SUPPLEMENTARY DATA
Doncieux, A., Yobrégat, O., Prudham, S., Caillon, S., & Renard, D. (2022).
Agrobiodiversity dynamics in a French wine-growing region. *OENO One, 56*(4).
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SUPPLEMENTARY DATA

Supporting Information Text

Diversity indices

$$H = -\sum_{i=1}^{S} p_i log p_i$$ Shannon-Weaver (1)

$$J = \frac{H}{log_2(S)}$$ Pielou evenness (2)

Where p_i is the area or relative abundance of grape variety i and S is the total number of grape varieties (Pielou, 1966; Shannon, 1948).

Details on the Casier Viticole Informatisé (CVI) database

Growers are identified by a unique identifier and are attached to a headquarters *commune.* Communal-level data need to be used with caution because growers may have plots located in *communes* that differ from the grower' headquarters.

National grape diversity

In order to evaluate the current diversity of grapevine varieties in the Gaillac wine-growing and compare it to the other French wine-growing regions, we used public CVI based data of grape variety inventory at communal level from FranceAgrimer for 2020. For each *commune*, the dataset includes the list of cultivated grape varieties, their respective areas, the number of farms that cultivate them and the total number of growers. In order to comply with statistical confidentiality, data on the area planted for a given grape is not provided if there are less than three farms cultivating it or if one farm holds more than 85 % of the wine-growing area. Moreover, a large share of area data is missing for the Champagne wine-growing area (Hauts-de-France, Grand-Est and Ile-de-France region) because of its specific legal status.

We first computed varietal richness for the ten wine production basins of France (Supplementary Table S3), which are the main wine producing areas (Code Rural et de la Pêche Maritime, 2006). *Communes* in each wine production basin were retrieved from the article D. 665-16 of the Decree n° 2017-1771 (27/12/2017) of the *Code Rural et de la Pêche Maritime*. Then, we calculated varietal richness and relative grape varieties abundance (Rgva) for each *commune* (N= 9,395 *communes*). For each *commune* in each wine-growing region, we obtained Rgva by dividing the number of farms growing variety i by the total number of farms in a given *commune*. Then, we calculated the average H Shannon index and the standard deviation across *communes* for the ten wine production basins (Supplementary Table S3 and Figure S4). These values were compared to the H Shannon index calculated for the Gaillac wine-growing region (N=68 *communes*) using the same data set.

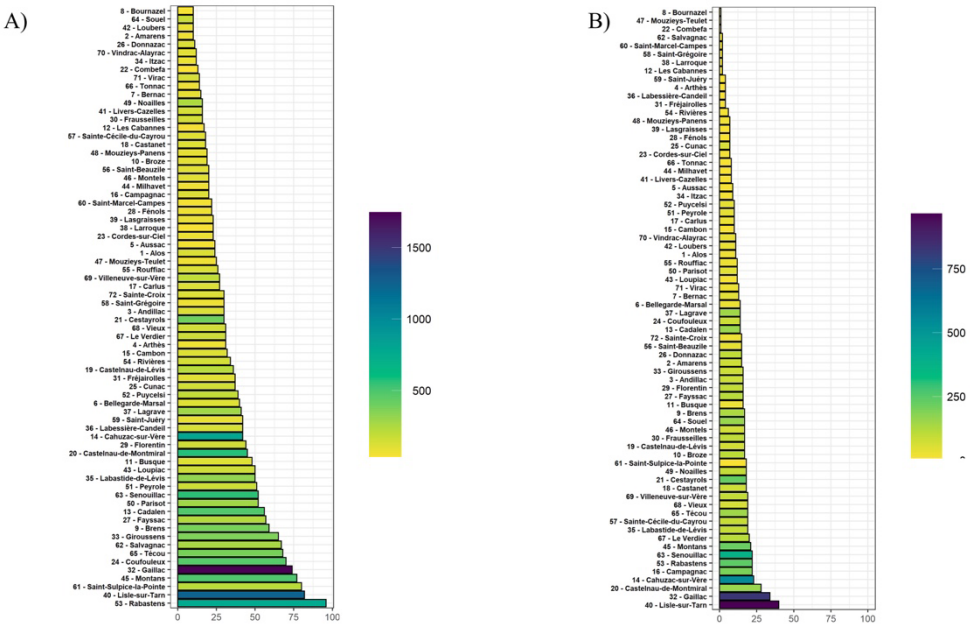
International and local grape varieties classification.

