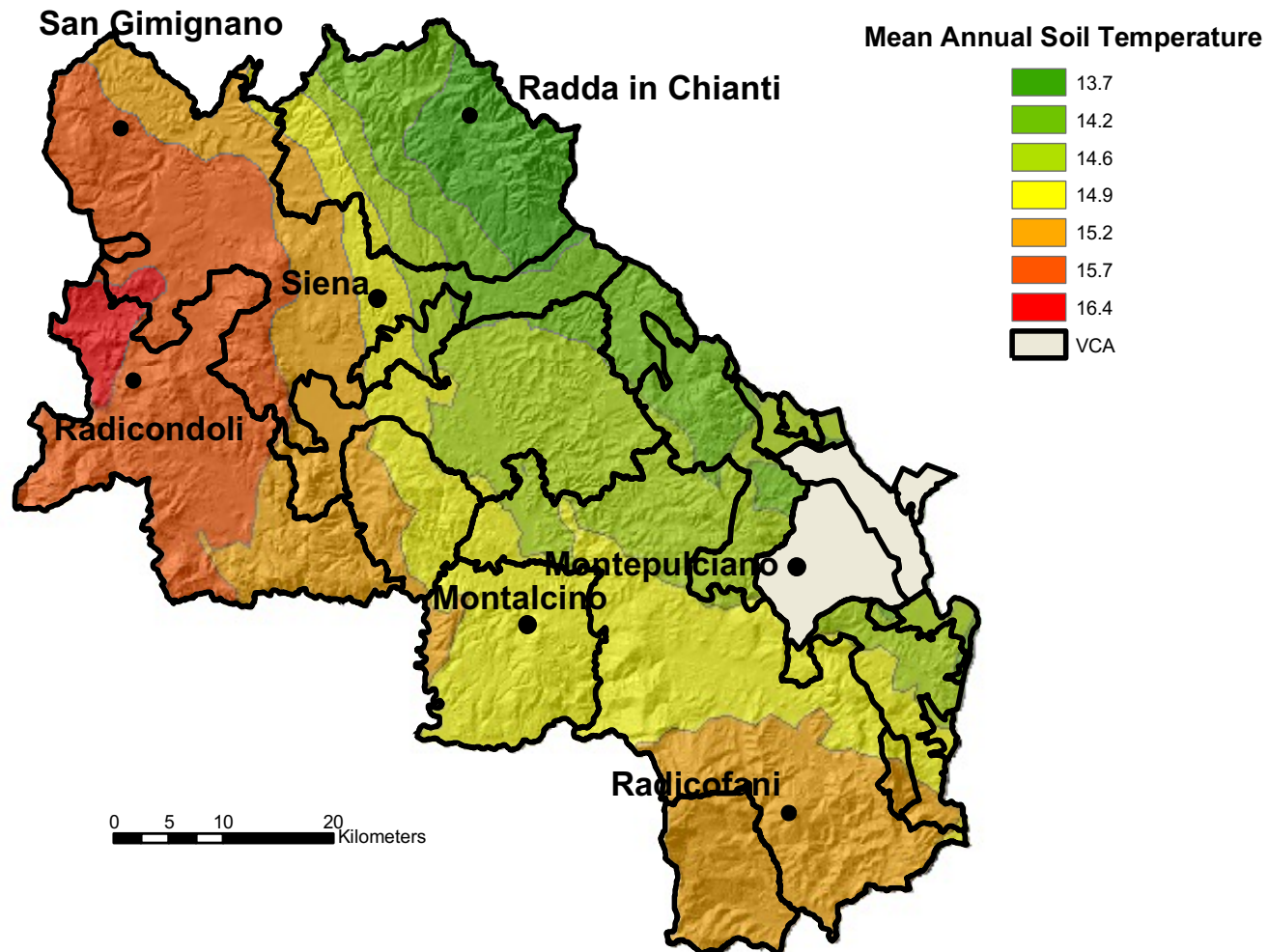
Pioggia media annua di lungo periodo



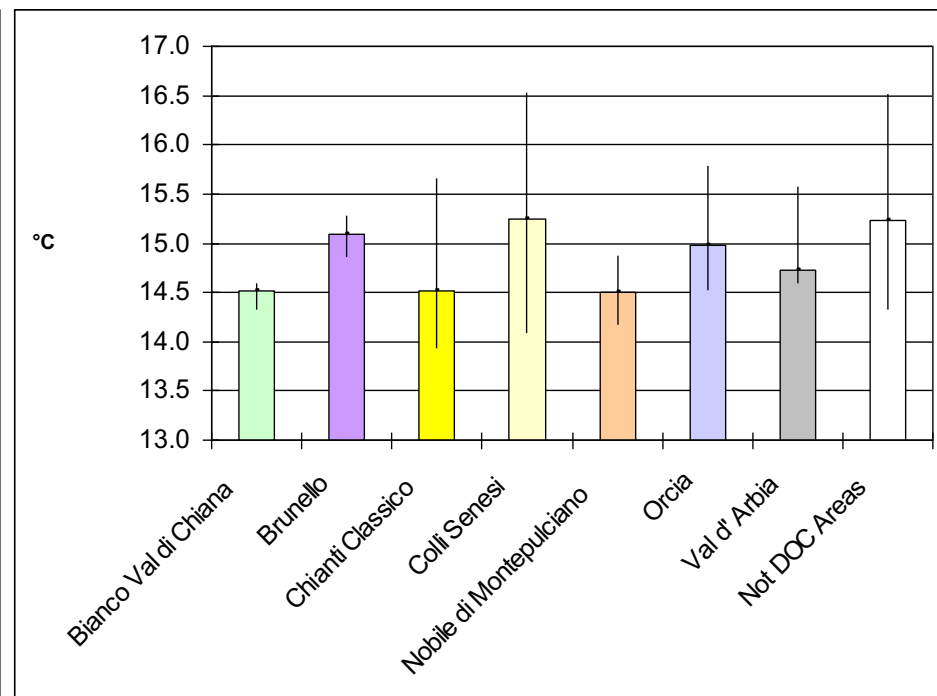
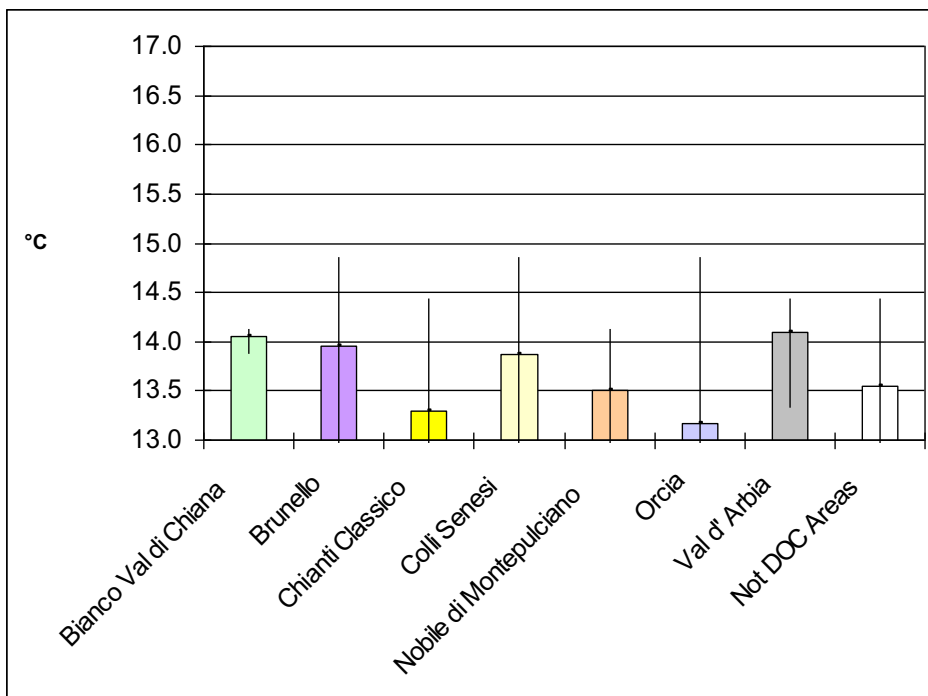
Temperatura media annua dell'aria di lungo periodo (° C)



