SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

Supplementary Data

TABLE ST1. List of the 20 most grown grapevine varieties in our case study, their average yield and cultivated area (hectares).

Grapevine Variety	Average yield ($hl \cdot ha^{-1} \cdot year^{-1}$)	Cultivated area (ha)
Merlot	82.3	17877.8
Cabernet Sauvignon	82.6	11103.2
Syrah	80.1	9134.5
Chardonnay	79.8	8495.4
Grenache Noir	82.8	6400.9
Sauvignon Blanc	82.8	4891.9
Cinsault	85.3	4070.9
Viognier	75.3	1633.9
Pinot Noir	80.5	1432.8
Mixed Red Varieties	65.4	1272.0
Mixed Rosé Varieties	77.2	1039.7
Cabernet Franc	80.1	973.5
Marsanne	74.5	688.8
Carignan	72.1	662.3
Grenache Blanc	77.4	529.2
Muscat Petit Grain	62.9	524.9
Mixed White Varieties	64.9	508.9
Vermentino	76.8	307.6
Colombard	80.7	251.2
Malbec	82.3	228.2
Mourvèdre	71.0	221.8

SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

TABLE ST2. Indicators for the comparison of the mixed models tested to annually simulate grapevine yield at the municipality scale. Variable acronyms are shown in Table 1; df stands for degrees of freedom, AIC for Akaike information criterion and BIC for Bayesian information criterion.

Model		Fixed variables	Random variables	df	AIC	BIC variables
1	SAWC; Soil_ph; CDI; HI; DoF; FoLF; SoLF; HD; VHD; SoHS	Municipality	Year	15	38944.06	39040.09
2	SAWC; Soil_ph; CDI; HI; DoF; SoLF; HD; VHD; SoHS	Municipality	Year	14	38944.60	39034.22
3	SAWC; Soil_ph; CDI; HI; DoF; SoLF; HD; VHD	Municipality	Year	13	38942.93	39026.16
4	SAWC; Soil_ph; CDI; HI; DoF; HD; VHD	Municipality	Year	12	38941.24	39018.07
5	SAWC; Soil_ph; CDI; HI; DoF; VHD	Municipality	Year	11	38939.51	39009.93
6	SAWC; Soil_ph; CDI; HI; DoF	Municipality	Year	10	38951.61	39015.63
7	SAWC; CDI; HI; DoF	Municipality	Year	9	38956.56	39016.18
8	SAWC; CDI; DoF	Municipality	Year	8	39049.10	39100.32
9	SAWC; CDI	Municipality	Year	7	39053.29	39098.10
10	SAWC	Municipality	Year	6	39051.89	39090.30

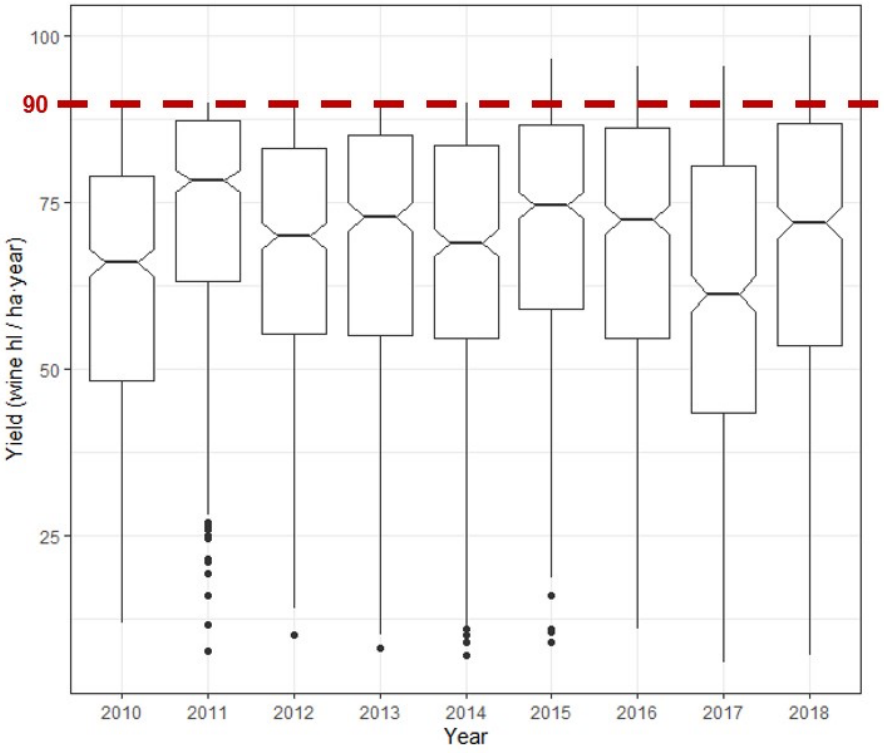
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

TABLE ST3. Proportional area of the 9 most grown varieties in each zone.

Zone	% area of 9 varieties
1	84.67
2	75.50
3	82.27
4	88.89
5	91.75
6	87.94
7	93.30

