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Given the lack of sources that historical demography typically uses to describe populations' demographic behaviour, little is known about the population structure of France during the Middle Ages. One must therefore rely on—and decipher—other types of information often collected for economic purposes. In this article, the authors examine the inventory of peasant families working for the Abbey of Saint Victor in Provence in the 9th century. The age structure of this population can be used to deduce new information on family sizes and types, where they were settled, and age-specific mortality risks.

To better understand early medieval population dynamics and family formation, we analyse an ancient source: the polyptych of the Abbey of Saint Victor in Marseille, in the Provence region of southern France, compiled between 813 and 814.(1) While the polyptych's information is limited, it is one of few written sources to offer quantifiable demographic data for the period.

Little is known about the early medieval European population. General estimates of its size have been proposed (McEvedy and Jones, 1978), and recent palaeodemographic analyses indicate that early medieval Europe was characterized by heterogeneous demographic regimes (Barbiera and Dalla-Zuanna, 2009; Séguy and Buchet, 2013; Barbiera et al., 2018; Steckel et al., 2019). Yet such studies have not shed light on either marriage systems or fertility.

While not representative of the demography of Provence, much less that of early medieval Europe, the Marseille polyptych does allow previous findings to be incorporated and further explored. A novel and attentive demographic analysis of the data can be used to discern the sex and age structure, marital regime, workforce organization, as well as the role of mobility. Based on these results and the literature, we identify a plausible mortality and birth regime.

(1) The document is a parchment scroll, measuring 2.16 metres by 25 centimetres. It was published by Guérard in 1857.

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These findings can be compared to other late medieval populations, thus increasing our knowledge of European population dynamics before the spread of property surveys and parish registers.

Polyptychs are inventories of land tenures and the peasants working on them, compiled by owners to control their properties. They offer the clearest available picture of the tenures' components and productive capacities. Together with the many sources of the Carolingian period, they reflect an effort to create a semblance of order and organization (Fourquin, 1975). Polyptychs were drawn up according to varied formal standards and could include a description of the territorial composition of the estates, a list of the kinds of workers employed, and an account of the dues and required tasks. Of the dozen preserved polyptychs dating from the 9th to the 10th centuries, only four record both the properties and the individuals employed. These four were compiled by the following monasteries: Saint Victor in Marseille, Saint-Germain-des-Prés in Paris (829), Saint-Remi in Reims (after 848), and the Abbey of Farfa in the Abruzzi region of Italy (ca. 829).

The names attributed to these polyptychs are somewhat misleading. They list assets and families concentrated not in the monastery areas themselves, but scattered over large areas, whose economic dependence on the monastery varied.

Neither were there any shared rules in their compilation. As underlined by Devroey (1981), each document has its specificities, reflecting different ways of using and organizing the land, and thus necessitates a detailed analysis that considers both the compilation system and the landowners' point of view.

The polyptych of Saint-Germain-des-Prés lists the properties' extension and tenants, along with their duties to the monastery, from which household size can be deduced (Herlihy, 1985). The Farfa polyptych describes kinship ties between individuals, enabling detailed analysis of peasant household structures (Ring, 1979; Feller, 1994). The polyptych of Saint-Remi is the most specific in describing the properties and the duties owed by the household heads settled on each property, though household components are missing (Devroey, 1981). Given their rich information, these three sources have been studied extensively in recent decades (Ring, 1979; Devroey, 1981; Herlihy, 1985; Devroey, 1993; Feller, 1994). In contrast, the polyptych of the Abbey of Saint Victor describes properties and kinship types less precisely and thus has been neglected by scholars (Renard, 2012). Work has mainly aimed to locate the farms accurately and has developed several hypotheses on the area's population distribution (Sauze, 1984; Devroey, 2004; Faith, 2010; Renard, 2012). Nonetheless, this polyptych is unique in that the ages of children are recorded with precision, allowing the age structure of an early medieval population to be reconstructed for the first time. Except for the study by Zerner-Chardavoine (1981), which considered only the children listed in the document, more detailed demographic analyses are lacking. Our contribution aims to fill this gap.

Given that this source was not designed for demographic purposes, but rather reflects seigneurial interests—and thus only records individuals directly connected to the Abbey's scattered properties—we first assess whether the registered population represents a coherent set producing a consistent population structure. The polyptych can then be investigated from a demographic and social perspective, focusing on the listed population and the way farms were organized.

In Section I, we contextualize the demographics of Europe and southern France during the early Middle Ages. In Section II, we explain the polyptych's structure, particularly the ways individuals, families, and farms are listed and described. In Section III, we reconstruct the population's structure by age and sex, comparing it to that of other populations of medieval and modern Europe. In Section IV, we reflect on the demographic dynamics generating the above age structure, also employing standard life tables. In Section V, we discern the marriage pattern, based on sex, age, and marital status data. Finally, in Sections VI and VII, we use the information on farm, family, and farm-head characteristics to conduct a differential analysis, aimed at highlighting the power dynamics between farmers and the Abbey of Saint Victor.

I. Population decline and resurgence in southern France

Estimated European population trends suggest that a first demographic decline took place during the economic crises of the 3rd century. A second critical period occurred during the 4th and 8th centuries, which witnessed the fall of the Roman Empire, barbarian migrations, and then the Plague of Justinian in the mid-6th century (Biraben, 1975; Biraben and Le Goff, 1975; Little, 2008; Green, 2014). A slow recovery likely began at the end of the 9th century, accelerating in the 11th century (McEvedy and Jones, 1978; Bardet and Dupâquier, 1997).

Similar trends of decline and recovery characterized the population dynamics of the period in Gaul (or *Gallia*, the Latin name for present-day France), although differences have also been highlighted. More specifically, an estimated population of 5.8 million during the 1st century most probably decreased during the 3rd and 4th centuries due to economic crises (McEvedy and Jones, 1978; Étienne, 1988). Such declining trends persisted until the 5th century and then worsened in the mid-6th century. From this time on, the Justinianic Plague, first documented in written sources[(2)] in 543 in southern France and the area of Lyon, provoked a new phase of demographic decline that lasted approximately until the middle of the 8th century (Biraben and Le Goff, 1975).

(2) Written sources document the spread of the Justinianic Plague in Mediterranean areas, particularly those touched by trade, although genetic analyses have also shown its presence in the cemetery of Aschheim, in Upper Bavaria, where according to ancient sources it had not spread (Wiechmann and Grupe, 2005).