Temperatura media annua del suolo di lungo periodo ($^{\circ}$ C a 0,5 m)



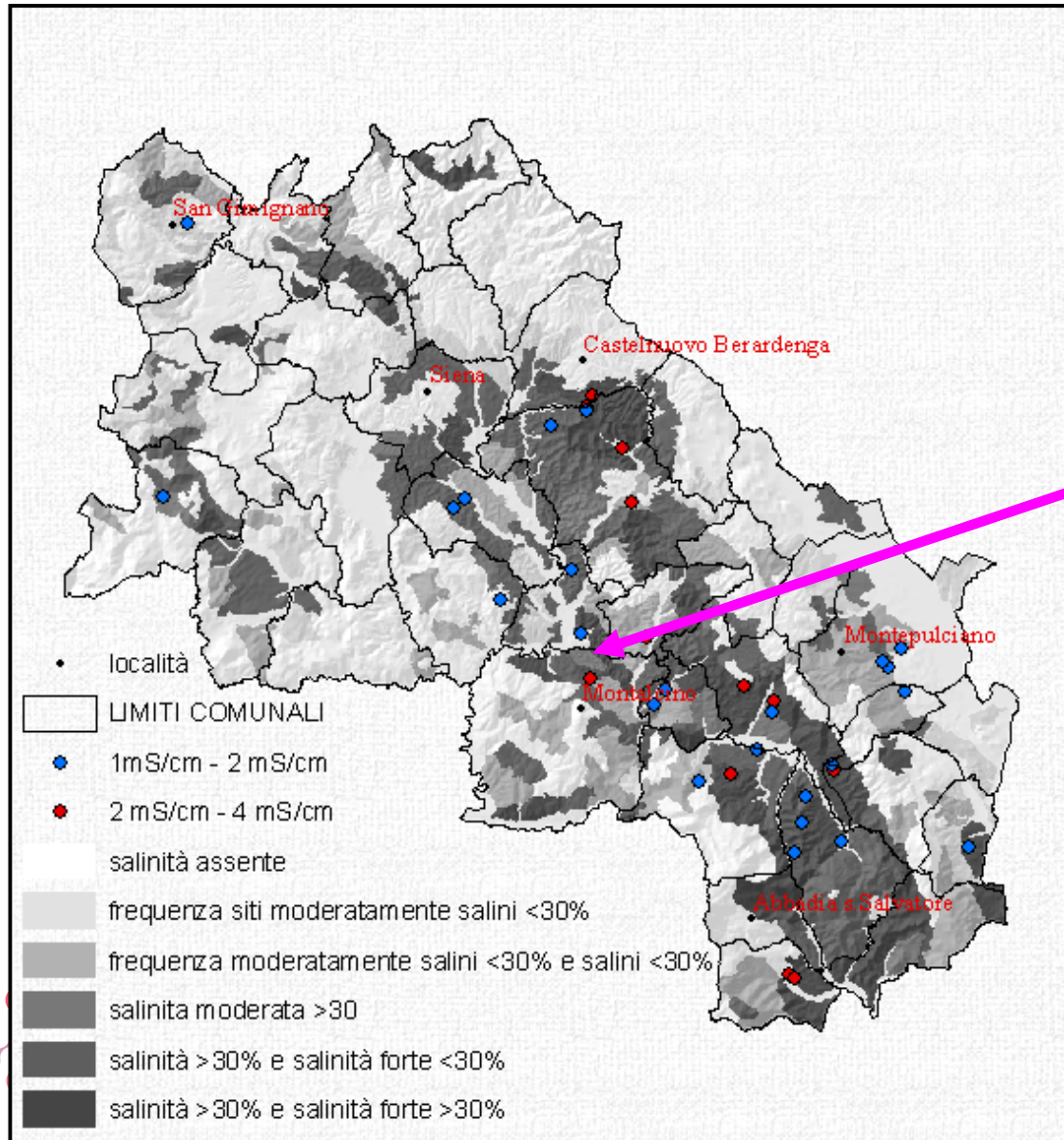
Temperatura dell'aria e del suolo (media, max e min) nei vigneti