We defined international varieties following Robinson and Harding, (2015) which defines them as "vine varieties with an international reputation for their varietal wines ... [which] are planted in every major wine region in which they stand a chance of ripening" and categorizes Cabernet-Sauvignon, Chardonnay, Merlot, Pinot noir, Syrah, Sauvignon blanc, Riesling, Muscat Blanc a Petits Grains, Gewurztraminer, Viognier, Pinot blanc and Pinot gris as the main international varieties. The local grape varieties were listed using Plageoles (2006) classification which include grape varieties which are cultivated for at least five centuries in the vineyard: Mauzac blanc, Mauzac rose, Len de l'el, Ondenc, Verdanel, Duras, Braucol, Prunelard and Négrette.

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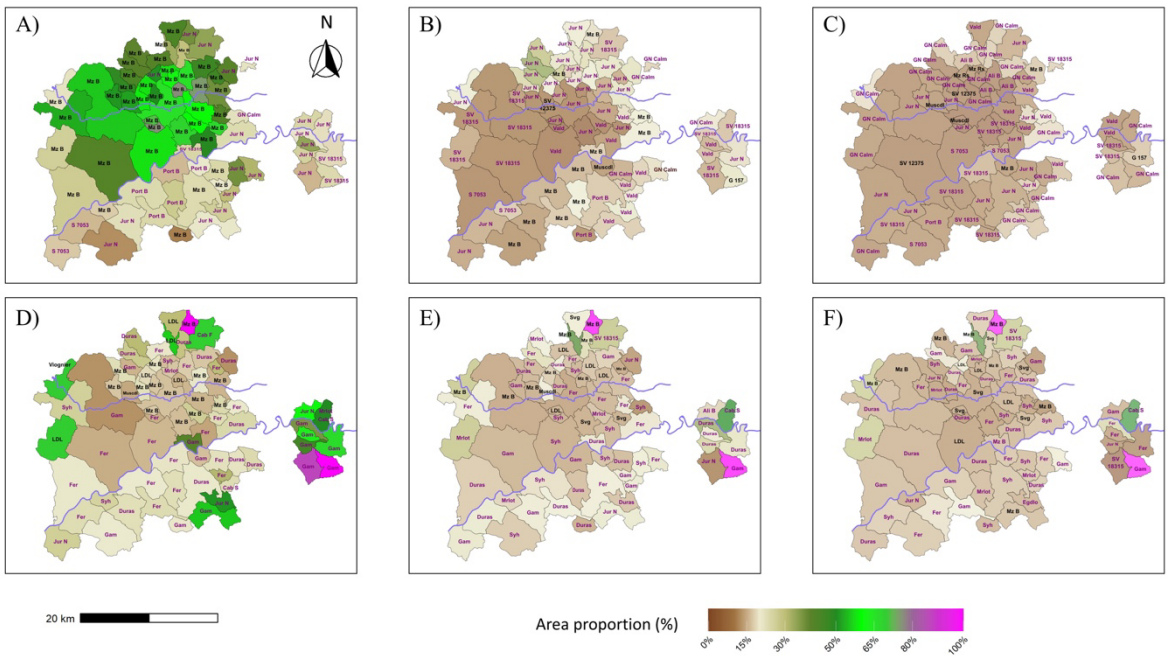
FIGS. S1 TO S4