The end of the plague, followed by the political stability brought on by the reign of Charlemagne (768–814), saw a period of economic steadiness and demographic growth. The Carolingian Renaissance brought not only a flourishing of culture but also relative peace and the growth of estates, particularly those owned by ecclesiastical institutions, such as monasteries (Bautier, 1988).

This broad picture was likely marked by local and regional variance, although relatively little is known in this regard. Indeed, limited information is available for the time preceding the spread of parochial registers beginning in the late 16th century. Scholars generally agree, however, that northern and southern Gaul experienced quite different political and economic trends. While northern Gaul witnessed a period of instability after the Roman Empire came to an end, southern Gaul's experience was less dramatic, as continuity with the Roman system was stronger than in other regions of Europe. The Roman senatorial aristocracy maintained its power, large-scale land properties persisted, and taxes were likely still collected during the 7th century (Wickham, 2005; Halsall, 2007). This area then became more unstable beginning in the 8th century due to tensions with Muslims in Spain and Saracen attacks starting in the 9th century (Bautier, 1988).

Further insights into population trends for this region are also offered by palaeodemographic analyses (Deverly, 2005; Mafart, 2007). In a previous study of 10 cemeteries in southern France between the 1st and 11th centuries (Barbiera et al., 2017), we estimated an indicator *d*, or the ratio between deaths at ages 5–19 and those at age 5+. Merging all the necropolises, this indicator is 0.20. We show that this value should correspond to a life expectancy of around 20 years. In Section IV, we assess whether the age structure of the Saint Victor polyptych is compatible with this mortality estimate, which corresponds to the South Europe high-mortality life table model (Woods, 2007).(3)

II. The farms of the Abbey of Saint Victor and their distribution

Written in medieval Latin, the polyptych of the Abbey of Saint Victor was drafted in 813–814 under the authority of the Abbot Wadalde (for this reason, it is often referred to in the French literature as the *polyptyque de Wadalde*). It describes the monastery's tenurial units and lists their settlers by name and different types of attributes. Only the farm head is identified by the type of connection to the monastery (e.g. *colonus*, *mancipium*, *accola*, *verbecarius*). If two or more families inhabited the same farm, the kinship relationship between the heads of families is only occasionally indicated, and the families are listed in succession. Within each family, the link (wife, husband, son, and daughter)

(3) Woods (2007) proposed several standard life tables for South Europe based on different mortality indicators deduced from the analysis of populations ranging from the times of ancient Greece to the beginning of the 20th century. Unlike the more well-known tables of Coale and Demeny (1983), these are not the result of extrapolations for higher mortality levels (life expectancy at birth < 30 years).

to the head of the family is noted along with several attributes that can be used to identify different variables of demographic interest, as discussed below.

The document bears the title *descriptio mancipiorum*, literally 'inventory of slaves', yet scholars agree that the term *mancipium* should be understood in the generic sense of 'employee' (Rio, 2017). According to Carrier (2012), the document's purpose was to reorganize the peasantry and relocate the future population. This would explain the accuracy in recording the ages of children and the number of youths, or those individuals who would one day work the Abbey's lands. Another hypothesis suggests that the polyptych was drafted to establish land property rights against aristocratic and peasant claims (Rio, 2017). One hypothesis does not necessarily exclude the other, however; the document may have been written to overcome tensions over land properties and control the peasantry, or to arrange possible relocation.

The document lists 272 farms (identified mostly by the term *colonica*), located in 14 districts in Provence, covering both low lands and highlands in the Alps. Among these, 127 are described as *apste*, or empty, which has sparked much debate among scholars. According to Weinberger (1973), for example, the high proportion of empty farms is a sign of demographic decline and instability provoked by Saracen attacks. Some scholars trace these attacks in southern France back to the early 9th century, which would thus have impacted the people recorded in our document (Renard, 2012). Others, however, believe that their destabilizing effects on Provençal society began only after the reign of Charlemagne (Poly, 1976). Zerner-Chardavoine (1981), based on her analyses of children, suggested that the registered families experienced a period of demographic recovery. That 16 of the farms identified as *apste* were actually inhabited by single individuals or one or more families suggests that a reorganization of tenants was under way (Zerner-Chardavoine, 1981; Carrier, 2012). Moreover, in 23 of the empty farms without dwellers, the document compilers added the words *pasco* (two occurrences) or *pasco verbecem* (21 occurrences), possibly indicating that these lands were used as pasture (*pasco*), mainly for sheep (*verbecem*) and perhaps seasonally.

Thanks to previous work (Sauze, 1984; Devroey, 2004; Faith, 2010; Renard, 2012), it is possible to locate 177 farms (88 in the plains/hills and 89 in the mountains, at least 600 metres above sea level).[4] Among the farms in the plains/hills, 61% were empty (and without dwellers), while among those in the Alps only 27% were empty, suggesting a higher concentration of farm dwellers in the highlands. The shift of settlements towards higher lands, starting in the 5th century, is documented by archaeological research in Provence. Apart from the effect of the Saracen attacks, climatic changes during this period could have provoked hydrological disturbances, affecting settlements located near

(4) The precise location has been identified for 84 of the farms, while for the other 93 farms we know whether they were in fully mountainous or in fully plain/hilly districts, and can thus distinguish between highland and lowland farms.

the bottom of hillsides and fluvial channels, and leading to the decline of certain arable lands and the occupation of new areas (Constant et al., 2015).

Most of the settlements are described as *colonicae,* generally indicating a farm, although 20 are defined as *vercarias*, suggesting they were primarily devoted to raising sheep or goats. The latter were all in the highlands, and five were uninhabited. Various scholars believe, however, that all farms had a mixed economy based both on the raising of sheep and pigs and the cultivation of cereals (Faith, 2010). This hypothesis is supported by the types of fees due to the monastery and annotated in the document. Although only sporadically recorded and thus unusable for a detailed study of the extension and economy of all the farms (e.g. fees in money are annotated for only a few *vercarias*), they nonetheless indicate that peasants owed the monastery taxes in money or in goods such as poultry, livestock, or, more generally, meals.