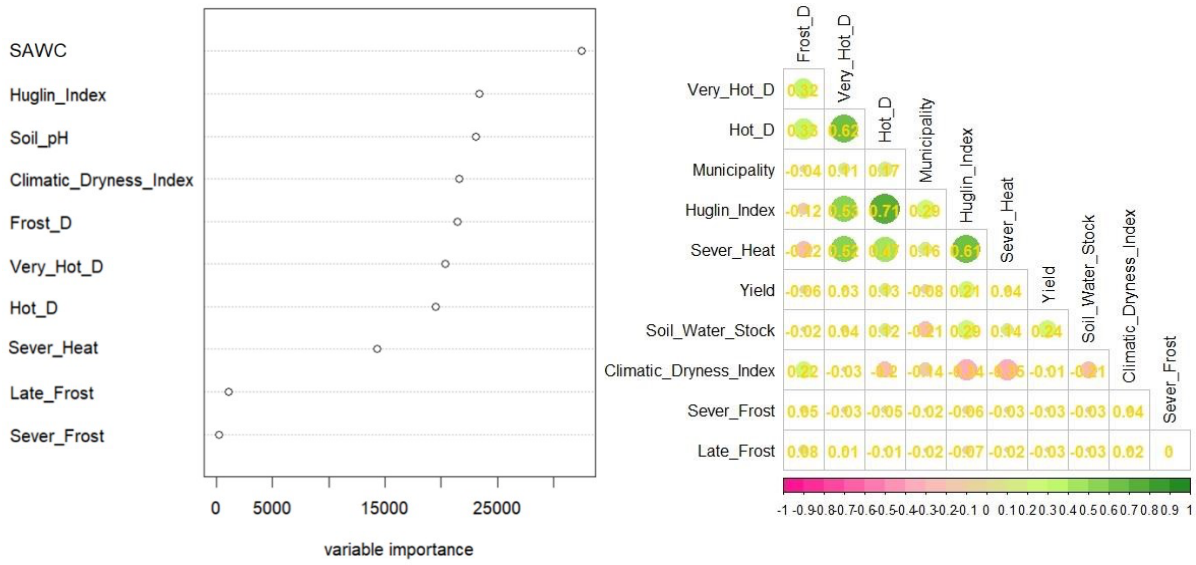
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S1. Average yield in municipalities over time. The yield objective (i.e., 90 hl·ha-1·year-1) is indicated with a red line. The boxplots represent the distribution in quartiles with median lines. The dashed red line corresponds to the 90 hl·ha-1·year-1 maximum label yield used for yield gap calculation.



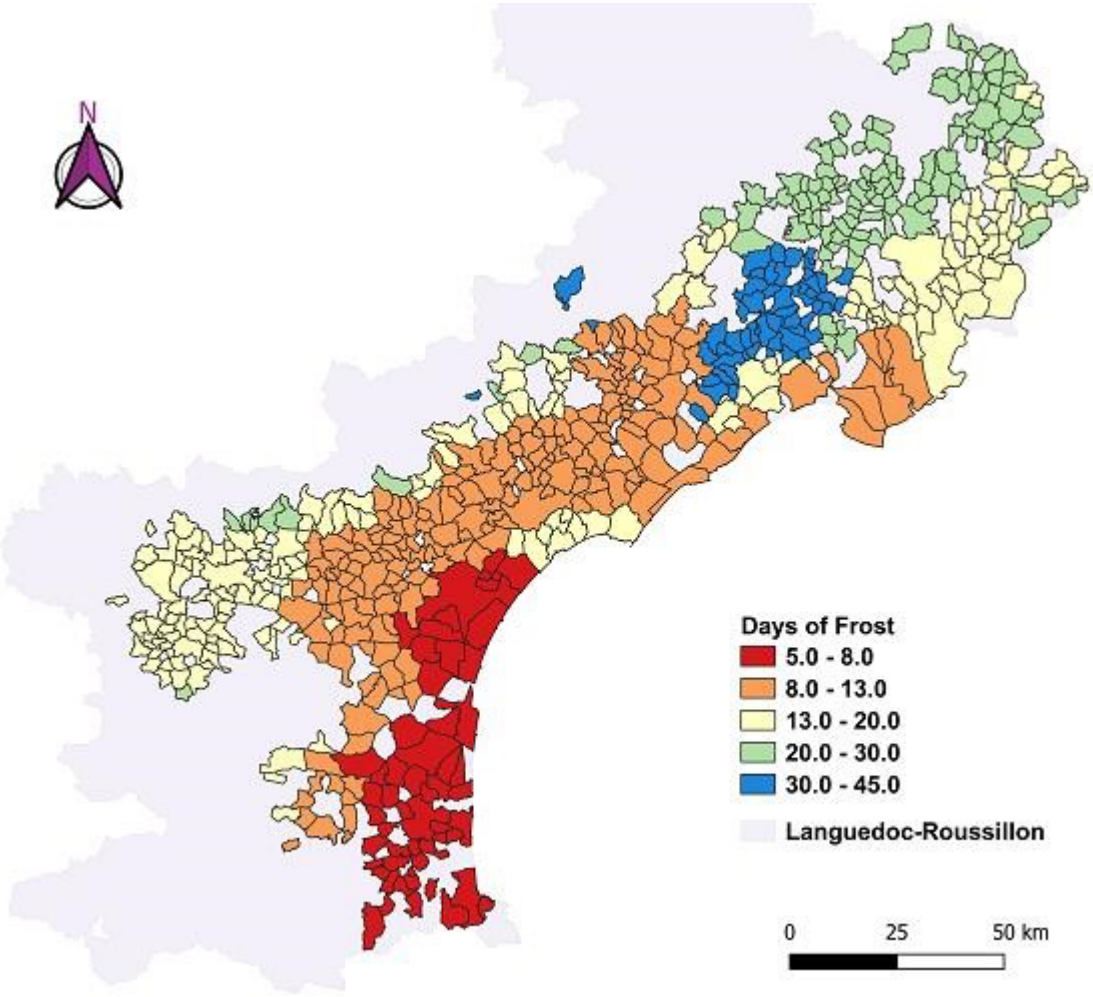
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S2. On the left: Partial dependence plot of variable importance (ranger R package). On the right: Pearson's correlation matrix.