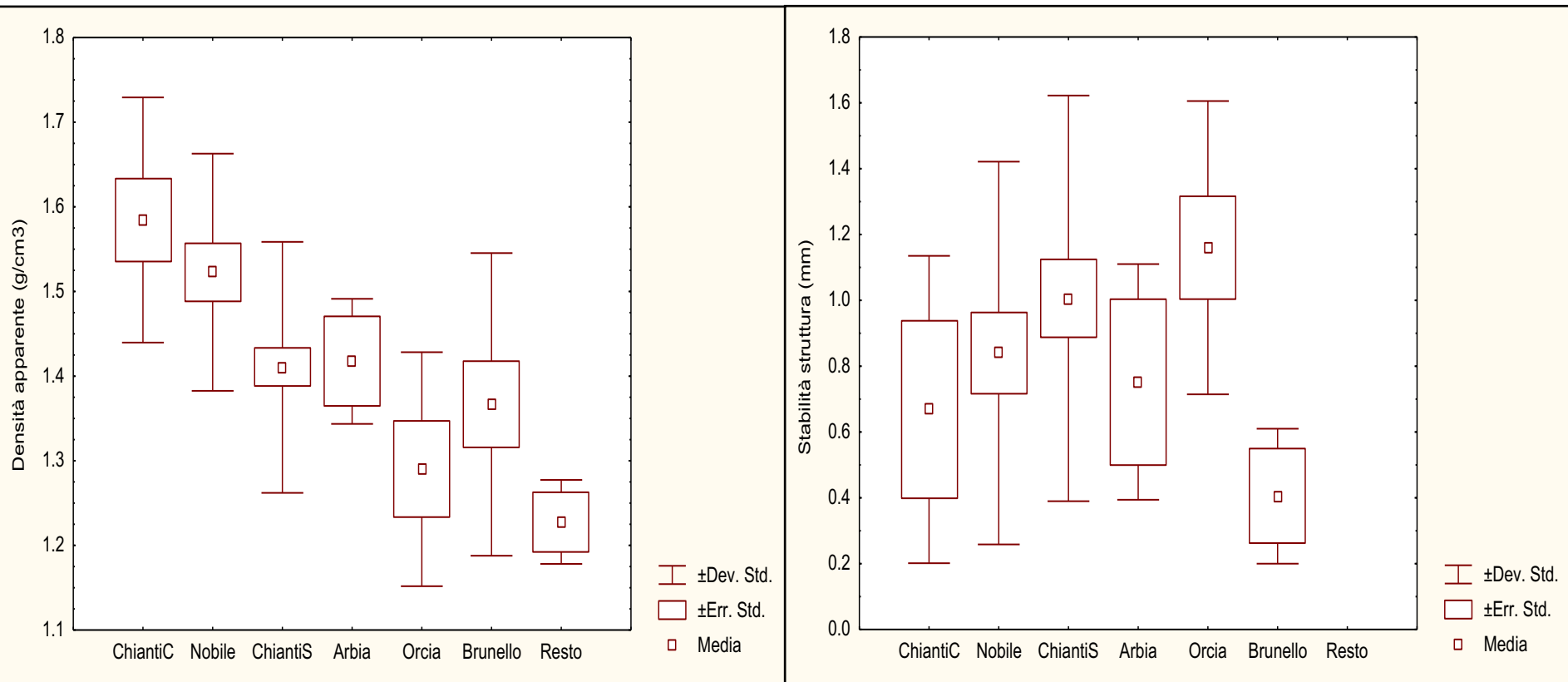
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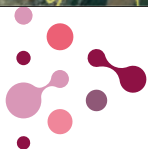
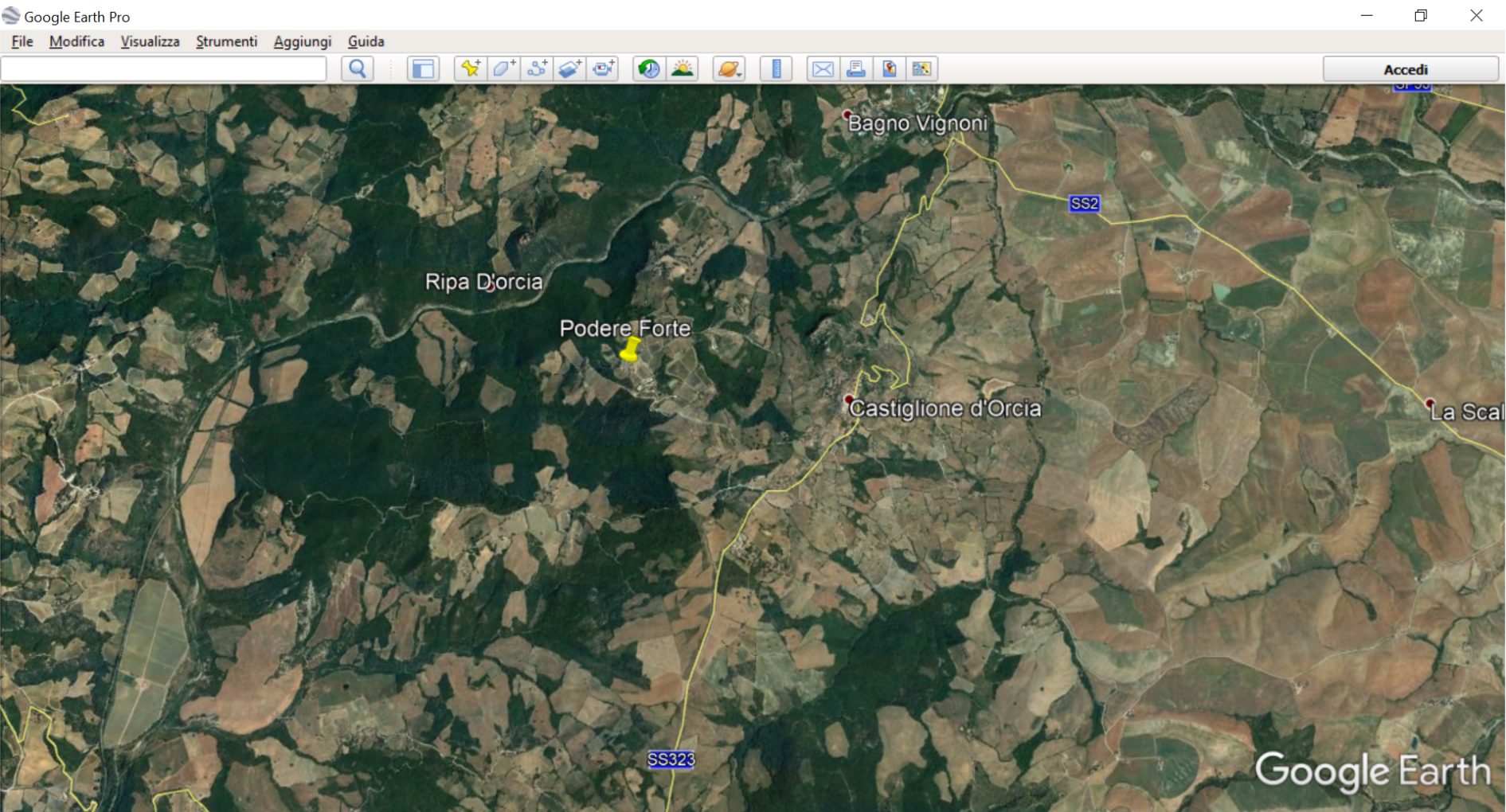
Salinità dei suoli



Caratteri pedologici nei vigneti: struttura



Podere Forte



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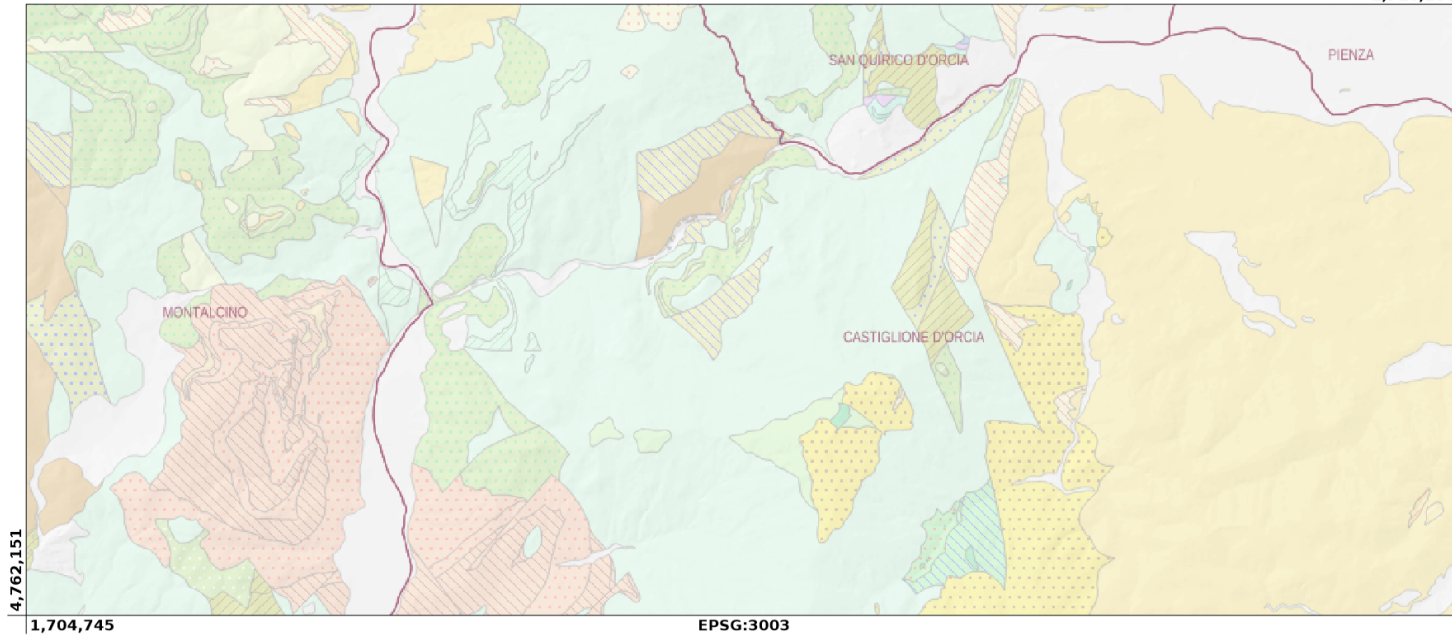
Regione Toscana - DB Geologico