Devroey (2019) showed that the early 9th century was characterized by climatic instability, combined with a bovine plague that spread during the period 800–824 and that may even have altered the use of such animals in agricultural production. These events appear to have provoked a crisis in cereal production with a consequent rise in prices. Nonetheless, low population pressure and the settling on diverse landforms (plains, hills, and mountains) offered peasants flexibility in the ways they could react to crises (Devroey, 2019). The period between the 7th and 9th centuries was therefore characterized by a slow increase in production, interrupted regularly by crises, the shock of which stimulated the resourcefulness of peasants and the coordinated reactions of elites.

III. Population structure

Based on age, sex, and family relationship information reported in the polyptych, we begin by estimating the population size and its age-sex structure to discern whether the registered individuals, albeit scattered across a large territory, represent a coherent population.

1. Estimating the population by age and sex

The document lists 935 individuals and records for each their name (thus sex), marital status, and kinship relations (*uxor* [wife], *maritus* [husband], *filius* [son], *filia* [daughter]). The ages of children are also registered, most frequently between 3 and 10; only a few are reported as aged 1 or 2, while a high number are listed as *infans ad uber* (breastfeeding). A very low number of children aged between 10 and 15 is recorded. A separate group of individuals, boys and girls, is defined as *baccalarius* or *baccalaria*. Scholars agree that this term was the precursor of the word 'bachelor' and indicates young unmarried individuals (Zerner-Chardavoine, 1981; Faith, 2010). This

hypothesis is supported by the observation that 70% of *baccalarii* in the document are described as children, and most do not have either a spouse or children. Only two of the 129 male *baccalarii* had a wife, while among the 122 female *baccalariae*, only one was married and four had children. Thus, we conclude that *baccalarii* and *baccalariae* were young individuals, almost all unmarried, who still lived with their parents. In addition, a group of children of unspecified ages is recorded as *ad scola* (at school). Generally, we observe an age heaping around years 5 and 10 (Table 1). The ages of adults are unrecorded.

Table 1. Age and sex of children and youths precisely registered in the polyptych of the Abbey of Saint Victor, Marseille

Sex	Child age groups				Children by age												Youths		Total
	Infans ad uber	*Infante*	*Ad scola*	Age illegible	1	2	3	4	5	6	7	8	9	10	11	12	15	*Baccalaria*	*Baccalarius*	
Male		7	8	2		1	7	7	7	3	4	11	2	9	1	1	1		129	200
Female		3	4		1	3	7	5	21	10	6	4	5	10	1		2	122		204
Unspecified	30	2					2	1	5	2				1						43
Total	30	12	12	2	1	4	16	13	33	15	10	15	7	20	2	1	3	122	129	447

Source: Authors' calculations.

Moreover, some individuals are described as children, but their number is unreported. For instance, in Villa Betorrida, Colonica in Curia, a man named Saumo is listed *cum infantes suos* (with his children), or in Agro Galadio, in Vercarias in Nannas, Maria and her husband are listed *cum infantes suos* (with their children). The polyptych contains 59 family units for which children are generally listed with notations such as *infantes suos, cum infantes suos, filii eorum, filios suos* (all meaning '[with] their children'). Although 'children' is always plural, it may have been standard to indicate 'with children' even in cases of just one child, as is the practice in modern Romanic languages. We estimate the number of children in these family units, distributing them following the proportion of units with known numbers of children (Table 2). Among the 131 family units with known numbers of children, 15% had one child, 22% had two children, 18% had three children, etc. Based on these percentages, for the 59 family units with unreported numbers of children, we estimate that about nine had one child, 13 had two children, and so on. This procedure allows us to calculate the total number of unreported children by multiplying these family units by their respective number of estimated children. For instance, the 9.01 units with one child add nine individuals, the 13.06 units with two children add 26 children, the 10.36 units with three children add another 31 children, and so forth.

This estimation results in 206 additional individuals. We define them as children when described in the polyptych as *infantes* (199 individuals), and as adults (5) and youths (2) when described as *filii*, according to the distribution of youths and adults of known age (see Table 3). Thus, the total population

Table 2. Estimate of children in family units with an unreported number of children from the polyptych of the Abbey of Saint Victor, Marseille

Number of children	Number of units with known number of children	Proportion of units with known number of children	Breakdown by number of children of units with unreported number of children	Estimated number of unreported children
(a)	(b)	(c) = (b) / 131	(d) = (c) × 59	(e) = (d) × (a)
1	20	0.15	9.01	9
2	29	0.22	13.06	26
3	23	0.18	10.36	31
4	21	0.16	9.46	38
5	19	0.15	8.56	43
6	9	0.07	4.05	24
7	5	0.04	2.25	16
8	3	0.02	1.35	11
9	2	0.02	0.90	8
Total	131	1.00	59.00	206

Source: Authors' calculations. Numbers are rounded.

Table 3. Population structure by age group and sex in the polyptych of the Abbey of Saint Victor, Marseille

	Children aged 0–12.5	Youths aged 12.5–22.5	Adults aged 22.5+	Total
Males	70	130	254	454
Females	80	124	234	438
Sex unknown[(a)]	43	0	0	43
Estimated	199	2	5	206
Total	392	256	493	1,141
Total (%)	34	22	44	100
M/F sex ratio	0.88	1.05	1.09	1.04

(a) Of these children, 30 are cited as *ad uber* (breastfeeding), therefore presumably half males and half females aged 0–2 (see Table 1).
Source: Authors' calculations.

living in the lands of the Abbey listed in the polyptych amounts to an estimated 1,141 individuals.

We then use these data to reconstruct the structure of the population by age group and sex. The general sex ratio of the total population is balanced (Table 3), suggesting neither an over- nor underestimation by sex.

More specifically, for the group of *baccalarii* and *baccalariae*, the balanced sex ratio implies that this age-class referred to the same age span for both males and females, excepting differences related to mortality or migration by sex of young people, of which the data contain no trace, however. The sex ratio of adults is also mostly balanced. In the document, 37 husbands and 25 wives are defined as *extranei/extraneae* (foreigners). If we exclude these individuals

from the group of adult males and females, we obtain a balanced sex ratio of 1.04. The sex ratio of children, however, is slightly unbalanced towards females. The lack of male children can perhaps be attributed to some of them having been away from home attending school (presumably in a monastery) and possibly omitted from the registration. Among the children defined as *ad scola*, eight were males and only four were females, indicating boys were sent to school more often than girls.