Cartographic supports for surveys

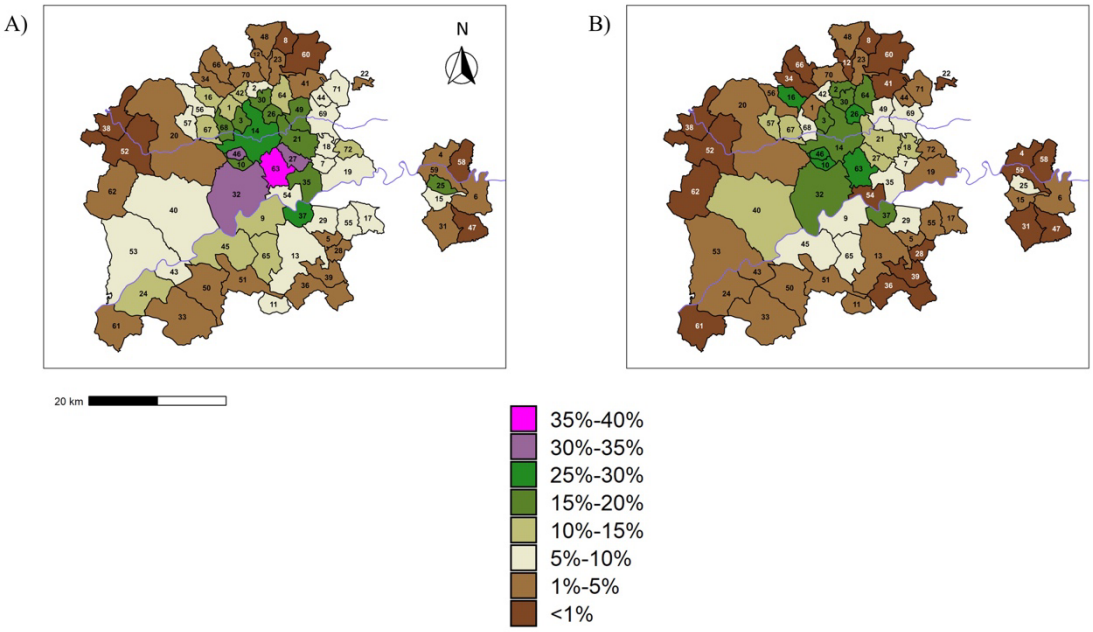


SUPPLEMENTARY FIGURE S1. Barplots represent the varietal richness index for the 72 *communes* for A) 1960 and B) 2020. Fill colors represent the planting area (in ha) for each date. Numbers correspond with the location of the different *communes* published in the Supplementary Figure S3.

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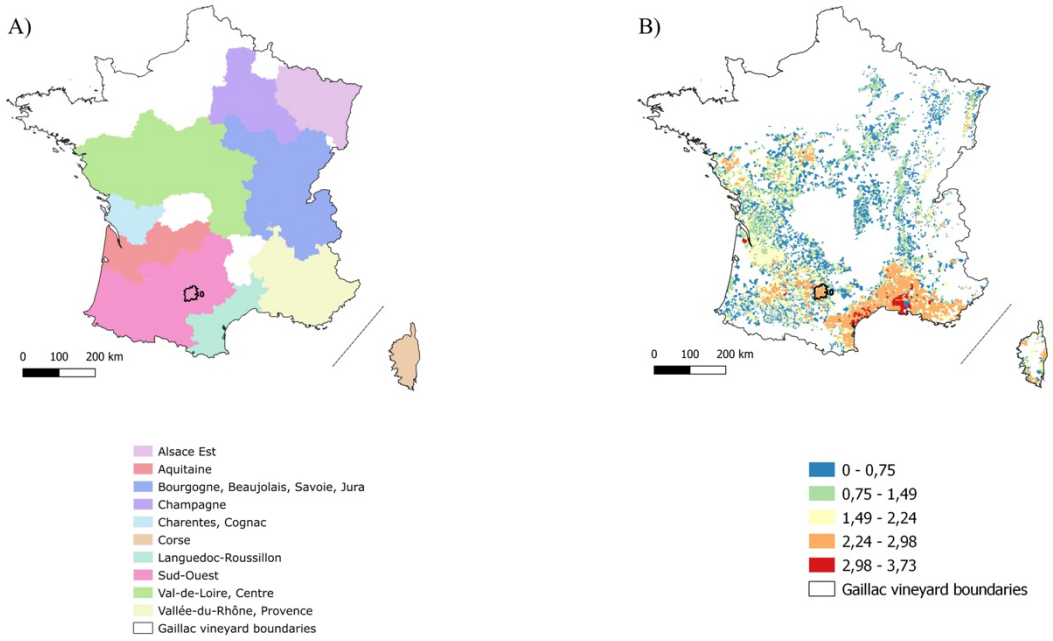