Podere Petrucci-Forte











Scala 1 :50,000

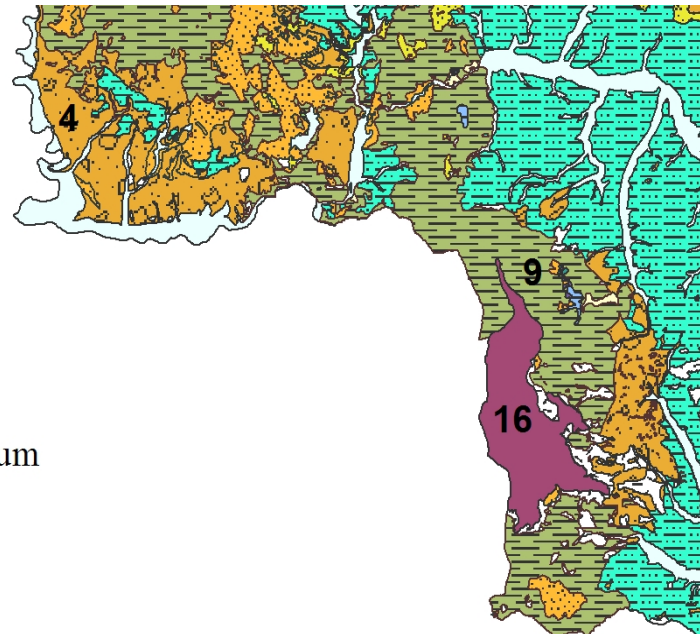
1,718,186

4,767,971



Legend

-  1, Debris and slope deposits
-  2, Alluvial deposits
-  3, Travertine and calcareous tufas
-  4, Conglomerates and breccias
-  5, Marine sands
-  6, Marine clays and silty-clays
-  7, Lacustrine clay and sandy-clay with gypsum
-  8, Arenaceous flysches
-  9, Schisto-clayey flysches
-  10, Marly-calcareous flysches



Cg2 150 cm colore umido 2,5Y 5/3, determinato su superfici di piccoli aggregati; figure redox principali, 10YR 6/8, comuni (2-15%) medie (5-15 mm), di evidenza marcata, localizzazione su masse arricchite di ferro; figure redox secondarie, 2,5Y 6/0, abbondanti (30-50%) grossolane (>15 mm), di evidenza marcata, localizzazione su masse impoverite di ferro e presenza di aree con arric.di ferro e manganese; scheletro comune (5-15%) del tipo ghiaia grossolana (20-76 mm), forma irregolare, calcare; stima della tessitura: argilla limosa; struttura assente, massivo; consistenza molto resistente; molto adesivo; plastico, conducibilità idraulica bassa (0,01-0,1 µm/s); pori molto fini (<0,5 mm) scarsi (0,1-0,5%); effervescenza debole; stima reazione:



ANALISI CHIMICHE E FISICHE

Orizz.	Profondità		Sabbia dag/kg						Limo dag/kg			Arg. dag/kg	CaCO3 dag/kg		C.O. dag/kg	S.O. dag/kg	pH		
	cm	cm	m. grossa	grossa	media	fine	m. fine	totale	grosso	fine	totale		totale	attivo			H2O	CaCl2	KCl
Ap	0	20	2.2	3.6	2.1	2.6	1.5	12.0			42.9	45.1	9.2	3.2	1.07	1.84	8.4	7.6	
Cg1	20	60	1.1	2.6	2.0	2.2	1.7	9.6			50.4	40.0	6.4	1.9	0.41	0.71	8.8	7.8	
Cg2	60	150	1.1	2.4	2.6	2.7	1.5	10.3			49.5	40.2	3.4	1.2	0.19	0.32	8.9	8.0	

Orizz.	Profondità		Complesso di scambio cmol(+)/kg								TSB %	Acid. totale	ESP %	N tot g/kg	P ass mg/kg	K ass mg/kg	d.a. g/cm3	cond. dS/m	C/N	c.c. (cm/m)	p.a. (cm/m)	AWC mm/m
	cm	cm	Ca	Mg	Ca+Mg	Na	K	H	Al	CSC sc												
Ap	0	20															1.36	0.15		25.8	41.8	159.9
Cg1	20	60	12.3	5.4	17.66	1.09	0.32			19.07		100	5.7	0.48			1.68	0.188	8.6	22.5	39.3	168.0
Cg2	60	150																0.602		22.6	39.3	167.1

Orizz.	Campione		Ferro estraibile g/kg			Alluminio estraib. g/kg			Si g/kg ossal. tot.	vetri %	pH NaF	Fe	Mn mg/kg	Cu mg/kg	Zn mg/kg	P tot g/kg	P ads %	CSC arg	MWD mm	COLE dm/m
	cm	cm	ossal.	dition.	pirof. totale	ossal.	dition.	pirof. totale												
Ap	0	20																	1.33	0.05
Cg1	20	60									6	2.8	2.2	0.7						0.03



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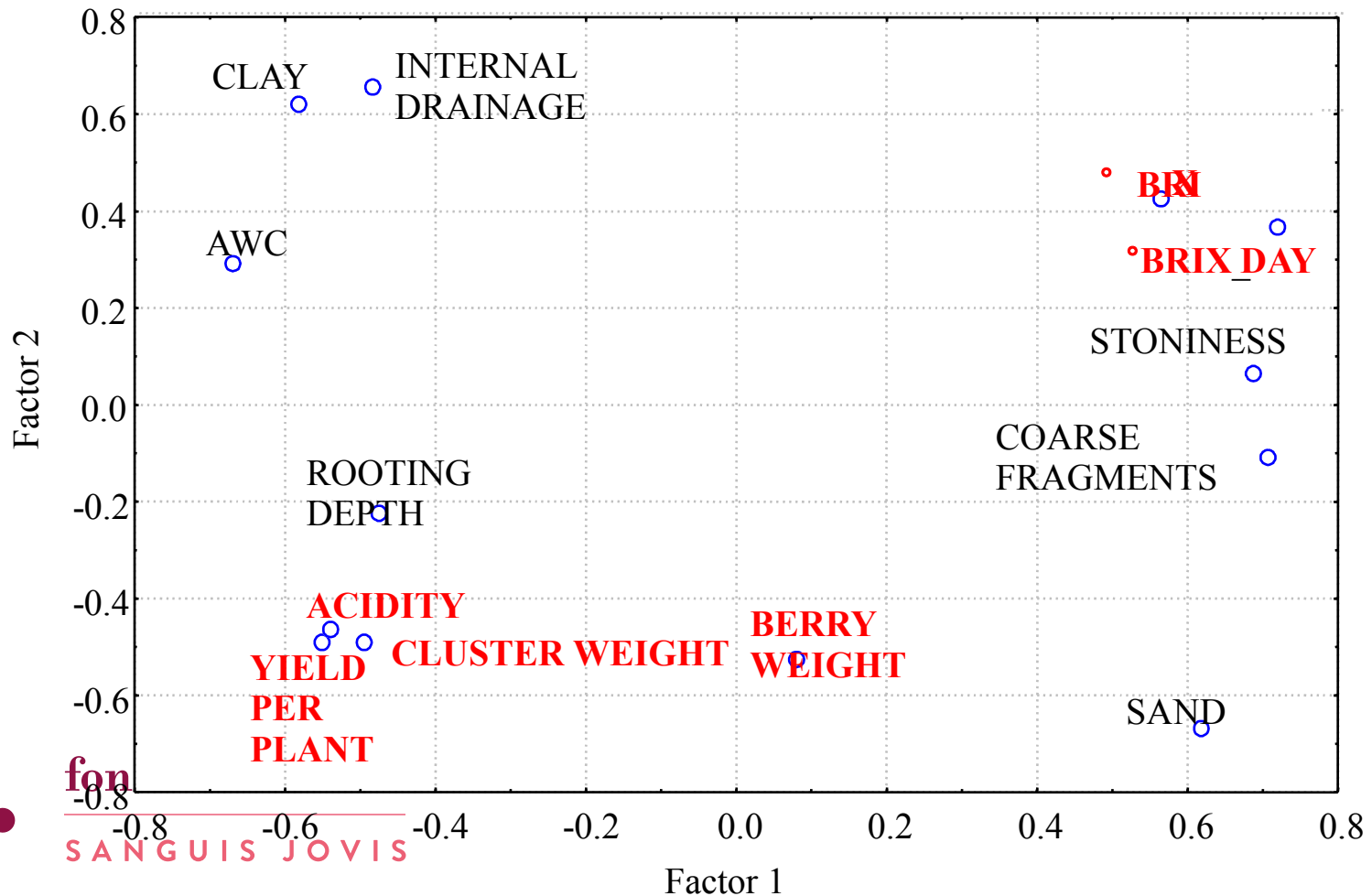
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Variabili in prova sul Sangiovese nel senese (13 anni, 69 vigneti, 223 casi)