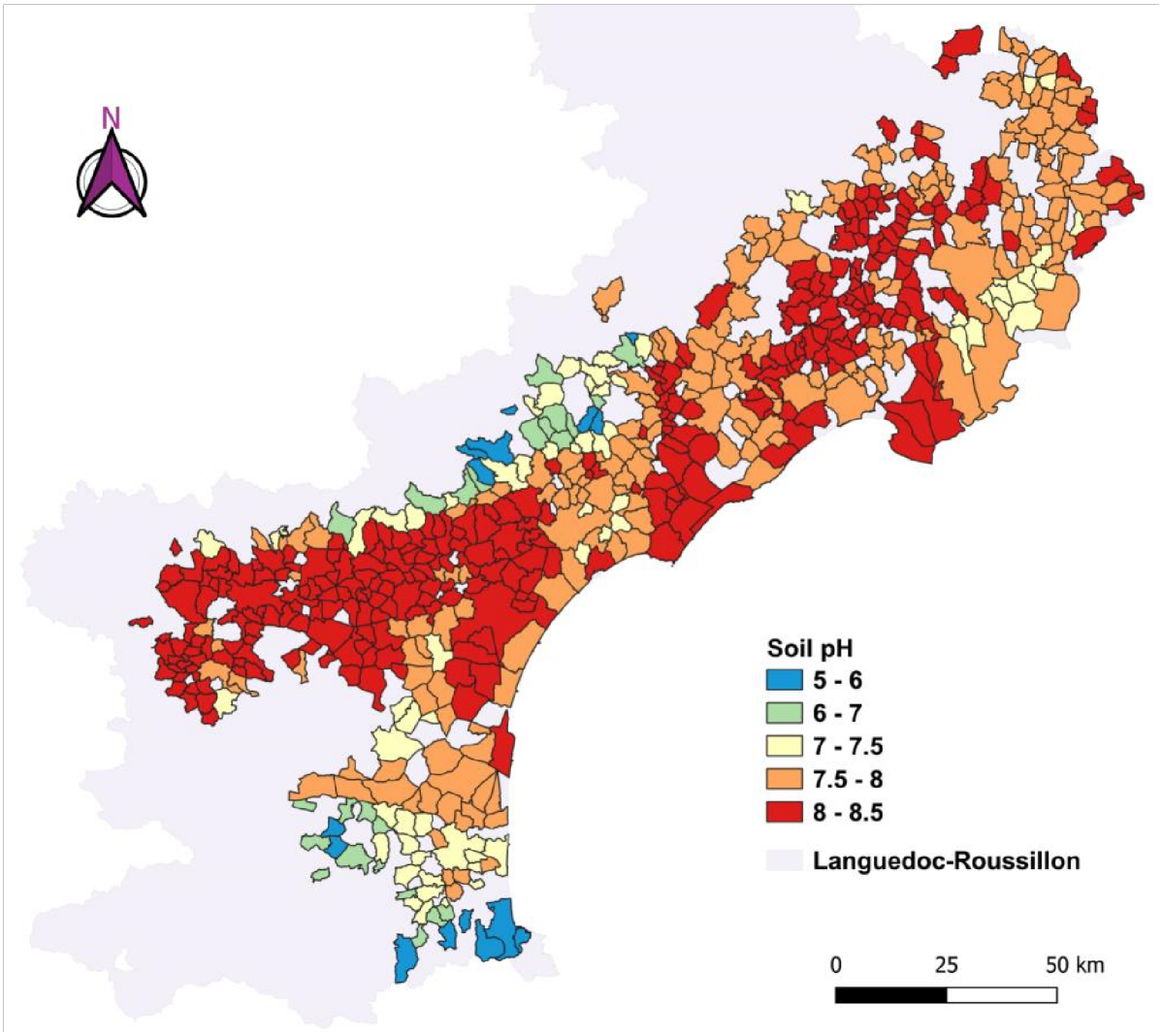
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S3. Days of Frost index - average for the 2010-2018 period.



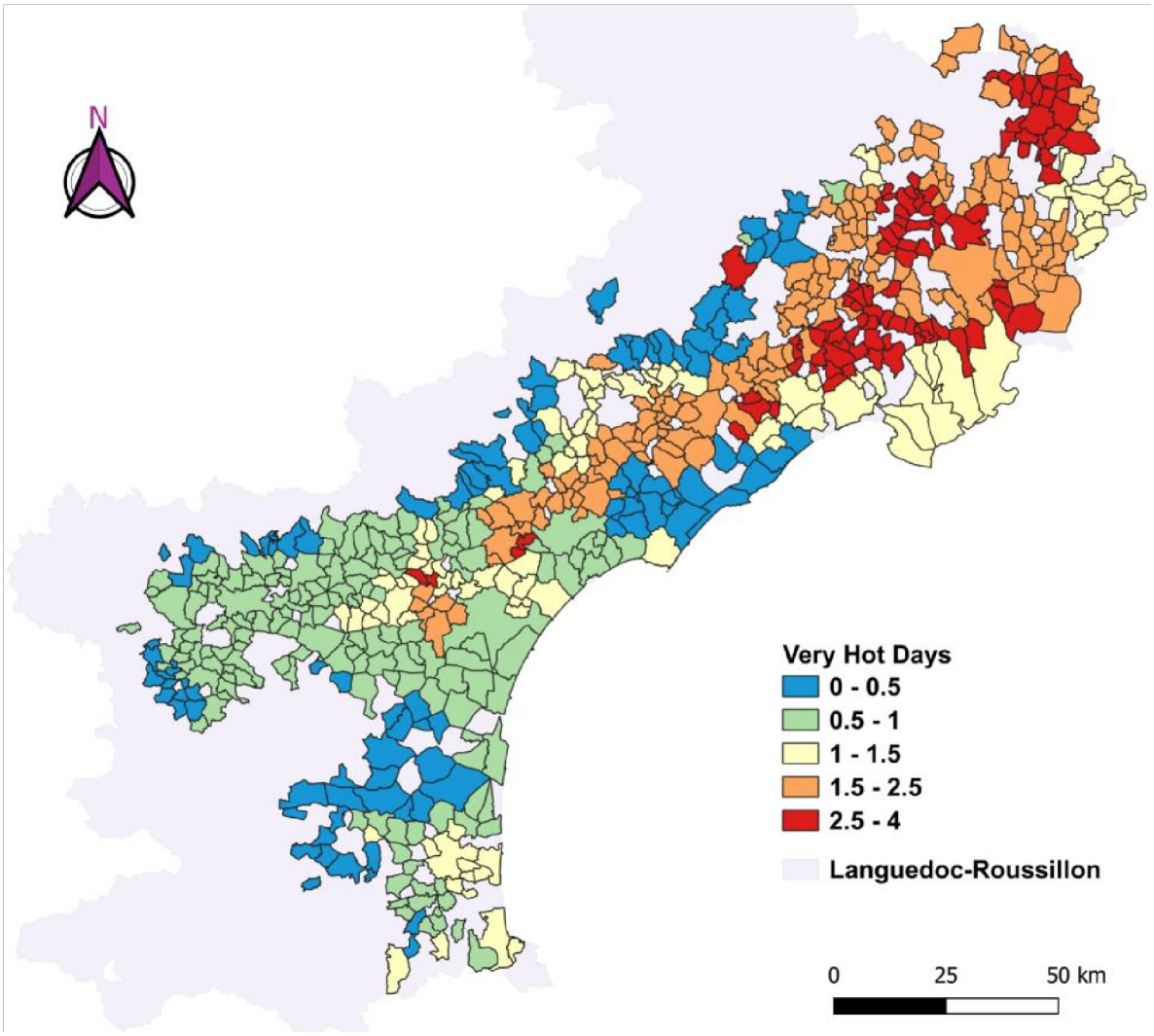
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S4. Soil pH index - average for the 2010-2018 period.