These results paint a different picture than that observed in Italy during the same period, where medieval written and archaeological sources report a constant imbalanced sex ratio towards males from the 6th century until the 15th, interpreted as the result of higher mortality among young females (Herlihy and Klapisch-Zuber, 1988; Barbiera, 2012; Barbiera et al., 2017). The sex ratio obtained from the polyptych is consistent, however, with medieval archaeological data from the region (Deverly, 2005; Barbiera et al., 2017), which also display a balanced sex ratio. In contrast, the other Carolingian polyptychs feature high sex ratios. In the polyptych of Farfa, a higher proportion of males is observed among children, which Ring (1979) interpreted as the result of an under-recording of daughters or their having been registered as males. A similar explanation has been put forth for the high sex ratio among children in the polyptych of Saint-Germain-des-Prés (Herlihy, 1985). Moreover, in both this document and in the polyptych of Saint-Remi, an imbalanced sex ratio among adults has also been noted. The latter may be related to a high proportion of recorded solitary men, arguably because their wives and children were not registered due to living elsewhere or their association with another landowner (Devroey, 1981; Herlihy, 1985). This would suggest, according to Devroey (1981), high virilocality and frequent mobility of women for marriage reasons. In this light, the almost balanced sex ratio observed in the Saint Victor polyptych might reflect greater accuracy in recording all individuals. The mobility of spouses might also have been less frequent here than in other areas (further discussed below).

We now consider the age structure of the registered individuals. The document records ages in years for children. Given the heaping observed around age 10, we assume that the ages of children can be defined between 0 and 12.5. Thereafter, the source groups listed young people under a blanket designation of *baccalarii* and *baccalariae*. We add those few individuals described as 13, 14, and 15 years of age to these groups. Given the balanced sex ratio for *baccalarii* and *baccalariae*, we expect that this age group ended at the same age for males and females. As almost all the *baccalariae* have no children, we set the threshold for adulthood for both men and women at 22.5 years of age (see Section V for considerations on age at first marriage). We simulated different population structures with varying age spans for the group of *baccalarii* and *baccalariae*. If this threshold were lower or higher (for example 20 or 25 years), the picture would not change substantially.

What characterizes this population's age structure, differentiating it from those of the modern age and bringing it closer to other medieval contexts, is the relatively high proportion of children.

2. Comparing age structures with other populations

We compare the Marseille polyptych's age structure with those of several populations studied by other scholars. The data on which these studies are based are of good quality and sufficient completeness, even for children, allowing demographic parameters such as fertility and mortality to be reconstructed. Specifically, we consider four comparable populations (Table 4): that of Tuscany in the Cadastre of 1427 (Herlihy and Klapisch-Zuber, 1988[(5)]), the city and countryside of Legnago (south of Verona, Italy) in the Cadastre of 1430 (Dalla-Zuanna et al., 2012), England in 1696 (Wrigley and Schofield, 1989), and France in 1740 (Henry and Blayo, 1975). In Legnago and Tuscany, the last outbreak of plague occurred a few years before the documents were compiled; therefore, both represent a post-crisis population, characterized by a high fertility regime (Rossi, 2013).

Table 4. Population age structures and demographic parameters in five medieval and modern populations

	Population structure (in %)				Births		Mean age at first marriage for women	Life expectancy at birth
	0–12.5	12.5–22.5	22.5+	Total	per 1,000	Total fertility rate		
St Victor (813)	34	22	44	100	51*	–	–	(20)**
Tuscany (1427)[(a)]	32	15	53	100	47*	–	18[(c)]	(20)**
Legnago (1430)[(b)]	37	21	42	100	55*	7.5	21	(20)**
England (1696)[(d)]	27	17	56	100	32	4.5	26	34.1
France (1740)[(e)]	28	18	54	100	40[(f)]	5.5[(f)]	26[(g)]	24.7[(h)]

* Authors' estimate using Equation 1 (Section IV.2).
** Authors' hypothesis, see Section IV.1.
Sources: (a) Herlihy and Klapisch-Zuber (1988, Appendix 5, Table 2; authors' calculations); (b) Dalla-Zuanna et al. (2012); (c) Herlihy and Klapisch-Zuber (1988, p. 540); (d) Wrigley and Schofield (1989); (e) Henry and Blayo (1975); (f) Vallin (2006, p. 50); (g) Henry and Houdaille (1979); (h) Vallin (1989).

The polyptych's population age structure is practically identical to that of the Legnago Cadastre and not very different from the Tuscan Cadastre. Interestingly, in the reconstruction of the population of England, based on the Domesday Book of 1086, Harvey (1988) estimated that the proportion of children aged 0–14 was 37.5%, quite close to our own estimates. These resemblances with other medieval populations indicate that even if the farms of the Abbey of Saint Victor were unevenly distributed across a wide and diverse territory, they display a plausible population structure, one whose age structure differs

(5) We considered the Italian version as it contains detailed tables on the population structure, absent from the English version.

from that of England in 1696 and that of France in 1740, where the proportion of children is smaller.

IV. Clues to population dynamics

1. Mortality

By observing the age structure of a population, we can obtain information on the demographic dynamics that generated it, assuming firstly the hypothesis of a stationary population (one closed to migration, with a growth rate of 0 and with crude death and birth rates equal and stable over time). Here we compare the Marseille polyptych with the stationary populations associated with several standard life tables proposed by Woods for ancient South Europe at different levels of mortality (Table 5).(6) The population age structure of the polyptych resembles that of Woods with a life expectancy at birth between 20 and 25 years. If mortality had been lower (e.g. a life expectancy at birth of 30 or 40), the age structure of the stationary population would have been older than that of the polyptych. This sign of high mortality is supported by previous palaeodemographic research, which suggests that populations in southern France closely resembled this mortality pattern (Deverly, 2005; Mafart, 2007; Barbiera et al., 2017).

Table 5. Population age structure of the polyptych of the Abbey of Saint Victor in Marseille and of stationary populations associated with several standard life tables

Age groups	Ages	Saint Victor polyptych (%)	Standard life tables – level of life expectancy at birth (years)		
			20	30	40
Children	0–12.5	34	35	33	31
Youths	12.5–22.5	22	22	21	20
Adults	Over 22.5	44	43	46	49
Total		100	100	100	100

Interpretation: Children aged 0–12.5 make up 34% of the population in the polyptych. In the stationary population associated with the standard life table with life expectancy = 20 years, children aged 0–12.5 make up 35%.
Sources: Authors' calculations; Woods (2007) for standard life tables.