SUPPLEMENTARY FIGURE S2. A) The first, B) the second and C) the third most cultivated variety according to their cultivated area (in percentage) in 1960, D) the first, E) the second and F) the third most cultivated variety according to their cultivated area (in percentage) in 2020. Fill colors represent the proportion (in percentage) hold by each variety in a given *commune*. The name of the grape variety is print in black for the white varieties and in purple for the red varieties. Ali (Alicante Bouschet), Cab F (Cabernet-Franc), Cab S (Cabernet-Sauvignon), Egdlo (Egiodola), Gam (Gamay), G 157 (Gaillard 157), GN Calm (Grand noir de la Calmette), Jur N (Jurançon noir), LDL (Len de l'el), Mzc B (Mauzac blanc), Mrlot (Merlot), Muscdl (Muscadelle), Port B (Portugais Bleu), Svg (Sauvignon), Syh (Syrah), S 7053 (Seibel 7053), SV family (Seyve-Villard), Vald (Valdiguié).



SUPPLEMENTARY FIGURE S3. Maps showing the percentage of communal area dedicated to wine-growing for A) 1960 and B) 2020. 1 - Alos, 2 - Amarens, 3 - Andillac, 4 - Arthès, 5 - Aussac, 6 - Bellegarde-Marsal, 7 - Bernac, 8 - Bournazel, 9 - Brens, 10 - Broze, 11 - Busque, 12 - Les Cabannes, 13 - Cadalen, 14 - Cahuzac-sur-Vère, 15 - Cambon, 16 - Campagnac, 17 - Carlus, 18 - Castanet, 19 - Castelnau-de-Lévis, 20 - Castelnau-de-Montmiral, 21 - Cestayrols, 22 - Combefa, 23 - Cordes-sur-Ciel, 24 - Coufouleux, 25 - Cunac, 26 - Donnazac, 27 - Fayssac, 28 - Fénols, 29 - Florentin, 30 - Frausseilles, 31 - Fréjairolles, 32 - Gaillac, 33 - Giroussens, 34 - Itzac, 35 - Labastide-de-Lévis, 36 - Labessière-Candeil, 37 - Lagrave, 38 - Larroque, 39 - Lasgraisses, 40 - Lisle-sur-Tarn, 41 - Livers-Cazelles, 42 - Loubers, 43 - Loupiac, 44 - Milhavet, 45 - Montans, 46 - Montels, 47 - Mouzieys-Teulet, 48 - Mouzieys-Panens, 49 - Noailles, 50 - Parisot, 51 - Peyrole, 52 - Puycelsi, 53 - Rabastens, 54 - Rivières, 55 - Rouffiac, 56 - Saint-Beauzile, 57 - Sainte-Cécile-du-Cayrou, 58 - Saint-Grégoire, 59 - Saint-Juéry, 60 - Saint-Marcel-Campes, 61 - Saint-Sulpice-la-Pointe, 62 - Salvagnac, 63 - Senouillac, 64 - Souel, 65 - Técou, 66 - Tonnac, 67 - Le Verdier, 68 - Vieux, 69 - Villeneuve-sur-Vère, 70 - Vindrac-Alayrac, 71 - Virac, 72 - Sainte-Croix.

National grape diversity



SUPPLEMENTARY FIGURE S4. A) French wine-growing basin boundaries from the Decree D. 665-16 of the Rural and Maritime Fishing Code (2017) and B) Distribution of Shannon index for 9,395 *communes*.

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TABLES S1 TO S3

SUPPLEMENTARY TABLE S1. URLs of data sources.

Data	URLs
Agricultural census of 1960	https://www6.montpellier.inrae.fr/vassal
FranceAgriMer	https://visionet.franceagrimer.fr/
INSEE postal code	https://www.data.gouv.fr/fr/datasets/base-officielle-des-codes-postaux/
OpenStreetMap	https://www.data.gouv.fr/fr/datasets/decoupage-administratif-communal-francais-issu-d-openstreetmap/
Pl@ntgrape	https://plantgrape.plantnet-project.org/en
Vitis International Variety Catalogue	www.vivc.de

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SUPPLEMENTARY TABLE S2 - Evolution from 1960 to 2022 of the varietal regulations involved for red and *rosé* wines.

