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Environmental systems and societies

Higher level

Paper 1 – resource booklet

30 April 2026

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

2 hours

Instructions to students

- Do not open this booklet until instructed to do so.
- This booklet contains all the resources to answer paper 1.

Figure 1(a): World map showing location of France

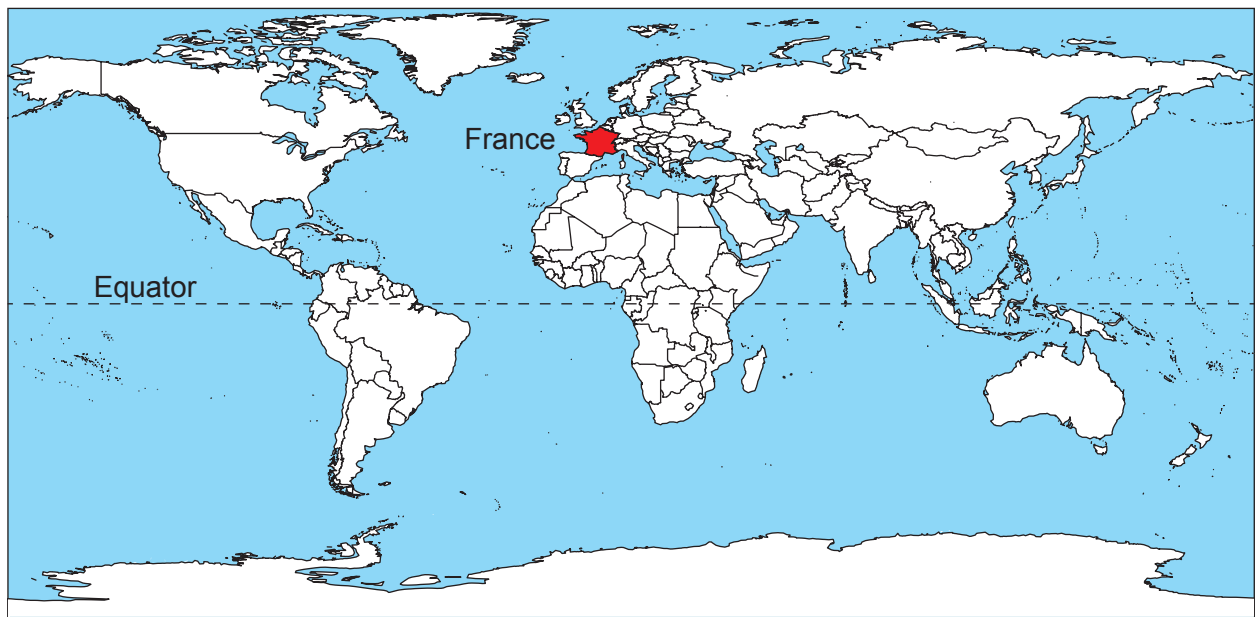


Figure 1(b): Map of France with neighbouring countries



Figure 1(c): Map showing the location of Corbières-Fenouillèdes Natural Park in France