Viticole ed enologiche (10)	Topografiche e pedologiche fisiche ed idrologiche (17)	Pedologiche chimiche (17)
<ul style="list-style-type: none"> ° Brix ° Brix/day Total titrable acidity Mean weight of cluster Berry weight Grape yield per plant Number of cluster per plant Colour intensity Total polyphenols Sensorial evaluation 	<ul style="list-style-type: none"> Elevation Slope gradient Aspect Stoniness Coarse fragments Rooting depth Sand Clay Internal drainage Available Water Capacity Wilting point Field capacity Runoff Bulk density COLE Structural stability 	<ul style="list-style-type: none"> pH (1:2.5 water) Organic carbon Total N C/N ratio Total lime Active lime Cation Exchange Capacity Exchangeable Ca Exchangeable K Exchangeable Na Exchangeable Mg Electrical conductivity Available Fe Available Mn Available Cu Available Zn

PCA delle variabili viticole e pedologiche in 69 vigneti sperimentali per 2-5 anni



Relazioni tra variabili pedologiche e viticole (R² per P<0,05)

	° Brix	° Brix/ day	Yield per plant	Acidity	Cluster weight	Berry weight
Pietrosità	0.32	0.48	-0.30	-0.32	-0.28	0.08
Profondità	-0.27	-0.28	0.37	0.26	0.19	0.22
Scheletro	0.17	0.45	-0.21	-0.23	-0.27	0.12
AWC	-0.11	-0.23	0.32	0.04	0.24	0.04
Argilla	-0.12	-0.19	0.06	0.10	0.00	-0.33
Sabbia	0.09	0.15	-0.06	-0.01	-0.09	0.29
Drenaggio	0.02	-0.03	0.14	-0.09	0.01	-0.24



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Spazializzazione pedologica

1425 soil observations (profiles and augerings)

Polygons of regional land units (1:100,000)

DEM 20x20 m (with derivatives as TWI)

**BEST INTERPOLATION
MODEL BASED ON
THE LOWEST MEAN
ERROR AFTER CROSS-
VALIDATION**

Simple kriging with
varying local means
(SKLM)

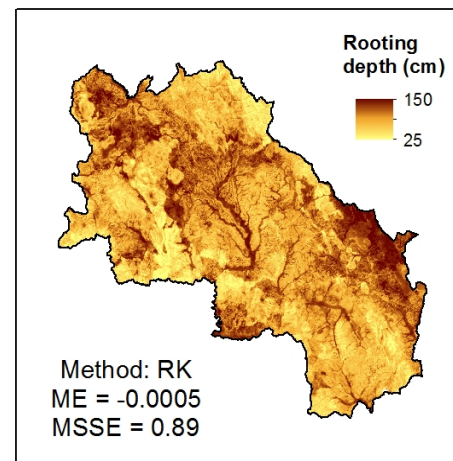
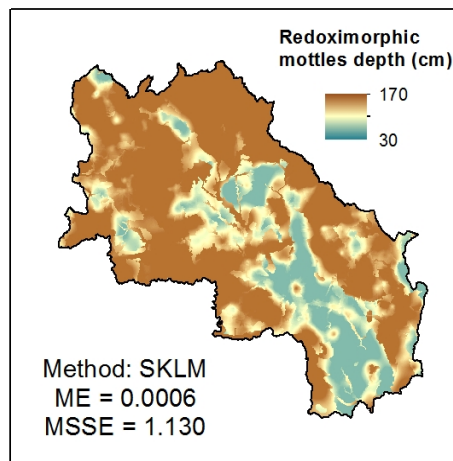
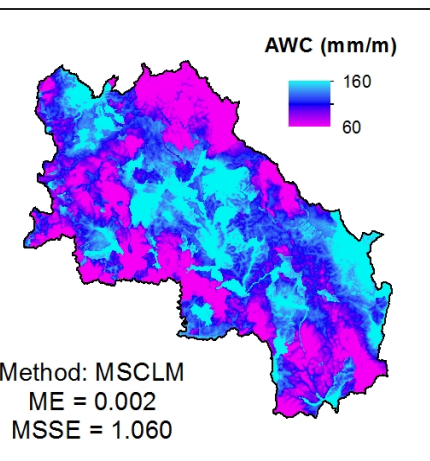
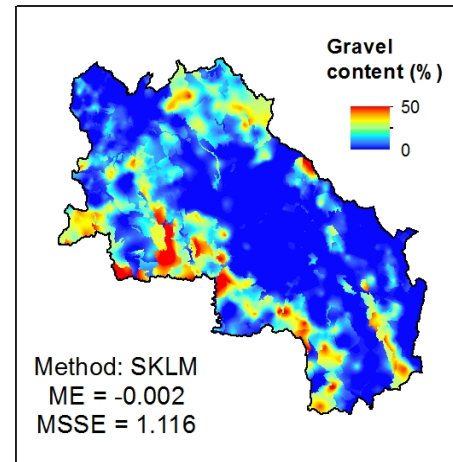
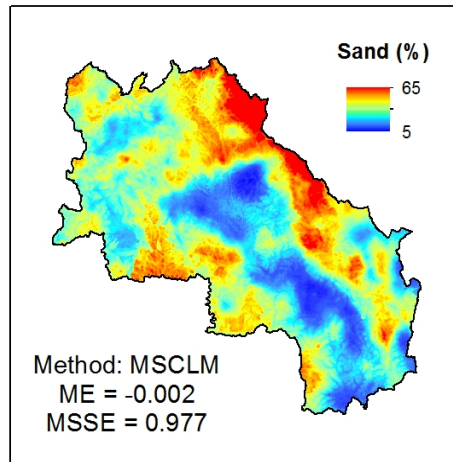
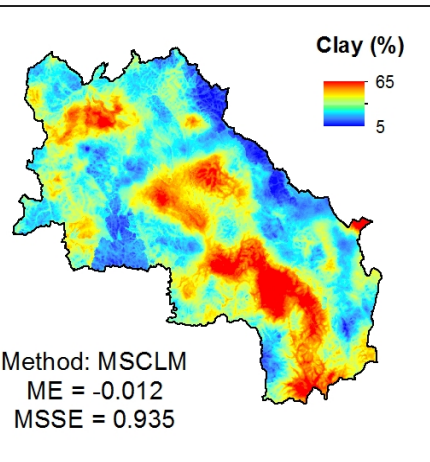
Using the mean value of
land units polygons as
secondary variable

Regression Kriging (RK)