Alternatively, if we take the stationary population hypothesis less strictly, mortality might have been lower but accompanied by a substantial and continual negative migration balance of young adults and children. The information on migration in the polyptych is only indirect, suggesting the existence of both inflows (evidenced by a number of spouses registered as 'foreigners') and outflows (evidenced by farms registered as 'empty'). The available data do not allow

(6) McEvedy and Jones (1978) suggested a growth rate of +0.5 per 1,000 for France between the 9th and 10th centuries.

us to establish whether the stationarity hypothesis is valid. However, with such high mortality levels, the net migration (negative or positive) would have had to be very substantial and have lasted for a sustained period before the drafting of the document for it to have had a significant influence on the age structure. Furthermore, even natural population growth similar to the peak observed during the High Middle Ages, from the 10th to the 13th centuries (+5 per 1,000; Bautier, 1988; Barbiera and Dalla-Zuanna, 2009), would not—given these high mortality levels—have been able to significantly modify the age structure compared to that observed under the hypothesis of stationarity.

2. Birth rate

From the data in Table 3, we estimate the birth rate b for the population of the polyptych, employing the own-children method for estimating fertility without any data on births, using only the age structure (Grabill and Cho, 1965). The births that occurred over the previous 12.5 years are expressed as the product between the estimate of the population aged 0–12.5 recorded in the polyptych and the inverse probability of survival between birth and reaching 12.5 years:

$$\begin{aligned}\text{Annual births} &= [\text{Population}_{0-12.5} \times (12.5 \times l_0 / L_{0-12.5})] / 12.5 \\ &= \text{Population}_{0-12.5} \times l_0 / L_{0-12.5} \end{aligned} \quad (1)$$

Mortality at ages 0–12.5 should be close to that of Woods's standard life table, with a life expectancy at birth (e_0) of 20 years (Woods, 2007). Using the ratio $l_0 / L_{0-12.5}$ from Woods[7], i.e. 0.148, we obtain the following estimate of the birth rate for the polyptych (see Table 3): $b = (392 \times 0.148) / 1{,}141 = 0.051$, or 51 per 1,000.[8]

Applying the same procedure, using the same level of mortality, the birth rate was 52 per 1,000 in Tuscany in 1427 and 55 per 1,000 in Legnago in 1430. While these estimates may seem raw, when applying Equation 1 for England in 1696 (Woods standard table with $e_0 = 35$) and for France in 1740 (Woods standard table with $e_0 = 25$), we obtain $b = 0.27 \times 0.12 = 32$ per 1,000 for England and $b = 0.28 \times 0.14 = 39$ per 1,000 for France, i.e. the same values of b obtained using other data and following entirely different procedures (see Table 4).

For Legnago, using the classic own-children method, we can estimate the total fertility rate for the 5 years before the Cadastre at around 7.5, whereas the singulate mean age at first marriage for females is 21 (Dalla-Zuanna et al., 2012). Although we cannot be sure that the population of the polyptych follows the same marital and fertility regime of Legnago, its age structure—practically

(7) l_x is the number of people surviving to exact age x. $L_{x/x+1}$ is the average number of people surviving in the interval between exact ages x and $x + 1$, which in our formula is between age 0 and age 12.5.

(8) Since the population of the polyptych is estimated at 1,141 (Table 3), this birth rate corresponds to the ratio 58 / 1,141. When calculating the confidence interval of this proportion (with a probability of 0.95), the birth rate ranges between 38 and 64 per 1,000. As with a stationary population, $e_0 = 1 / b$, the confidence interval of e_0 ranges between 16 and 26 years ($p = .95$).

identical—is compatible with women's fertility and age at first marriage in Legnago. This result also lends reasonable support to the age threshold of 22.5 for distinguishing between female *baccalariae* and adults.

Thus, several clues indicate that the population of the Marseille polyptych experienced high demographic pressure, with mortality at ages 0–4 close to 50%, life expectancy at birth around 20 years of age, and a birth rate around 50 per 1,000.(9) This demographic regime is quite different from that found in either late 17th-century England or in early 18th-cenutry France, but similar to that observed in other European medieval communities.

V. Marriage and remarriage

Nuclear kinship ties are specified within the various farms listed in the polyptych: wives, husbands, and children are clearly registered, as are some widows (but not a sole widower(10)), ecclesiastical males (seven *presbiter*, three *diaconi*, and six *clerici*), and individuals with children but who do not appear to have a spouse. This information allows us to distinguish between married individuals (having a wife or a husband recorded in the document) and unmarried individuals (widows and those without a recorded spouse, excluding ecclesiastical males), as well as between individuals with and without children (we did not include the five estimated adults registered as *filii sui*, for whom we have no information on marital status; Table 6). For adults without children, the proportion of unmarried individuals is higher among men (69%) than among women (59%), suggesting that men married later than women. A similar trend is also visible among the peasants registered in the polyptych of Saint-Germain-des-Prés (Herlihy, 1985). For adults with children, the proportion of unmarried men (16%) is lower than that of unmarried women (25%), indicating

Table 6. Proportions (%) of men and women with and without children by marital status, registered in the polyptych of the Abbey of Saint Victor, Marseille

	Men		Women		Total
	With children *n* (%)	Without children *n* (%)	With children *n* (%)	Without children *n* (%)	*n* (%)
Married	123 (84)	28 (31)	124 (75)	28 (41)	303 (64)
Unmarried	24 (16)	63 (69)	41 (25)	41 (59)	169 (36)
Total	147 (100)	91 (100)	165 (100)	69 (100)	472 (100)

Source: Authors' calculations.

(9) In a stationary population, the birth rate b is equal to the ratio $1 / e_0$. In our case, $1 / e_0 = 1 / 20 = 0.05$, which coincides with b around 50 per 1,000. We do not affirm that the polyptych population was stationary, but that, starting from the age structure generated by the data, it is possible to derive a reasonable mortality regime and birth rate.

(10) The category of widower did not exist in the early Middle Ages; rather, it was only women who became a concern for authorities once they lost their tutor husbands.

that more women remained widows than men, partly due to the different age at marriage, but mainly because men remarried more often.

If we examine the data from a different perspective and consider only unmarried individuals (Table 7), we obtain the same results as above: a higher proportion of individuals without children among men compared to women, indicating greater relative numbers of single men than single women and once again suggesting a later age at marriage for males. As discussed in Section III.1, boys and girls began to be described as *baccalarii* once they reached the age of about 12.5. Women continued to be categorized as such until they married, and almost all wed at some point. Indeed, among adult women we find a high percentage (83%) of individuals who married at some point.