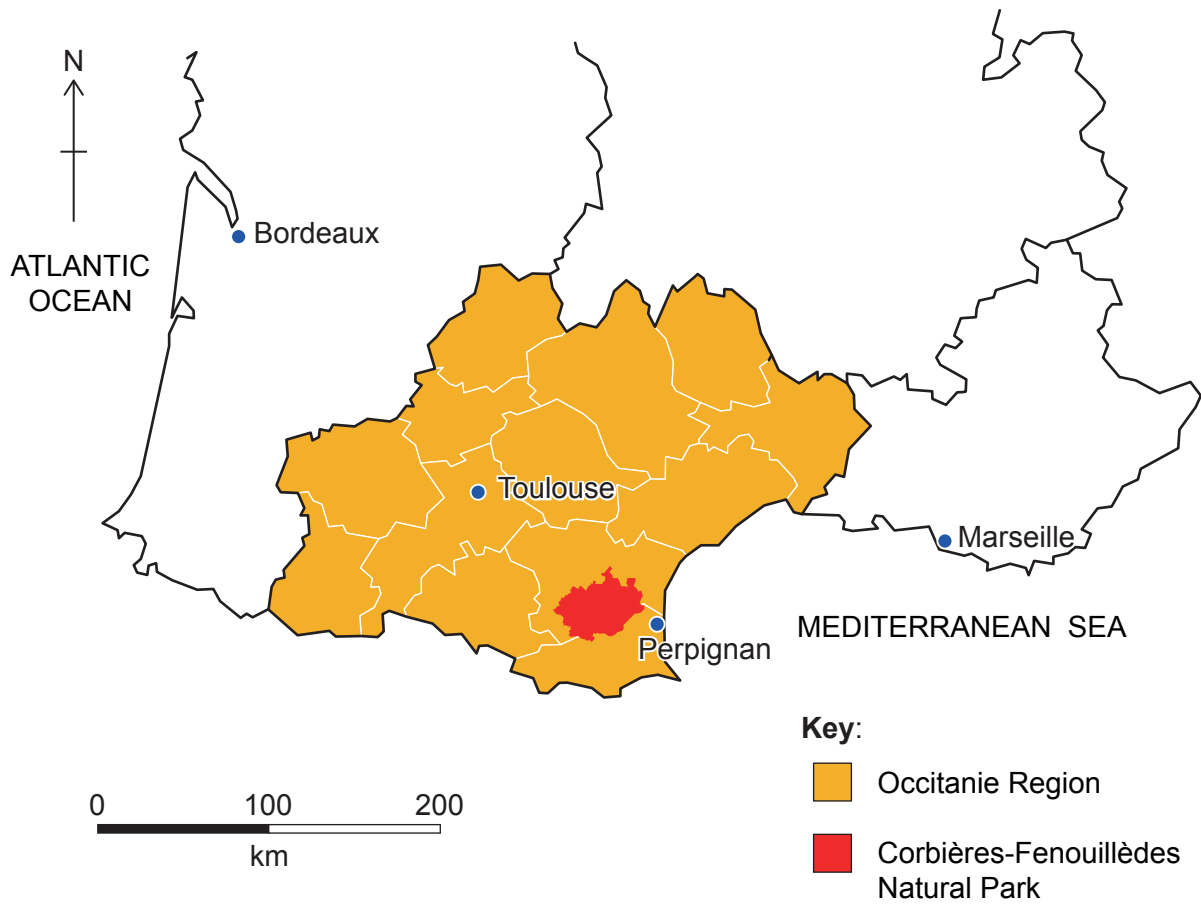


Figure 1(d): Climate data for the Corbières-Fenouillèdes Natural Park

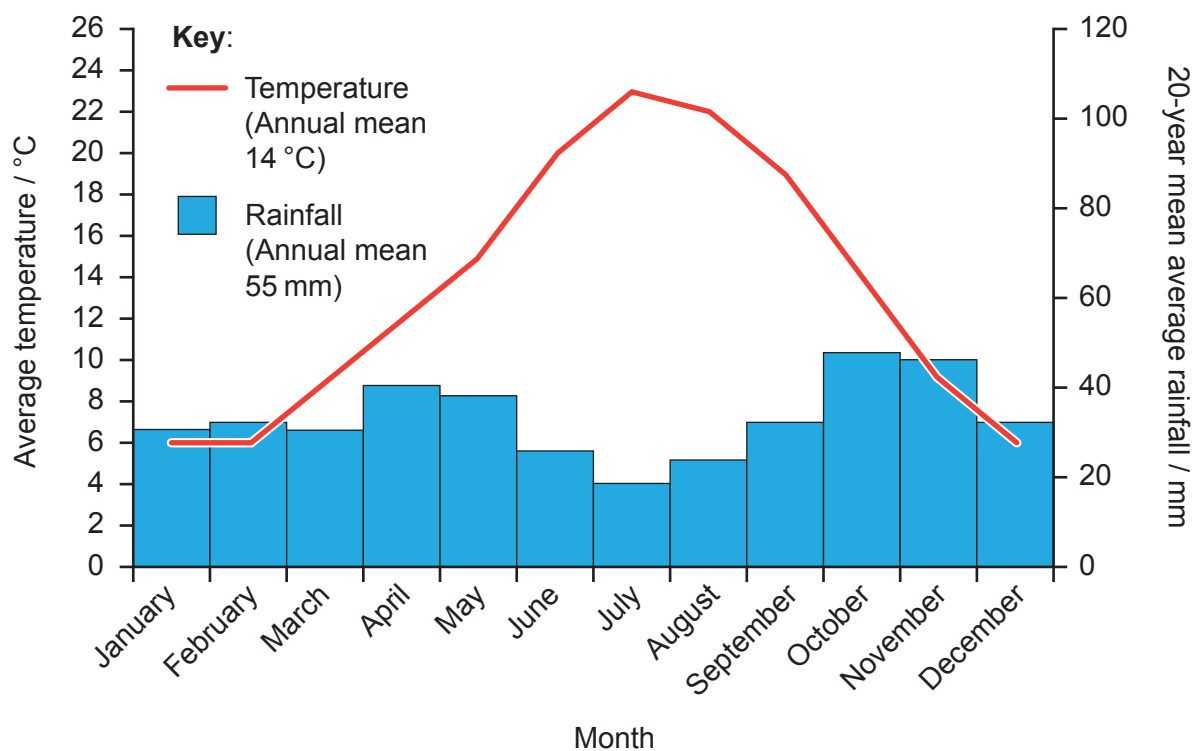


Figure 1(e): Fact file on the Corbières-Fenouillèdes Natural Park

- Found in the Languedoc-Roussillon area of the Occitanie Region
- One of 58 nationally recognized natural parks across France
- Natural parks are regional areas that have been selected for their rich cultural history and fragile ecology
- Created in 2021
- An area of 1800 km²
- Resident population of around 30 000 people
- Around 26 000 visitors each year, mainly in the summer
- A region of river valleys and low mountains extending from the Mediterranean coast to the Pyrenees
- Popular tourist destination with city of Perpignan and the summer beach resorts of Le Barcarès, Canet Plage and Argelès-sur-Mer to the south
- Broad-scale wine cultivation in valley bottoms. Lower slopes of mountains traditionally supported small-scale, low-impact seasonal grazing of goats, sheep and cattle
- Mainly areas of traditionally farmed grassland (pasture) and scrub (garrigue) on lower slopes
- Closed-canopy forests are found on steeper slopes
- Rocky ledges on steep valley cliffs
- Part of Mediterranean-type ecosystems with exceptionally high plant biodiversity with many endemic species
- Contains six areas designated as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) under the European Union's Habitats Directive and Birds Directive

	Number of species found in the Corbières-Fenouillèdes Natural Park	Status under the French National Strategy for the Creation of Protected Areas (SCAP)
Orchids	75	16 nationally important, 8 protected
<i>Gagea spp</i> (a lily species)	6	All protected
Birds of prey	16	All protected

Figure 1(f): Images of typical habitats of the Corbières-Fenouillèdes Natural Park



Figure 1(g): Carbon and water footprints of wine production process (per bottle)

	Amount per bottle	Main use
Carbon dioxide	1.28 kg	Agricultural vehicles, transport and electricity during wine production
Water (artificial irrigation is banned in the Corbières)	632.20 l	For growing vines, sterilization during bottling and crop spraying with pesticides