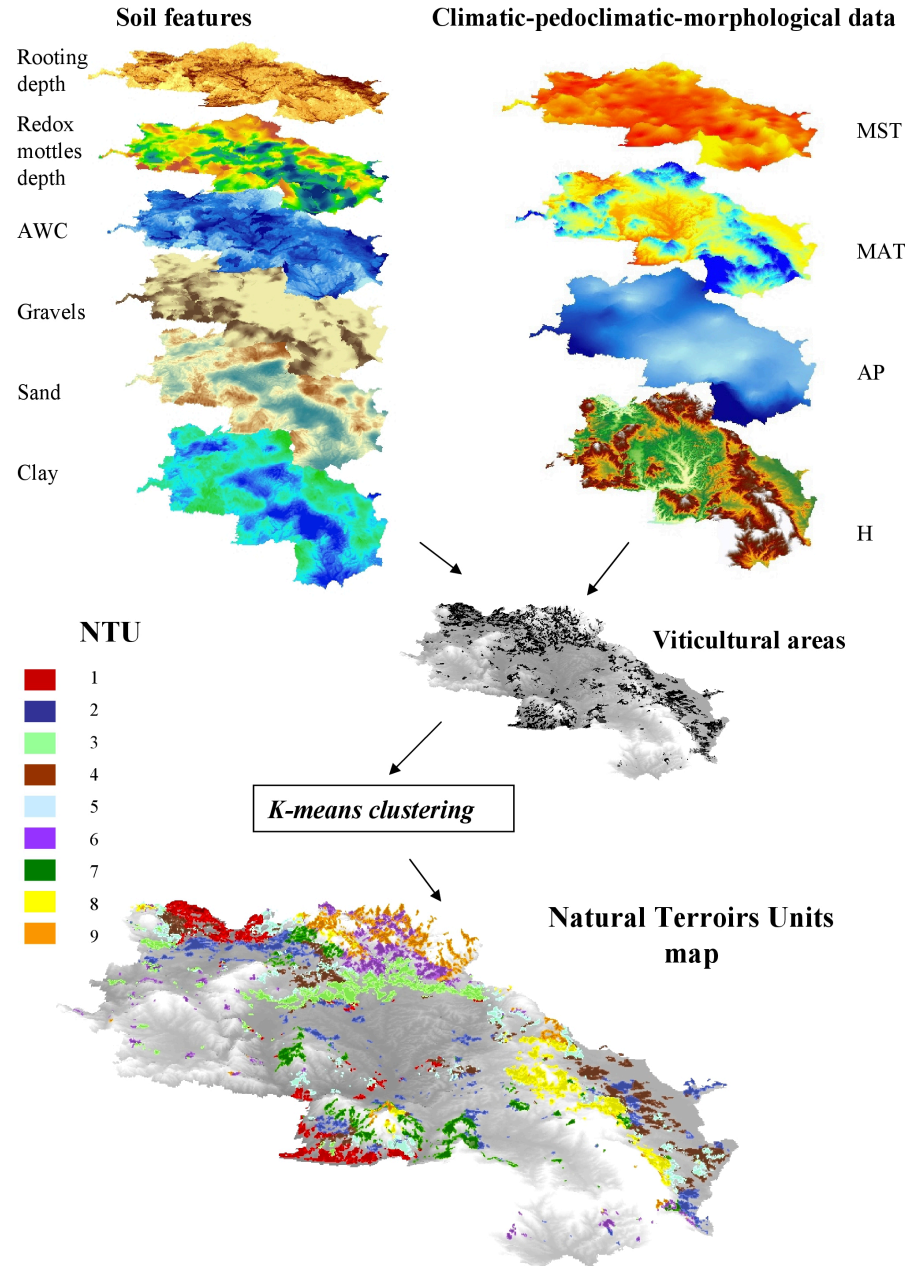
Using TWI as predictive
variable

Multicollocated simple
cokriging with varying
local means (MSCLM)

Using both TWI and mean
values of land units

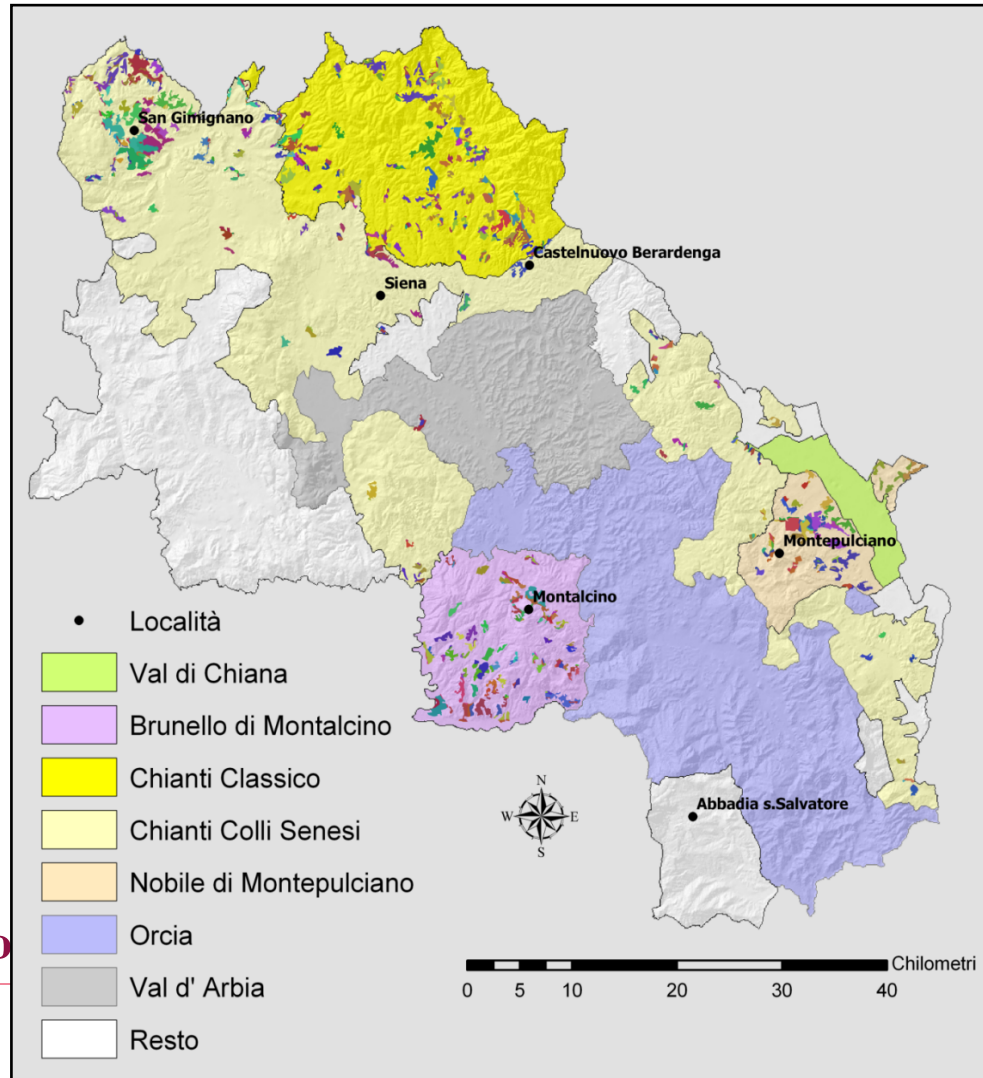


Clustering e mappatura



I 363 terroirs di Siena.

Media 46 ha, range 2-474 ha



L'effetto della scala e della variabilità locale

Variando la scala e la geologia, cambiano le variabili significative!