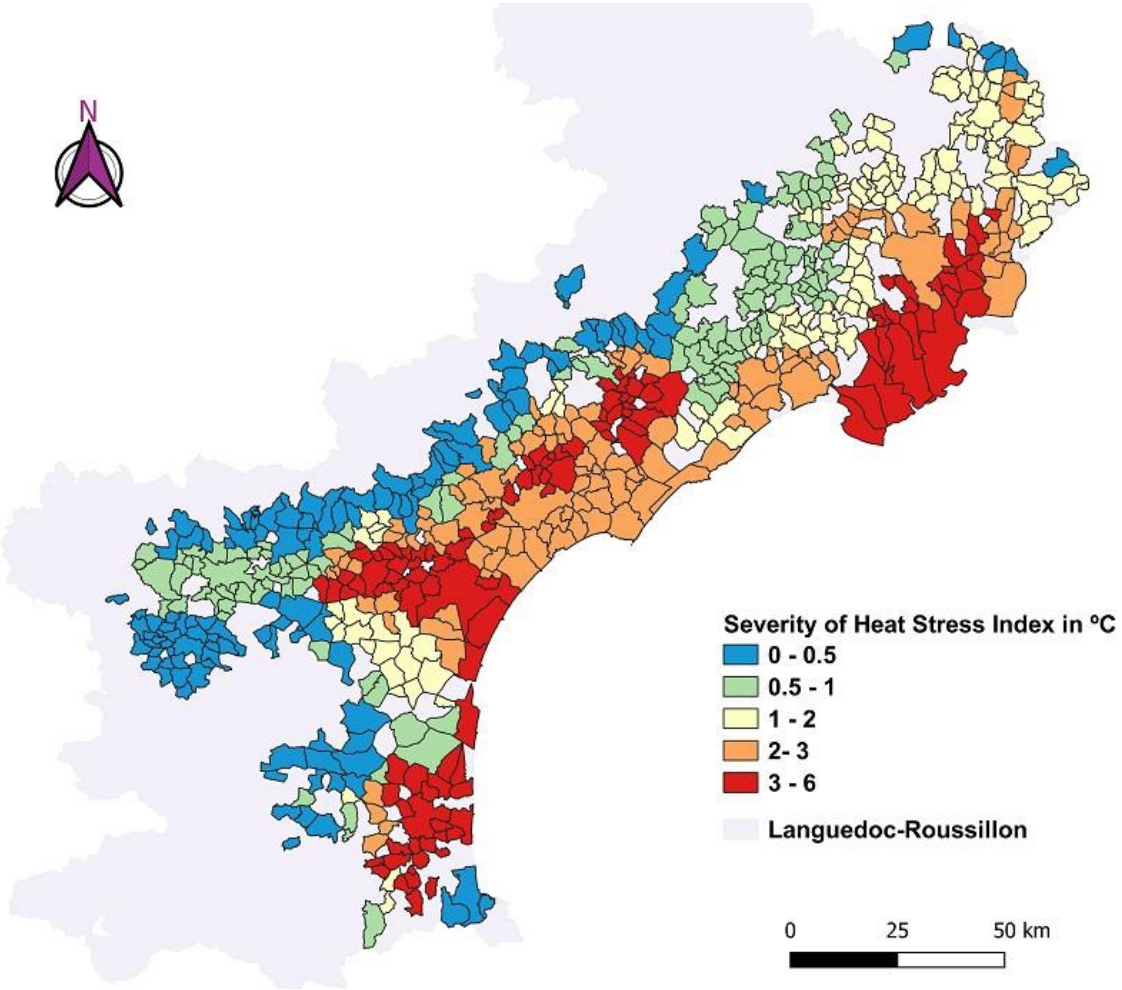
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S5. Very Hot Days per year - average for the 2010-2018 period.