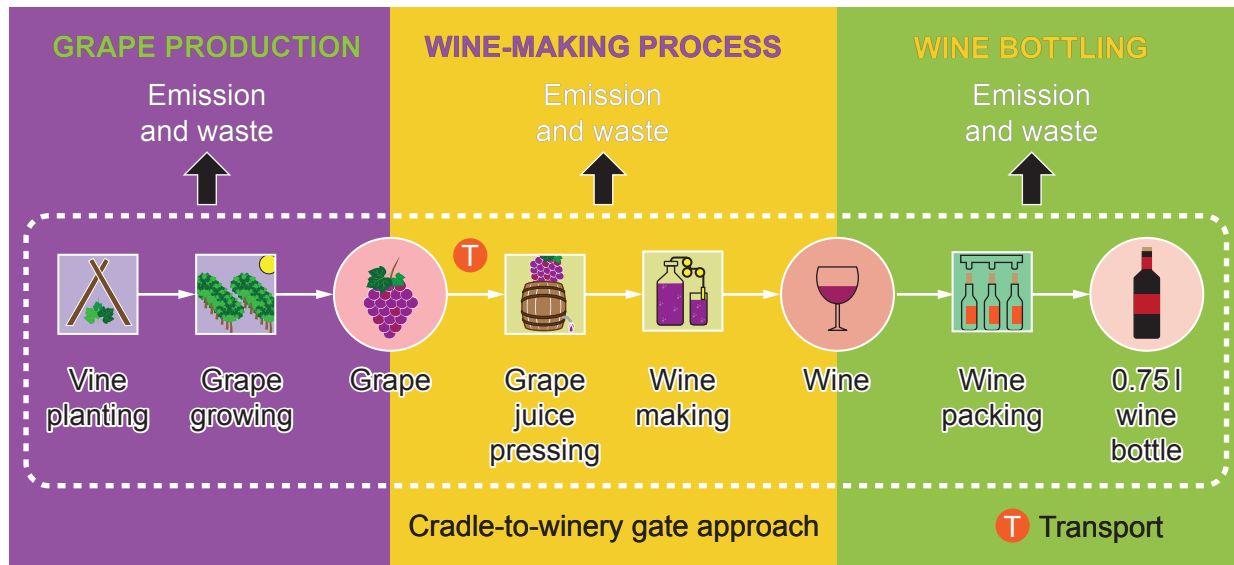


Figure 2(a): Image of Lac sur l'Agly



Figure 2(b): Position of Lac sur l'Agly on the river Agly in the region

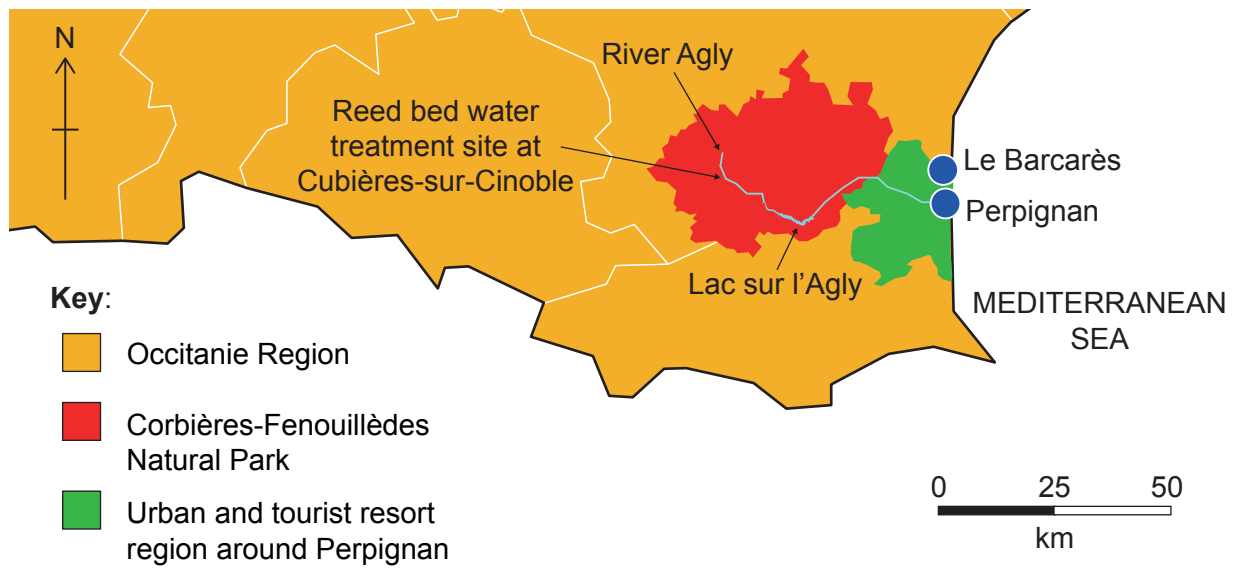


Figure 2(c): Fact file: River Agly and Lac sur l'Agly dam

- Lac sur l'Agly was constructed in 1994 as part of a regional water management initiative
- Designed for flood control in winter and as drinking water for Perpignan and the surrounding coastal areas in the high-demand summer tourist season
- Covers an area of 170 ha
- Surrounded by many walking paths used for recreation
- Both the river and lake are used for recreational fishing
- In January 2023 and 2024, fish were removed from the river and transferred to the lake to protect them from an ongoing drought
- In years where there is limited winter rain, a build-up of organic matter occurs in both the lake and river, causing algal blooms
- The river Agly is used extensively in the summer for recreational swimming and adventure sports like canyoneering