Table 7. Proportions (%) of unmarried individuals with and without children in the polyptych of the Abbey of Saint Victor, Marseille

	Males *n* (%)	Females *n* (%)	Total *n* (%)
With children	24 (37)	41 (63)	65 (100)
Without children	63 (61)	41 (39)	104 (100)

Source: Authors' calculations.

From these data, it is not possible to obtain direct information on the age at first marriage of the women in the polyptych. Based on the reasoning developed in Section IV.2, however, we know that the birth rate of the peasants of Marseille was high and therefore hardly compatible with a high female age at first marriage, also because many widowed women did not remarry. That said, the data do not show whether the age at first marriage for women was closer to 18 (Tuscany) or 21 (Legnago). We favour a slightly higher age because the demography of the peasants of Marseille seems to be closer to that of Legnago than to that of Tuscany (Table 4). These considerations are the basis of our age threshold dividing young people from adults (at 22.5 years); again, even if the threshold were a little different, the age structure and demographic regime would not vary greatly, as these are essentially determined by the high proportion of children.

To divide youths from adults, we set the same threshold for men and for women regardless of whether *baccalarii* were married, since the numbers of *baccalarii* and *baccalariae* are equal. This also helps to explain why we find a greater proportion of unmarried adult males. The definition of *baccalarius/baccalaria* thus refers more to the life cycle than to marital status.

Table 7 also shows a higher proportion of individuals with children among unmarried women than among men, again suggesting that men tended to remarry more often than women after being widowed. Other medieval sources from France indicate that second marriages were more frequent for men (Klapisch-Zuber, 1988).

Different ages at marriage for men and women have been documented for aristocratic families of the early Middle Ages in France and more generally in Europe, together with considerable kin group tensions over the second marriage of widows (Nelson, 1995; Le Jan, 1996; La Rocca, 2005). It seems that, at least in France, early medieval marriage patterns did not vary greatly among different social groups (Klapisch-Zuber, 1988).

Our results show that the marriage system of this period and area did not differ much from that observed in France at the beginning of the modern era, when males similarly married later than females and more often remarried (Charbonneau et al., 1987; Lebrun and Fauve-Chamoux, 1988).[11] However, in medieval France, women's age at first marriage was most likely earlier than in the modern age.

VI. Families and farms

We now turn to the internal composition of the 145 inhabited farms listed in the document. Farms were populated by individuals, single-family units, or several units together, with the most populated farm consisting of 43 individuals. We do not know how residence was organized or whether the different units listed for the same farm lived together, but rather only that they worked together on the same farm. Moreover, the registered kinship ties refer to nuclear units: 'husband of', 'wife of', 'daughter of', and 'son of'. In only a few cases, it is thus possible to discern the relationship between different family units working on the same farm. One clue is the average number of individuals per farm. In Provence, the mean farm size is 8 individuals per farm (considering only those inhabited), much greater than the 4.7 reported for the Farfa farms of Abruzzi and the 5.7 found for Saint-Germain-des-Prés (Ring, 1979; Herlihy, 1985). The mean farm size found in Provence is quite high; Burch (1972) estimated that with a life expectancy at birth of 20 years, even with high fertility (gross reproduction rate $R = 4$), the average number of individuals per nuclear family was 4.8. In England between 1574 and 1821, the highest average number of individuals found per household is 7 (Laslett, 1972a; Wall, 1972). These results suggest that a high proportion of the Provençal farms were likely run by extended groups that were not closely related to one another, perhaps better defined as 'working groups'. We therefore do not use Laslett's household classification, as it does not seem appropriate here (Laslett P., 1972b).

Of the 145 farms, 53 (37%) were inhabited by one nuclear unit (couples with or without children, singles, or widows with children), while 26 farms (18%) were populated by one nuclear unit composed of a couple with children and some individuals whose relationship with the head of the family is

(11) For a reconstruction of 17th-century French population and marriage dynamics, see Lebrun and Fauve-Chamoux (1988).

unspecified. Forty-two farms (29%) were occupied by two or more nuclear units, of these 29 (20%) included units not apparently related to one another, while 13 (9%) had related groups, mainly sons who continued to live with their family of origin, together with their own wives and children. For the latter case, Laslett's 'extended down' household could be applicable. Twenty-four farms (17%) were inhabited by singles or apparently unrelated individuals.

Table 8 shows the organization of different farms according to their geographical location. Forty-four per cent of farms in the plains and hills were managed by one nuclear unit, compared with only 28% in the mountains. In the Alps, many farms were managed by two or more units. In particular, 11% of such farms were run by two or more related units (mainly the head of the farm with his wife, children, and his children's families), while 26% were managed by several apparently unrelated units. This last type of farm organization is much less common in the plains and hills (9%), reflecting different forms of cooperation depending on the environmental location of the farm (Faith, 2010). The polyptych shows that farms in the Alps were not only generally more inhabited than those in the plains and hills but were also more densely inhabited. To explain this dynamic, Faith (2010) suggested that highland farms may have been self-sufficient and therefore characterized by a mixed economy, where pasture would have played an important role given the geographical features of the Provençal Alps landscape. This economy demands a complex deployment of labour: livestock needed be moved periodically, milk and cheese processed, hay cropped from upland pastures to be used during the long winters, and beyond these activities, crops had to be cultivated and processed to feed families (Cocchi et al., 1996; Viazzo, 2001). Shepherds might have looked after livestock for different neighbouring farms. However, given the farms' scattered distribution, such shared labour may not have been feasible, as the work of one or two adults needed to be devoted to driving, folding, and guarding even a small flock in a short-distance transhumance system. The necessary involvement of various adults to manage this economy in such an environment may have determined the higher concentration of different family units observed in the Abbey's highland farms. The lower concentration of families and individuals in lowland farms might partly have been determined by the changing climatic and hydrological composition of these areas during this period. This may also have been attributable, at least to some extent, to instability provoked by Saracen attacks, though these were seemingly not yet so intense, as compared to the aftermath of 838, when Marseille was ravaged (Poly, 1976). Less can be said about the tenures in the plains and hilly areas, given the lack of information in the document on the tenures' extension and the unreliable description of payments due to the Abbey. Scholars have hypothesized that these areas were exploited for the production of grain, olives, and wine, possibly for direct use or for sale, and employed specialized workers (Fourquin, 1975; Wickham, 2005; Renard, 2012). To further investigate these aspects, the following section focuses on farm heads' relationships to the Abbey.