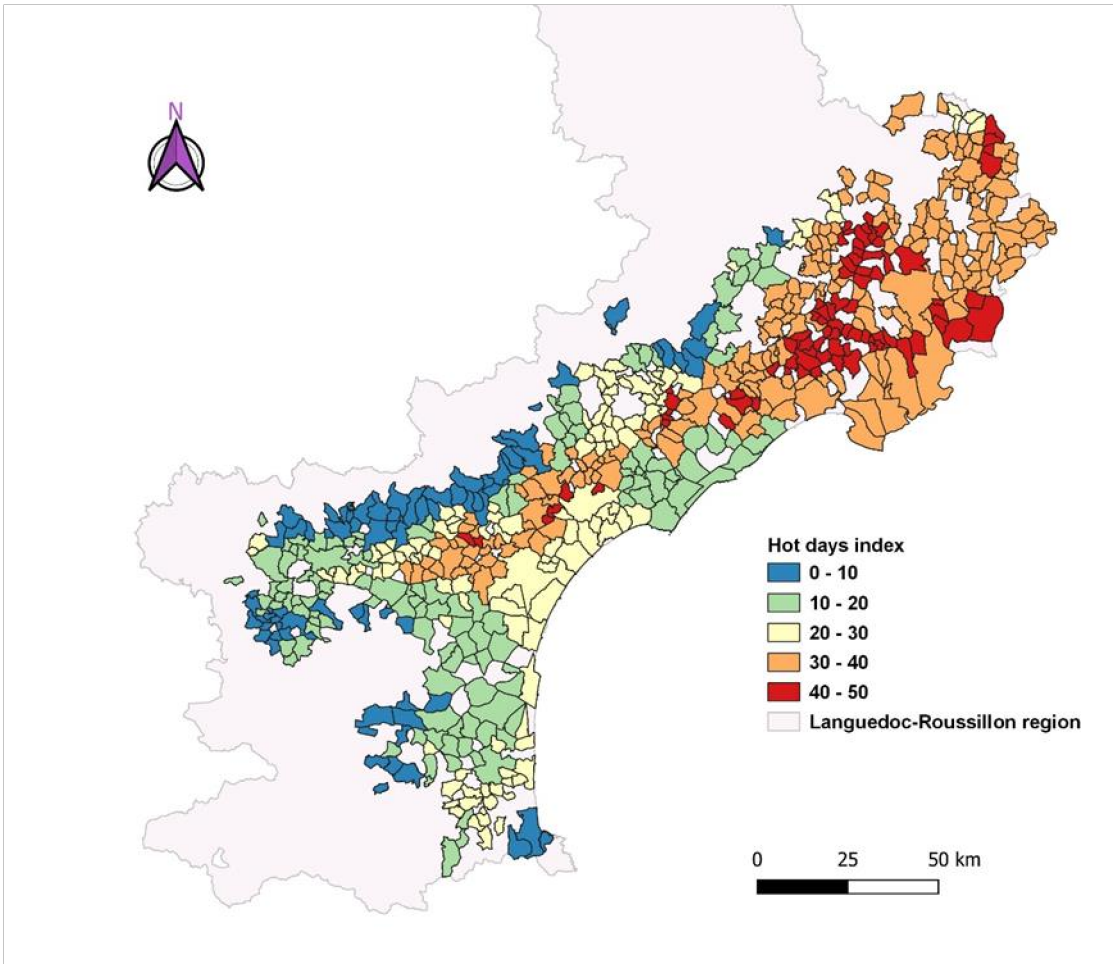
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S6. Severity of Heat Stress index - average for the 2010-2018 period.



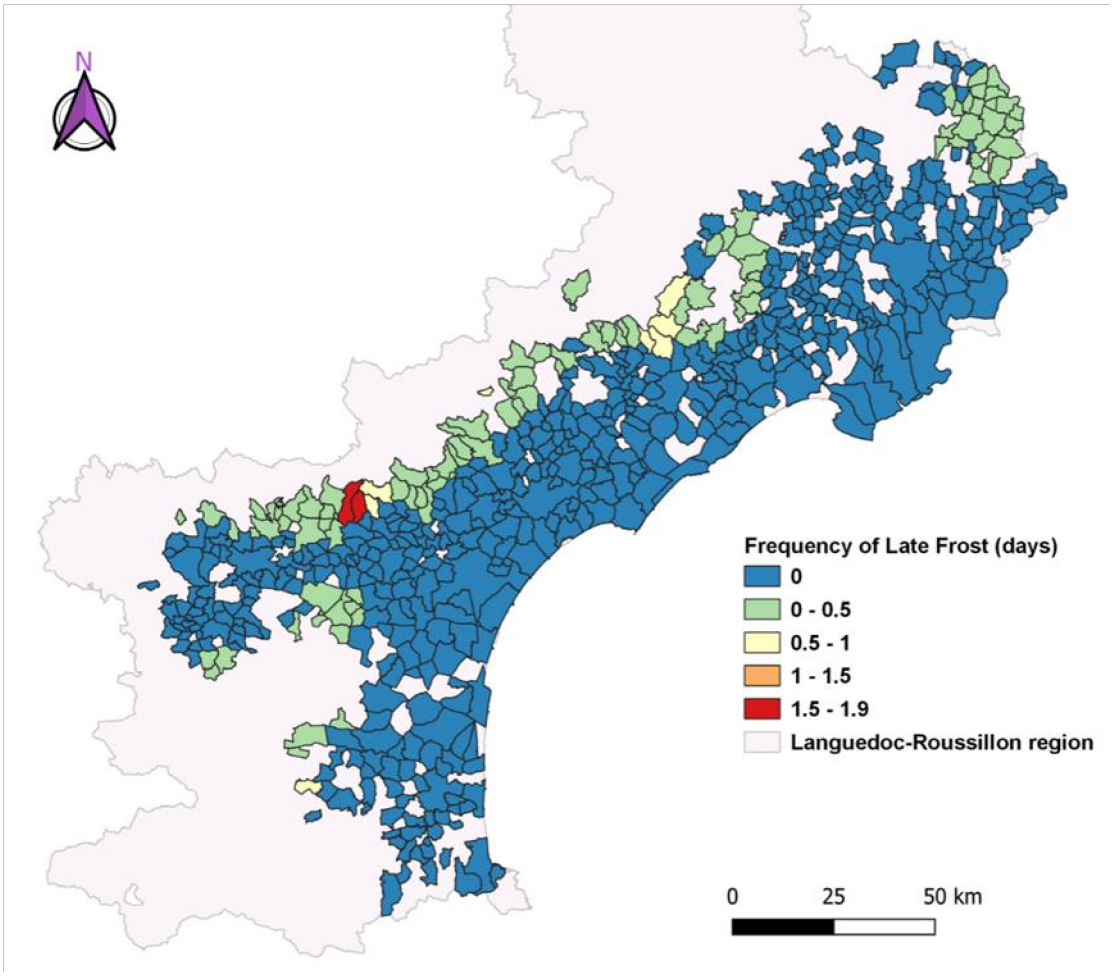
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S7. Hot Days index - average for the 2010-2018 period.