Figure 2(d): Water sources and supply in the Languedoc-Roussillon Region

Source	Supply / %
Aquifers	90
Lakes and reservoirs	10

Figure 2(e): Ground water recharge in Languedoc-Roussillon compared to capacity

Year	Recharge / %
2022	58
2023	75
2024	64

Figure 2(f): Water table levels at Le Barcarès

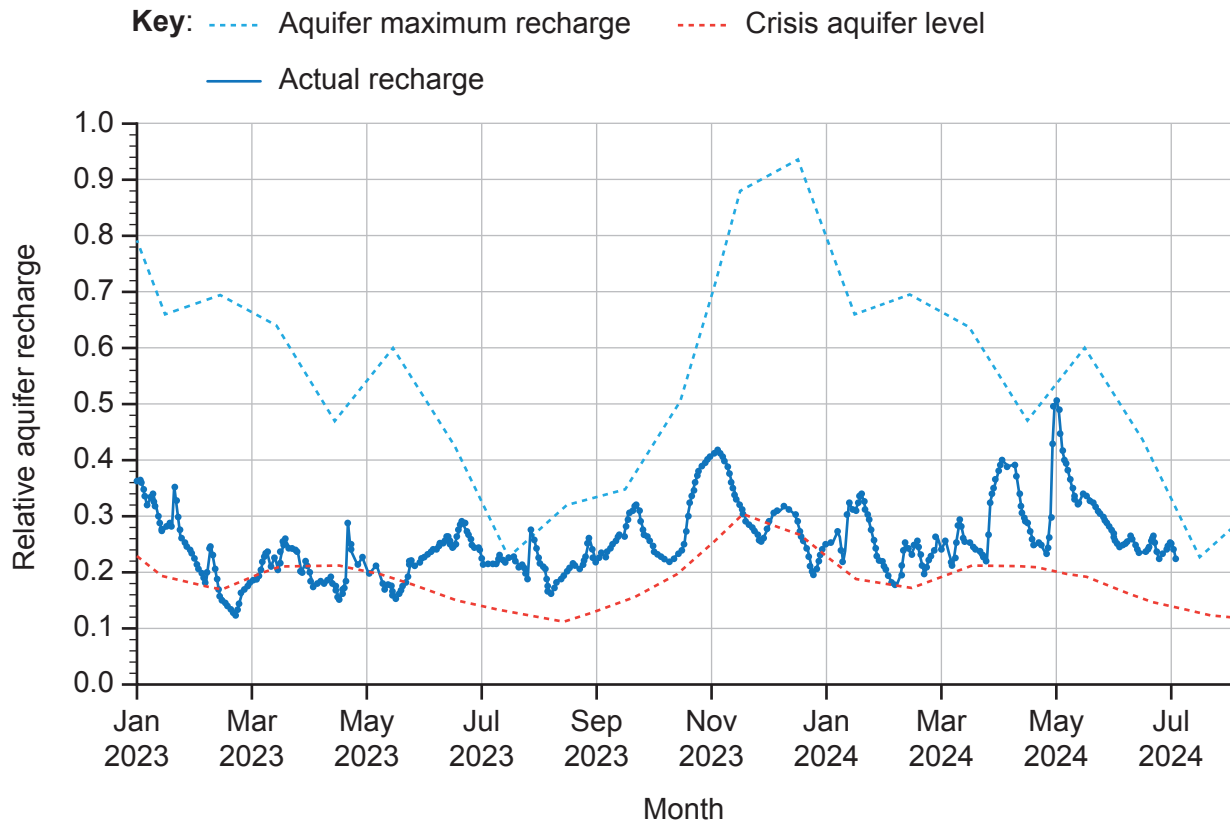


Figure 2(g): System diagram of a reed bed sewage system

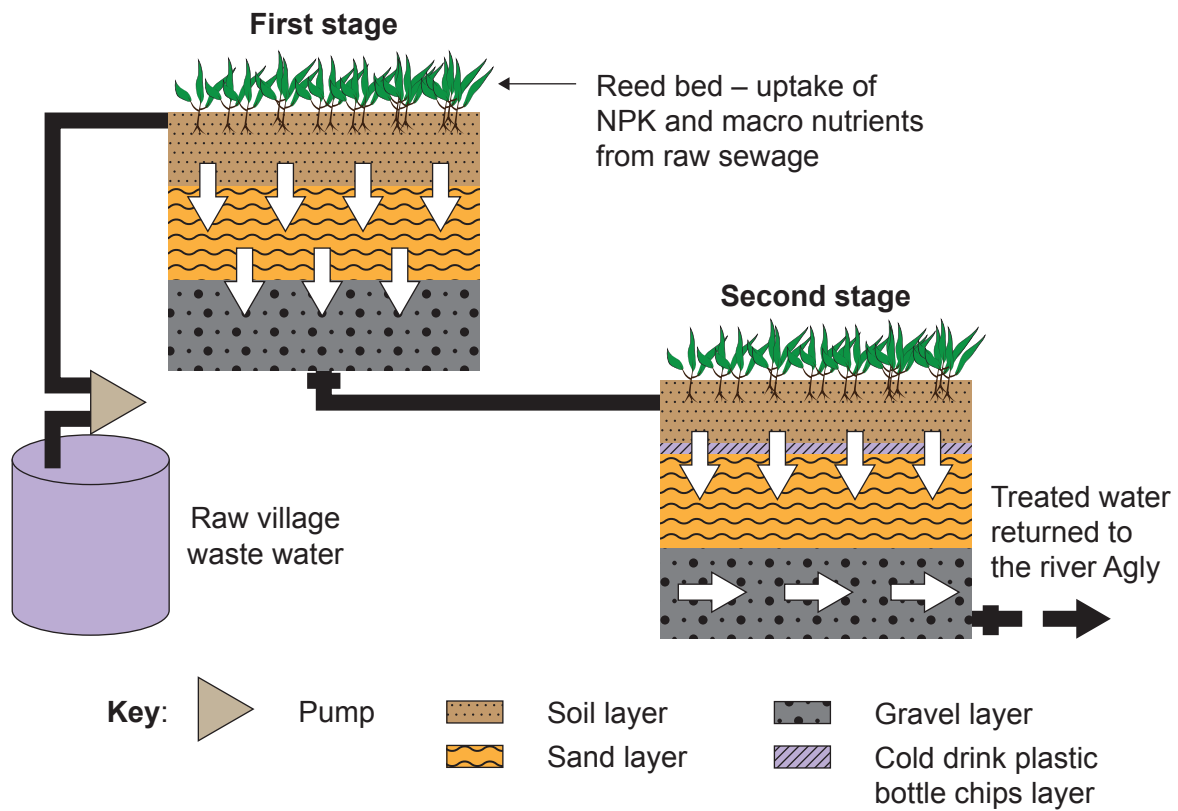