	1960-1966		1966-1970		1970-1983		1984-1990	1990-1992	1993-1999	2000-2011	2011-2017	2017 - today
Red varieties	Red	*Rosé*	Red	*Rosé*	Red	*Rosé*	Red and *rosé*	Red and *rosé*	Red and *rosé*	Red and *rosé*	Red and *rosé*	Red and *rosé*
Fer (F) Duras (D) Syrah (S)				The sum or the presence of S,D,F <= 20 %	>= 60 %	<= 20 %	>= 60 %	>= 60 % *For D,S,F: the combination of two or three grape varieties >= 20 %*	>= 60 % *F+D >= 10 %* *For D,S,F: the combination of two or three grape varieties >= 30 %*	>= 60 % *F+D >= 10 %* *For D,S,F: the combination of two or three grape varieties >= 30 %*	*F >= 10 %* *D >= 10 %* *F+D >= 40 %* *S <= 20 %*	*>= 70 %* *Two grape varieties are mandatory* *For D,F,P taken together or separately must be >= 40 %*
Gamay												
Négrette							x	x	x	x	x	x
Prunelard (P)				x	x	x	x	x	x			
Cabernet-Sauvignon Cabernet-Franc Merlot					<= 40 %	<= 30 %	<= 40 %	<= 40 %	<= 40 %	<= 40 % *P since 2008*	<= 40 % *P <= 10 %*	<= 30 %
Portugais bleu				RS			x	x	x	x	x	x
Jurancon noir						<= 50 %	x	x	x	x	x	x

RS: Restricted in a particular area. A black cross means that the variety was not authorized. Colors represent principal grape varieties (in orange) and accessory grape varieties (in green). For example, from 1970 to 1983 and for *rosé* wines, growers were allowed a maximum of 50 % of Jurançon noir for the production of *rosé* wines. The Cabernet-Sauvignon, Cabernet-Franc, Merlot and Portugais Bleu varieties must not exceed 30 % of the total area. The Fer, Duras, Syrah, Gamay and Négrette varieties should not exceed 20 % of the total area. For red wines, over the same period of time, the Fer, Duras, Syrah, Gamay and Négrette varieties had to account for at least 60 % of the total area. The other grape varieties should not exceed 40 % of the total surface of the farm.

SUPPLEMENTARY TABLE S3. Diversity indexes at the communal scale for the ten French wine producing basin and Gaillac vineyard. The Gaillac region is part of Sud-Ouest basin and was isolated for comparison purposes. Data: FranceAgrimer (2020).

Wine-growing bassin	Total varietal richness	Mean varietal richness	Mean relative H Shannon index
Alsace, Est (N = 674)	53	3.88 ± 3.74	0.8 ± 0.8
Aquitaine (N = 751)	134	6.56 ± 4.91	1.3 ± 0.7
Bourgogne, Beaujolais, Savoie, Jura (N = 1,285)	135	3.66 ± 3.1	0.8 ± 0.7
Champagne (N = 351)	10	2.36 ± 1.09	0.6 ± 0.4
Charentes, Cognac (N = 685)	71	5.34 ± 3.42	1 ± 0.6
Corse (N = 101)	40	6.68 ± 4.93	1.5 ± 0.7
Languedoc-Roussillon (N = 903)	183	17.42 ± 10.57	2.2 ± 0.7
Sud-Ouest (N = 2052)	160	5.33 ± 5.05	1.2 ± 0.8
Val-de-Loire, Centre (N = 1,620)	97	4.84 ± 4.31	1 ± 0.7
Vallée du Rhône,Provence (N = 973)	207	12.54 ± 10.8	1.7 ± 0.9
Gaillac vineyard (N = 68)	60	12.85 ± 7.34	2.15 ± 0.71

When compared to the diversity of varieties grown today in the other ten wine-growing regions in France, the Gaillac vineyard is one of the most diverse with an average H index of 2.1 ± 0.7 (N= 68 *communes*). Across France, values of the H' index ranged from 0.6 ± 0.4 (N= 351) for the least diverse Champagne region to 2.2 ± 0.7 (N= 903) for the most diverse Languedoc-Roussillon region (Supplementary Figure S4).

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