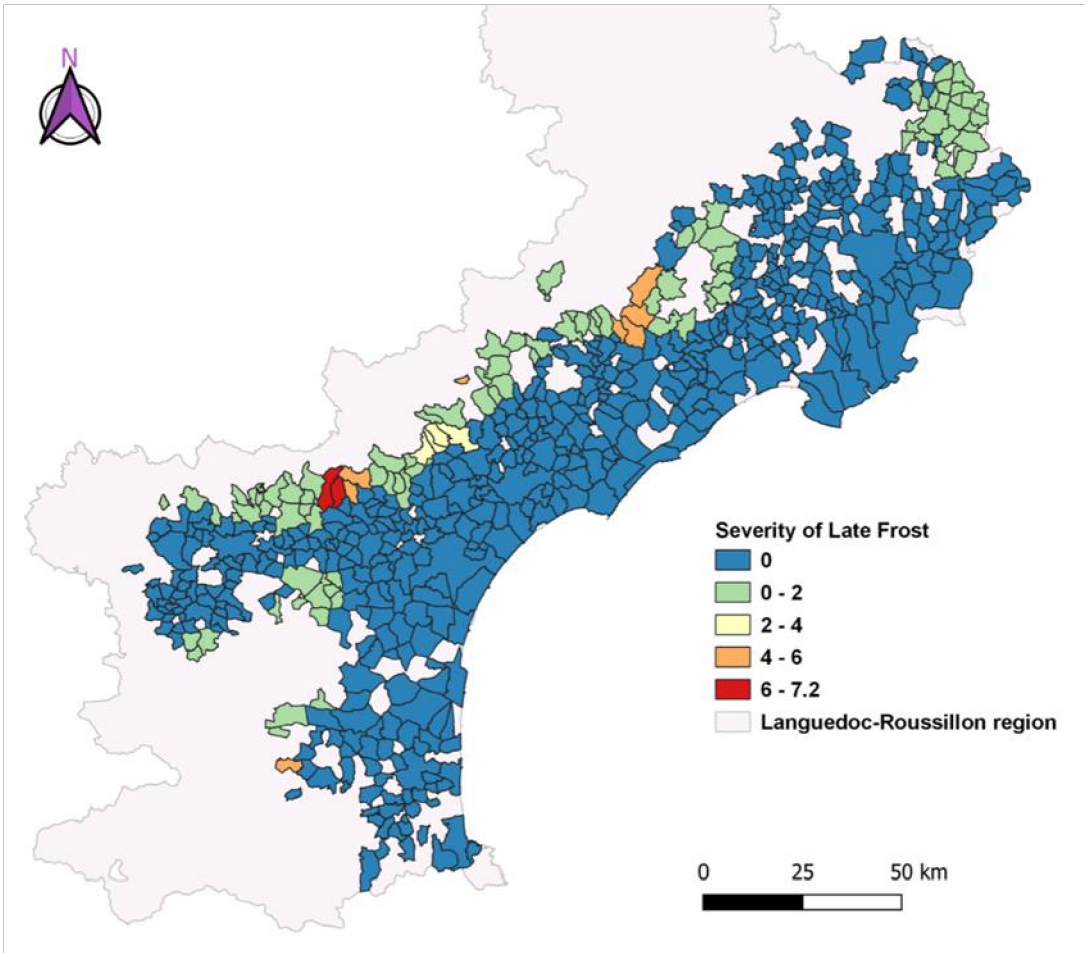
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S8. Frequency of Late Frost index - average for the 2010-2018 period.



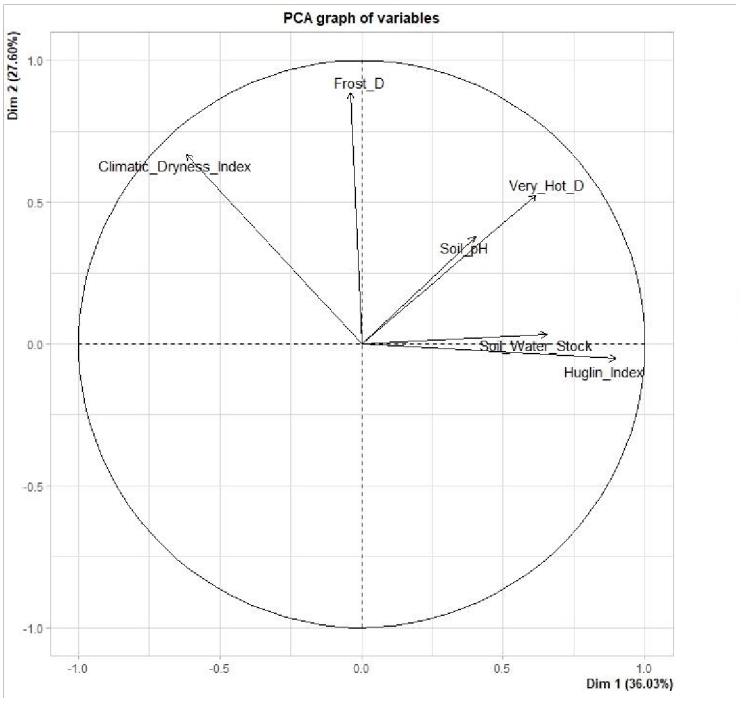
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

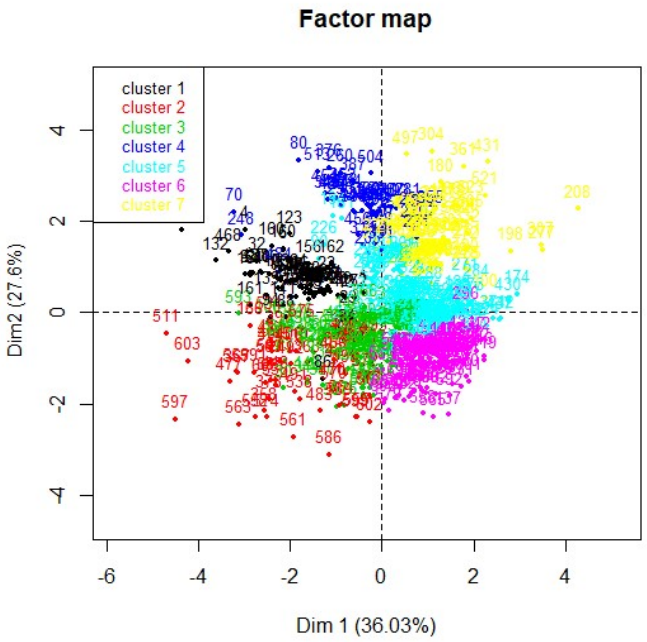
FIGURE S9. Severity of Late Frost index - average for the 2010-2018 period.