Table 8. Distribution (%) of farms by geographical location and management type in the polyptych of the Abbey of Saint Victor, Marseille

	Nuclear units	Nuclear units with unrelated members	Two or more related units	Two or more units without relation	Other types	Total (%) *n*
Plains and hills	44	21	12	9	15	100 (34)
Mountains	28	17	11	26	18	100 (65)

Note: *n* = 99 populated and geolocated farms.
Interpretation: Forty-four per cent of farms in the plains and hills were managed by one nuclear unit.
Source: Authors' calculations.

VII. Heads of farms

Each farm head (or the first name listed; a male in 83% of the cases) is described in the document as having certain attributes—*beneficiarius, colonus, mancipium, accola, cotidianus, verbecarius, artifex*—indicating different roles and obligations towards the Abbey of Saint Victor. In classical Latin, the term *mancipium* denoted 'slave' (Devroey, 2000; Rio, 2006, 2017), or those strictly tied to the land and transmitting this bond to their descendants, while *coloni* were free individuals, less firmly attached to the owner and the land. Scholars agree that during the early medieval period these terms were still used but had more nuanced meanings, and inconsistencies between a given status and associated duties have even been found within a single estate (Herlihy, 1985; Weinberger, 1990; Devroey, 2000; Wickham, 2005; Rio, 2017). Moreover, *mancipium* could take on different meanings depending on the situation: in normative texts, the term might still have been employed with the strict meaning of 'slave', while in property documents it rather referred to an individual attached to the land by a tie of dependence, regardless of whether the individual was free. In this context, *mancipia* had the right to legally marry, form a stable family, possess property, and pass it on to descendants (Devroey, 2000).

These descriptors seem to strongly reflect the ways farms were organized. In the polyptych, 46% of *coloni* were the heads of farms mostly run by one nuclear unit, while 57% of *mancipia* headed farms with two or more nuclear units, perhaps because the latter and their descendants were less free to move (Table 9). This hypothesis is supported by the observation that there were 24 foreign husbands (*maritus extraneus*) out of a total of 35 who lived on farms whose head was defined as *mancipium*, while only three lived on a farm where the head was a *colonus*, suggesting that husbands likely joined the wife's farm when she could not move from the land.

Fifty-four per cent of *mancipia* were heads of farms in the Alps, while farms headed by *coloni* were equally distributed among the plains and hills, and mountains (Table 10). The greater presence of *mancipia* in the mountainous areas may have been due to the monastery's need to manage its more distant, disputed, and volatile areas. The farms in the highlands were also those furthest

Table 9. Distribution (%) of farm heads by type of farm management in the polyptych of the Abbey of Saint Victor, Marseille

	Colonus/colona	*Mancipium*	Other	Total
Single	0	3	22	11
Without relation	0	6	9	5
Nuclear unit	46	23	37	37
Nuclear units with other members	35	11	11	18
Two or more nuclear units	19	57	21	29
Total	100	100	100	100
Number	43	35	67	145

Interpretation: Forty-six per cent of *coloni* headed farms inhabited by one nuclear unit.
Source: Authors' calculations.

Table 10. Distribution (%) of farm heads by geographical location in the polyptych of the Abbey of Saint Victor, Marseille

	Colonus/colona	*Mancipium*	Other	Total
Plains and hills	28	17	13	19
Mountains	28	54	27	34
Unknown	44	29	60	47
Total	100	100	100	100
Number	43	35	67	145

Interpretation: Twenty-eight per cent of *coloni* were heads of farms located in the plains and hills; 17% of *mancipia* were heads of farms in the plains and hills.
Source: Authors' calculations.

from the Abbey and the most difficult to reach. According to Rio (2017), 'the drawing up of a polyptych contributed strongly to imposing particular categories of legal status on ground, both for peasants and for land' (p. 193). Its creation thus allowed lords and their dependents to define and redefine the ties between them, establish rights over land, manage labour duties, and control potential mobility. Further, disputes over the status of peasants during this period suggest that negotiation was possible between the elites and commoners. Tensions may also have been tied to the fact that properties were small and scattered during this period in southern France. We have no clear indication that the manorial system, documented in the north of the country, developed in these areas. Rather, they seem to have been characterized by a less organized system of land control and exploitation. The inaccuracy in the recording of fees due from peasants may indicate the Abbey's difficulty in controlling far-away tenures and workers. More permanently tied to the land and in direct contact with the monastery, *mancipia* would have helped to guarantee more stability in production and greater control over such areas, otherwise easily reclaimable by local lords (Poly, 1976; Rio, 2017).

We also compared the structure of the population on farms headed by *mancipia* with the other farms (not shown). The proportion of young individuals

is higher in the former, which might be explained by the mobility of youths. Among farms headed by *mancipia,* we observe a greater proportion of *baccalariae* who were not daughters of the farm members and thus were not born on that same farm. More specifically, on farms headed by *coloni* or other categories, *baccalariae* were, in 33% of the cases, unrelated to the other farm members, while on farms headed by *mancipia,* this same category equals 41%, indicating a higher in-mobility of young females on these farms.

Taken together, these data suggest that young individuals moved from one farm to another, more often leaving farms not headed by a *mancipium*. By contrast, on farms headed by *mancipia*, mainly distributed in the mountains and more densely inhabited, younger individuals moved in. This fact, together with the mixed and self-sufficient economy of these farms, might explain why, in the highlands, a large number of families worked together on the same land tenures (79% of highland farms were managed by two or more nuclear families, while in the plains and hills only 45% of farms were managed by more than one nuclear family).

Conclusions

The data discussed in this article offer several insights into the demography of the people living on the farms owned by the Abbey of Saint Victor in Marseille in the early 9th century. Although scattered over a large area, this population consisted of more than 1,000 accurately registered individuals, with a balanced sex ratio and a coherent age structure—an arguably consistent demographic group. For most of these individuals, their name, kinship relation within their family, indication of their broad age group, employment (or servitude) relationship to the monastery, marital status, and geographical location of their farm are all recorded. Furthermore, perhaps for the first time in European history, the analytical age of children under 12 is also systematically noted. The data allow one to derive, directly or indirectly, a wide range of crucial demographic and social information and to compare it with (the relatively scant) available evidence related to medieval European demography.