Invariant variables

Province zoning

(Siena province)

Scala 1:100,000

Soil texture
Stoniness
Skeleton
Available water (AWC)
Soil drainage
Rooting depth

Wine district zoning

(Montepulciano, Siena)

Scala 1: 25,000

Available water (AWC)
Rooting depth

Farm zoning

(Barone Ricasoli, Siena province)

Scala 1: 10,000

Soil texture
Stoniness
Skeleton
Available water (AWC)
Nitrogen
Potassium

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Farm zoning

(Cetona, Siena province)

Scala 1: 10,000

Soil texture
Available water (AWC)
Drainage
Nitrogen
Salinity

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Montalcino-Banfi

Scala 1 :50,000

1,706,424

4,765,500



4,759,779











CINIGIANO

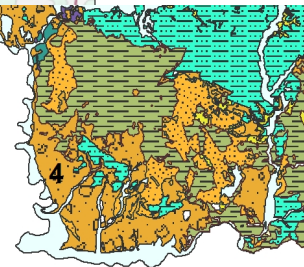
1,692,983

EPSG:3003



Legend

-  1, Debris and slope deposits
-  2, Alluvial deposits
-  3, Travertine and calcareous tufas
-  4, Conglomerates and breccias
-  5, Marine sands
-  6, Marine clays and silty-clays
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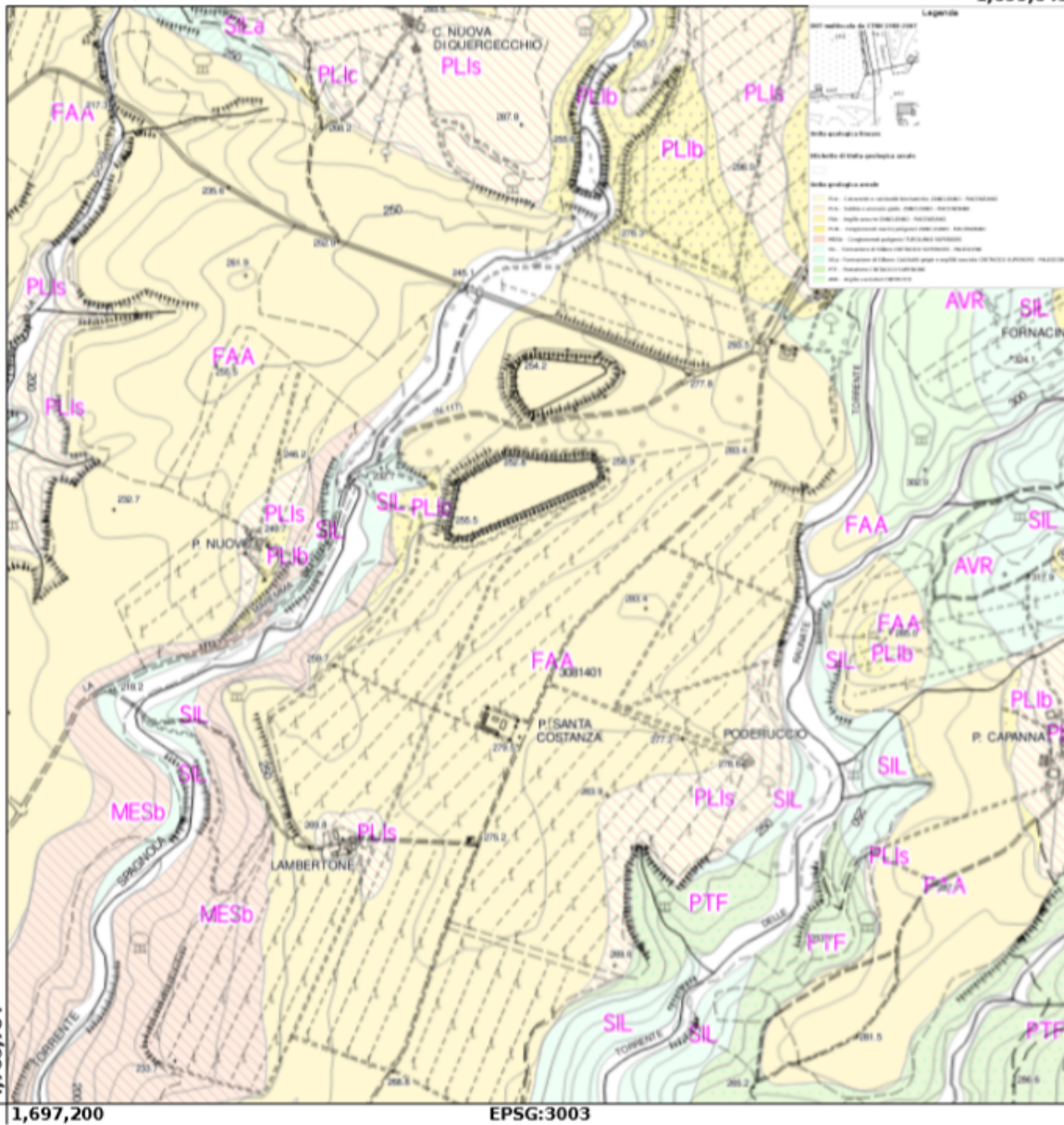
Regione Toscana - DB Geologico