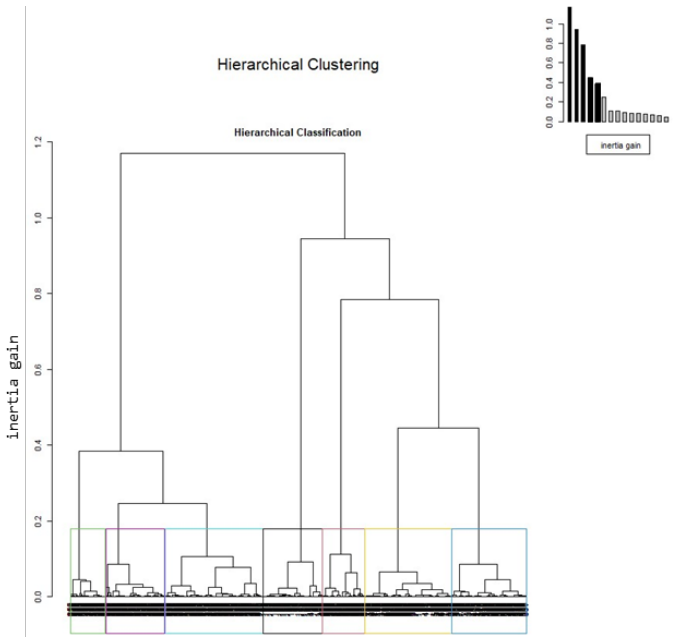


SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S10. Top left: variables projected in the first two first dimensions of the PCA. Top rht: individuals (municipalities) projected in the two first dimensions of the PCA. Below: dendrogram of the hierarchical clustering and inertia gain of the seven clusters, differentiated by colours corresponding to the plot in the top right-hand corner.

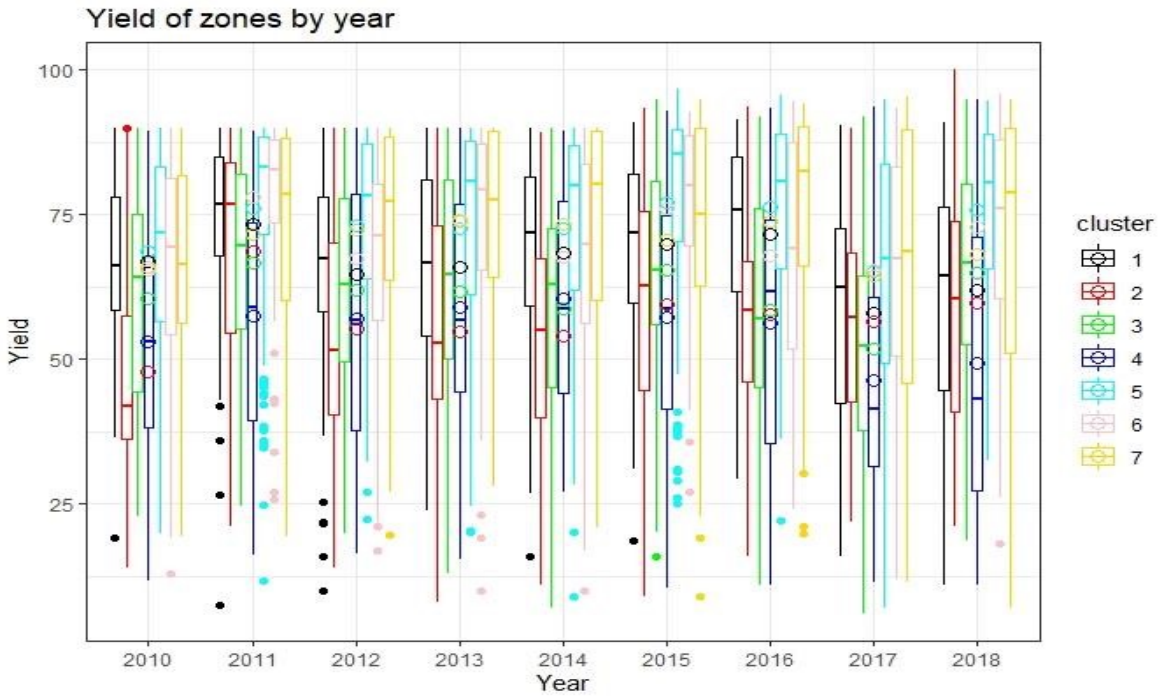






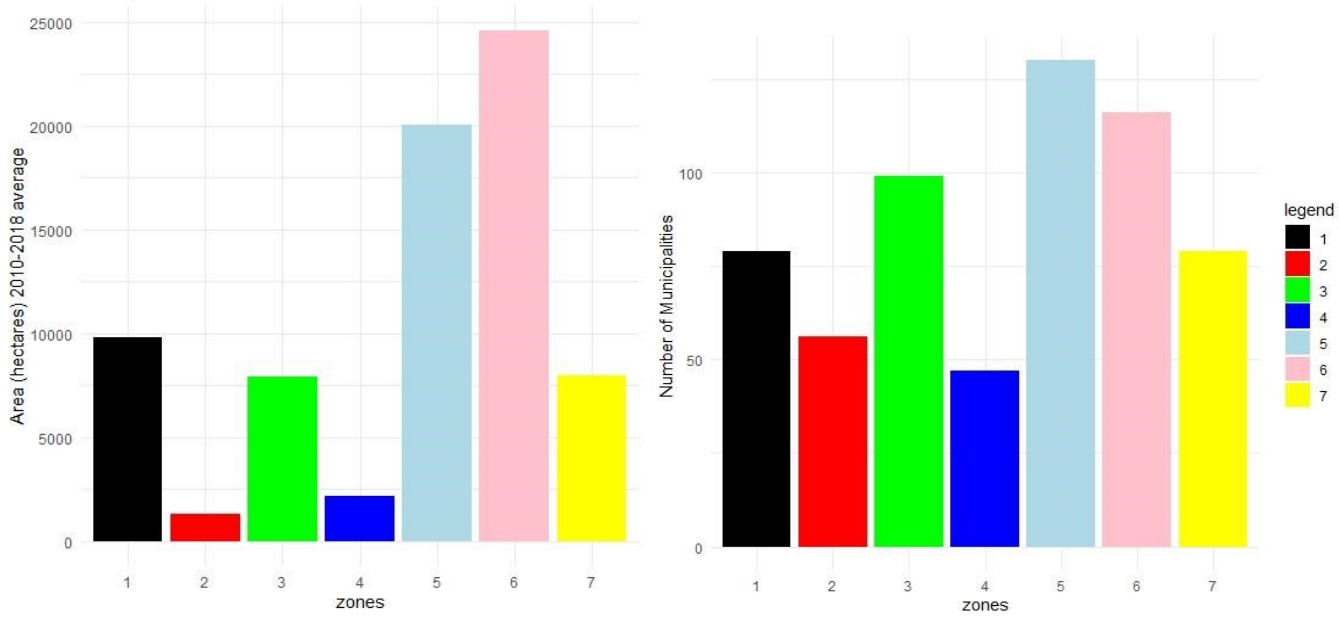
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S11. Temporal distributions of municipality average grapevine yields (n= 4455) in hl·ha-1·year-1 in the seven clustered zones in Languedoc-Roussillon. The boxplots represent the distribution in quartiles with median lines and dots as outliers.