First, the age structure of the population of the polyptych of Marseille was similar to that observed in two other medieval contexts (Cadastres of Tuscany in 1427 and of Legnago in 1430). These three age structures are younger than those in England in 1696 and France in 1740. The birth and death rates may have been around 50 per 1,000 and life expectancy at birth around 20 years, close to that observed when processing data on the age of skeletons in the cemeteries of southern France in the first millennium.

Secondly, data on marital status suggest a marriage system similar to that of modern France. Women married earlier than men at relatively young ages, possibly around age 21, and second or third marriages mainly occurred for

men. This is also partly compatible with marriage patterns observed on the farms owned by the Abbey of Saint-Germain-des-Prés (Herlihy, 1985).

Thirdly, the organization of farms greatly depended on location. Highland farms tended to be more populated and crowded, which may have been related to climatic changes recorded in this period, to political instability, or to the particular subsistence economy of these tenures, requiring the cooperation of several families. But it also might have been the result of the Abbey of Saint Victor's strategic effort to maintain or settle *mancipia* as heads of farms in more challenging areas to foster stronger ties. The data indicate that despite fluidity in the use of the terms *colonus*, *mancipium,* etc., differences existed, with *mancipia* referring to a more strictly servile status. The pattern observed suggests that *mancipia* brides were less free to leave the farm than other categories of women, and that it was thus the grooms who moved in. Young girls also joined households, possibly as domestic servants. On farms headed by *coloni* or those linked less tightly to the Abbey, people moved more freely. These farms were also less crowded and more commonly run by single-family units, as young men and women could depart and settle with their new families elsewhere.

The presence of densely inhabited farms suggests this population tended to increase, or that there existed a stop-and-go dynamic where some farms were depopulated and others were crowded, which can occur in a high mortality regime, even without significant epidemic outbreaks. Land-related legal constraints might have made it difficult to achieve a natural balance, which occurs when people are free to move.

Differences in human settlement density were related to varying degrees of ties to the land and the Abbey, anticipating trends observed in Europe in later historical periods. Methods of production, agricultural structures, links to tenures, and the system of property transmission all influenced nuptiality, fertility, and household organization (Delille, 1977, 1985; Kertzer and Barbagli, 2001). Working groups and families adapted to environmental fluctuations and economic systems (Le Play, 1855; Cocchi et al., 1996; Viazzo, 2010). The elites' control over the peasantry and the organization of tenancy increased during the early 9th century, as testified by the polyptychs in this period. Yet, commoners adapted and reacted in flexible ways to stress and change. Indeed, low population pressure and land availability allowed elites and peasants to adopt dynamic strategies of exploiting the land.

This study shows that an in-depth use of the demographic data available in medieval or modern cadastres or similar sources is possible and appropriate. They can also be used with archaeological and documentary evidence on population density and growth, as well as information on mortality and health derived from skeletons (Barbiera, 2012; Séguy and Buchet, 2013; Steckel et al., 2019). Such a multifaceted approach promises to help elucidate many aspects of medieval European demography.

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Irene Barbiera, Maria Castiglioni, and Gianpiero Dalla-Zuanna • **Demography, Peasantry, and Family in Early Medieval Provence, 813–814**

Compiled in 813–814, the inventory of peasants working for the Abbey of Saint Victor in Marseille offers insights into the early medieval demographic dynamics of Provence (southern France). We reconstruct the population's age structure and find it consistent with other European medieval registers. We also infer mortality—which closely resembles data on Provençal cemeteries of the first millennium and the standard life tables with high mortality for South Europe estimated by previous studies—and marriage and birth patterns. These results suggest that in early medieval Provence, demographic pressure had been higher than that observed in France and Western Europe after the Black Death. Finally, we analyse the way peasantry was settled and exploited in both flat and mountainous areas, clarifying the relationships between population settlements, environment, and production.

Irene Barbiera, Maria Castiglioni, Gianpiero Dalla-Zuanna • **Démographie, paysannerie et famille dans la Provence du haut Moyen Âge, 813-814**

Établi en 813-814, l'inventaire des paysans qui travaillaient pour l'abbaye Saint-Victor de Marseille donne des informations sur la dynamique démographique en Provence (France méridionale) durant le haut Moyen Âge. La structure de la population par âge est reconstruite et permet de constater qu'elle est similaire à ce que reflètent d'autres registres médiévaux européens. Avec des résultats très proches des données sur les cimetières provençaux du premier millénaire et des tables de mortalité classiques estimées dans le cadre de précédentes études, qui montraient une mortalité importante dans le Sud de l'Europe, on en déduit non seulement cet inventaire des tendances de mortalité, mais aussi des modèles de nuptialité et de natalité. Ces résultats paraissent indiquer que la Provence du haut Moyen Âge se caractérisait par une pression démographique plus forte que celle observée en France ou en Europe occidentale après la grande peste. Enfin, sont analysés les modes d'habitat et d'exploitation propres à la paysannerie locale, en plaine comme en montagne, pour clarifier les relations entre habitat, environnement et production.

Irene Barbiera, Maria Castiglioni, Gianpiero Dalla-Zuanna • **Demografía, campesinado y familia en la Provenza de la Alta Edad Media, 813-814**

Establecido en 813-814, el inventario de los campesinos que trabajaban para la abadía Saint-Victor de Marsella da información sobre la dinámica demográfica en Provenza (Francia meridional) durante la Alta Edad Media. Establecemos la estructura de edad de esta población y obtenemos resultados coherentes con los de otros registros medievales. Estimamos niveles de casados, nacimientos y defunciones, y estos son muy cercanos a los datos sobre los cementerios provenzales del primer milenio y a las tablas de mortalidad clásicas estimadas en estudios anteriores mostrando una mortalidad importante en el sur de Europa. Estos resultados sugieren que la Provenza de la Alta Edad Media se caracterizaba por una presión demográfica más fuerte que la observada en Francia o en Europa occidental después de la gran peste. Por último, se analizan los modos de hábitat y de explotación propios del campesinado local, tanto en llanura como en montaña, para aclarar las relaciones entre hábitat, medio ambiente y producción.

Keywords: demography of the Middle Ages, population structure and dynamics, population and environment, Provence, France