Montalcino Tavernelle

Scala 1 : 13,435

1,699,643

4,766,297



foi
—
S A

4,763,784

1,697,200

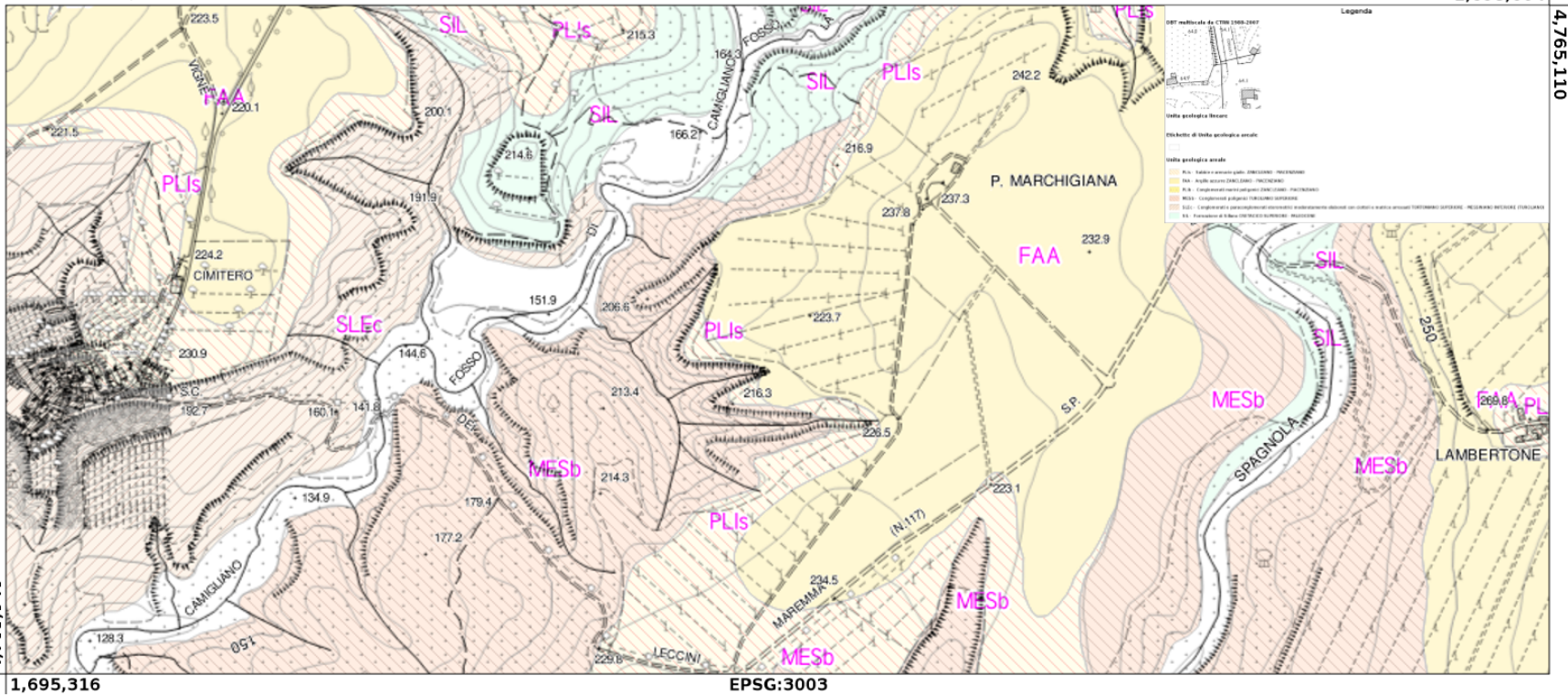
EPSG:3003

Regione Toscana - DB Geologico

Montalcino Marchigiana

Scala 1 : 10,000

1,698,004



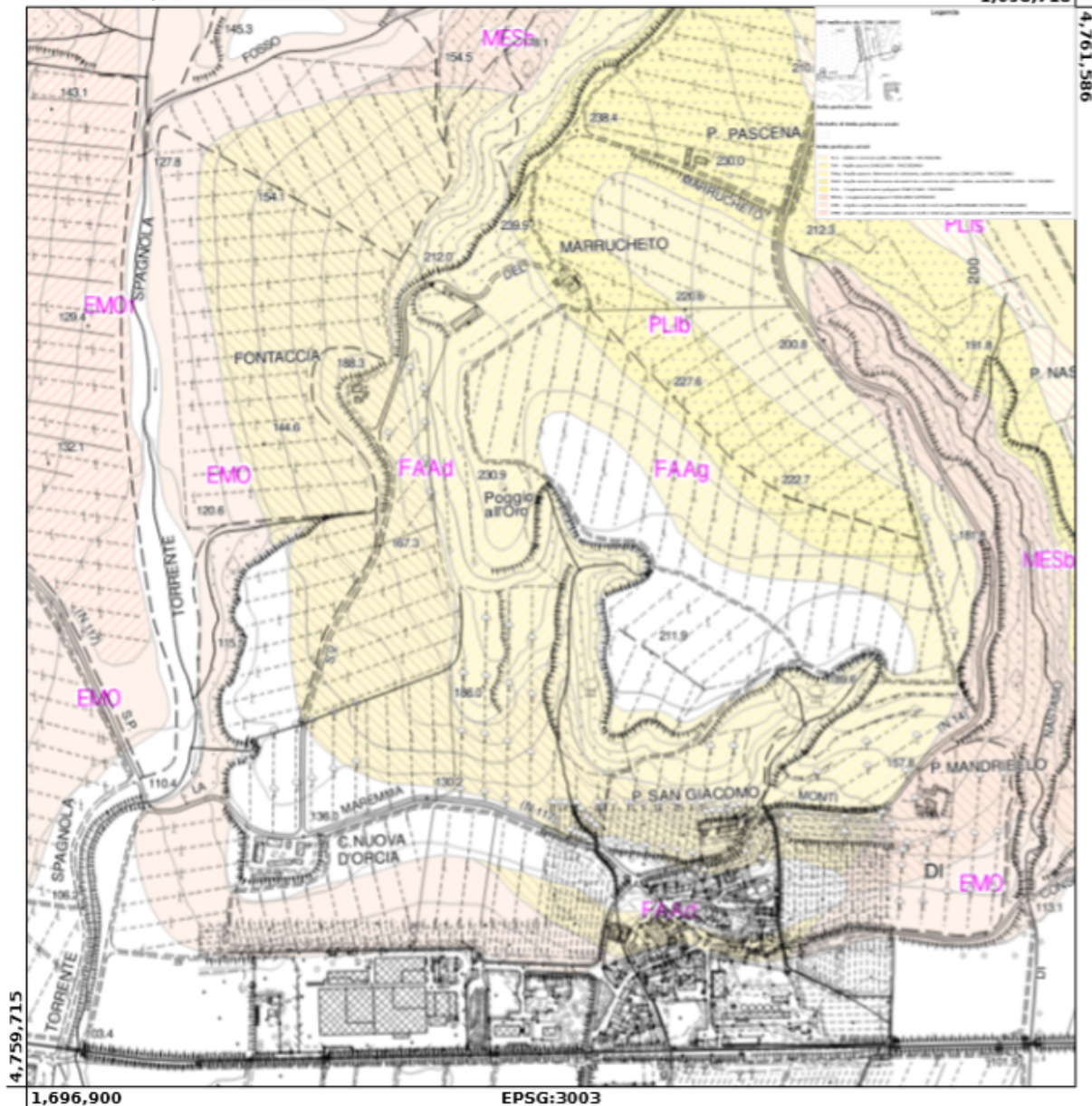
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Montalcino Marrucheto

Scala 1 :10,000

1,698,718



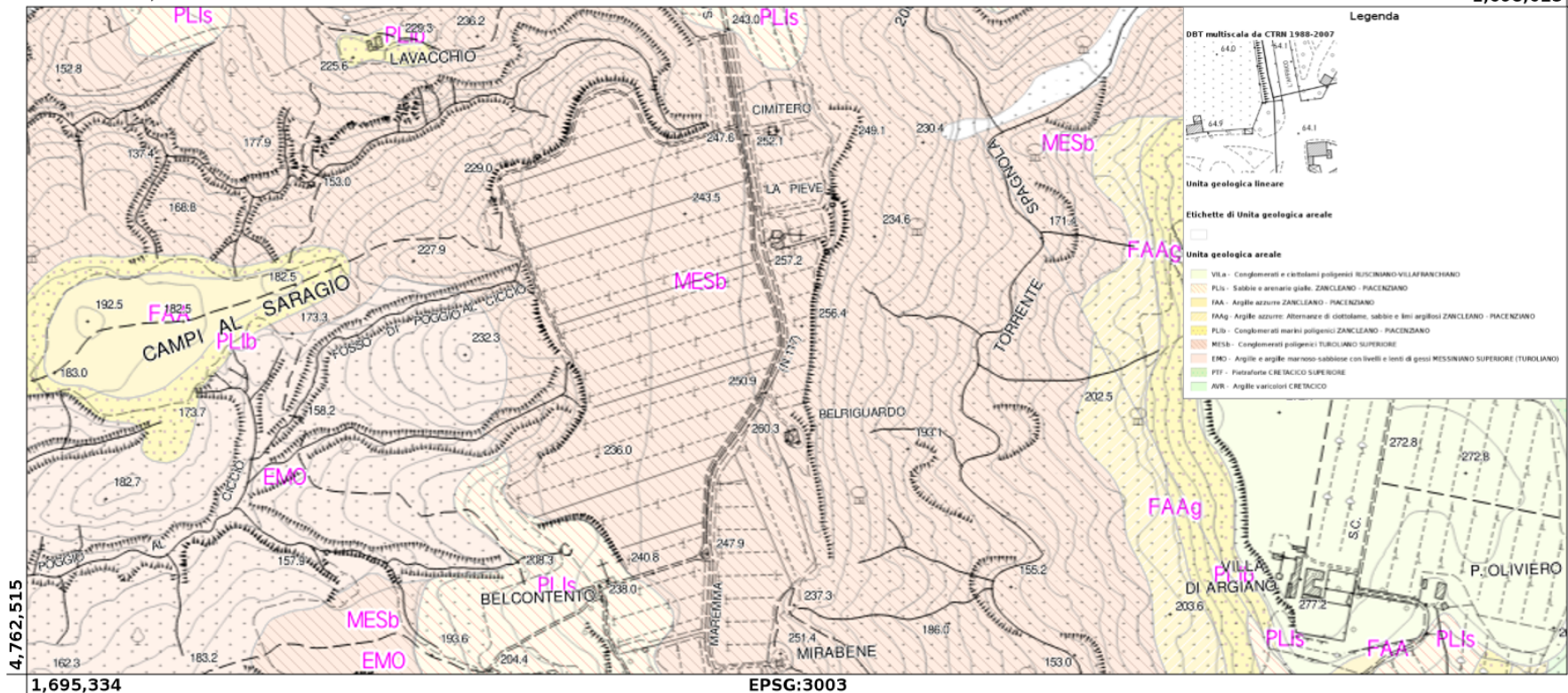
fon
SAI

Regione Toscana - DB Geologico

Montalcino La Pieve

Scala 1 :10,000

1,698,023



4,762,515

1,695,334

EPSG:3003



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