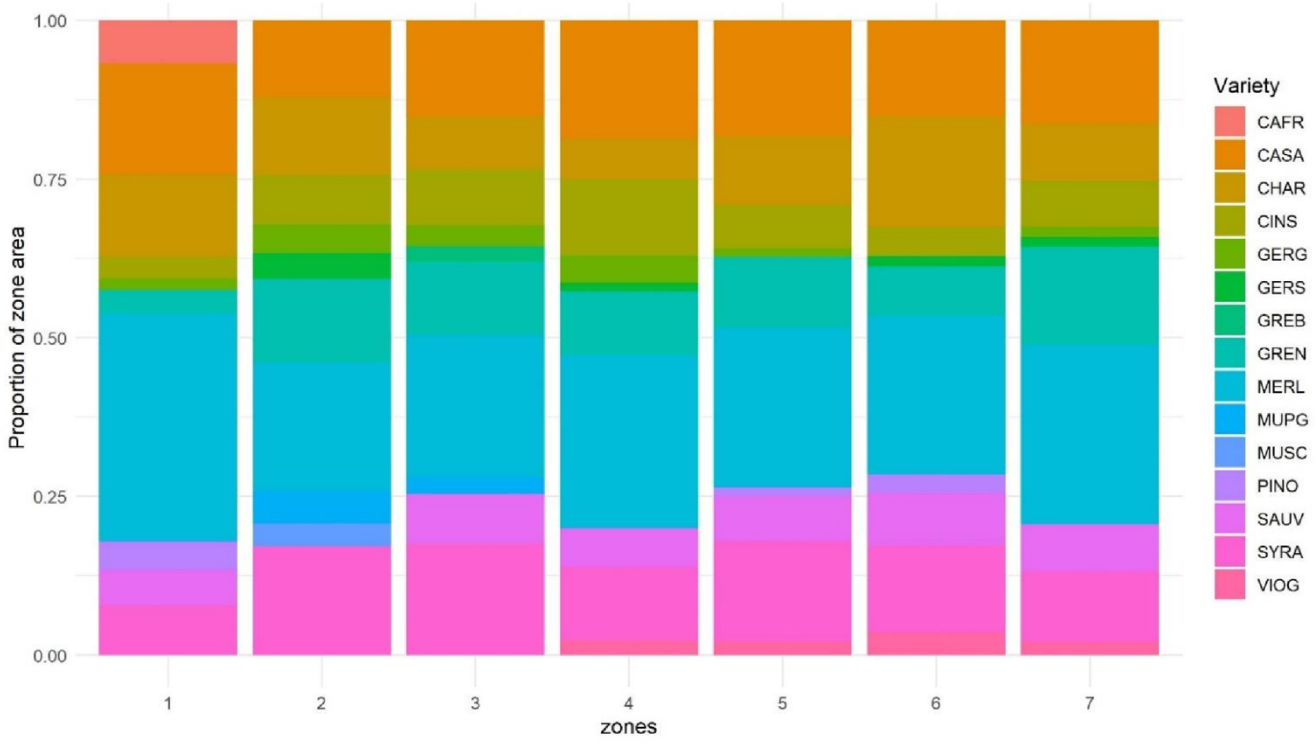
SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S12. Average grapevine area in hectares per year (left) and number of municipalities (right) in the seven pedo-climatic zones in Languedoc-Roussillon.



SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S13. Proportion of the zone cultivated areas planted with the main 10 grapevine varieties. The varieties abbreviations are: CAFR for Cabernet Franc; CASA for Cabernet Sauvignon; CHAR for Chardonnay; CINS for Cinsault; GERG for Générique Rouge (mixed red wine varieties); GERS for Générique Rosé (mixed rosé wine varieties); GREB for Grenache Blanc; GREN for Grenache Noir; MERL for Merlot; MUPG for Muscat Petit Grain; MUSC for Muscat; PINO for Pinot Noir; SAUV for Sauvignon Blanc; SYRA for Syrah and VIOG for Viognier. The p-value of the Chi-Square test of goodness of fit was 2.061e-09, indicating a significant unequal distribution across all zones.



SUPPLEMENTARY DATA
Fernandez-Mena, H., Guilpart, N., Lagacherie, P., Le Roux, R., Plaige, M., Dumont, M., Gautier, M., Graveline, N., Touzard, J.-M., Hannin, H., & Gary, C. (2023). Grapevine yield gap: identification of environmental limitations by soil and climate zoning in the region of Languedoc-Roussillon (South of France). *OENO One*, *57*(2).
https://doi.org/10.20870/oeno-one.2023.57.2.7246

FIGURE S14. Yield distribution of each of the nine most grown grapevine varieties per zone. The boxplots represent the distribution in quartiles with median lines. Circles represent the mean and filled dots are outliers. Letters correspond to Tukey's range test for means comparison. The dashed red line corresponds to the 90 hl·ha^{-1}·year^{-1}maximum label yield used for the yield gap calculation.