Figure 2(h): Reed bed sewage system on a tributary of the Agly river at Cubières-sur-Cinoble



Figure 3(a): Urban and rural populations of France between 1960 and 2020

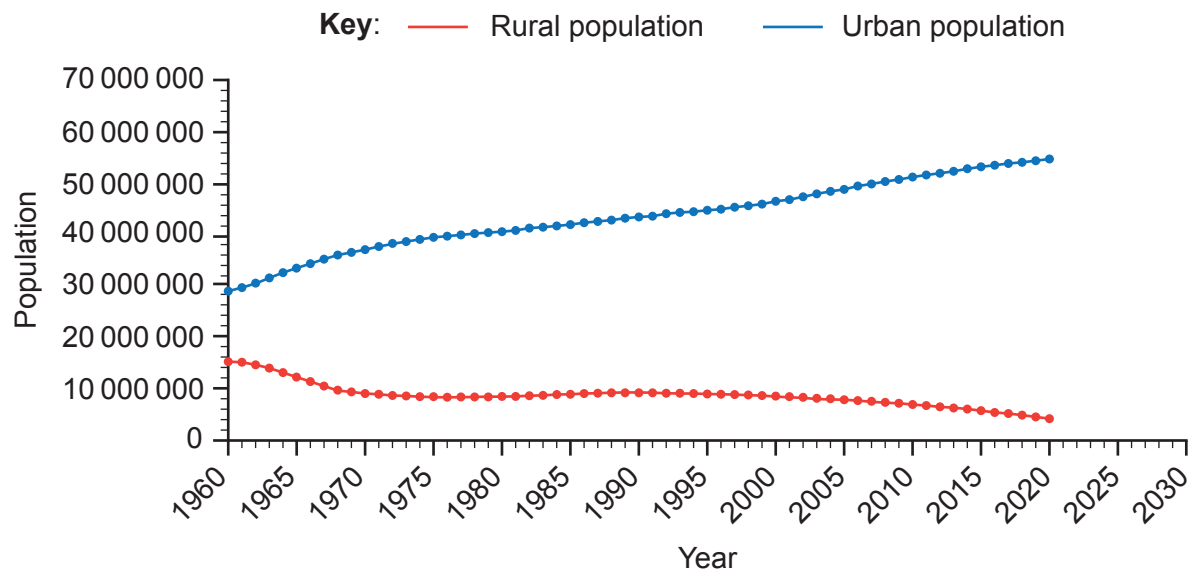


Figure 3(b): Adult employment in rural areas of France between 1968 and 2013

Year	Agricultural jobs (as % of all jobs)	All other jobs (as % of all jobs)
1968	47.4	52.6
1975	36.6	63.5
1982	33.9	66.1
1990	26.5	73.5
1999	20.1	79.9
2008	15.9	84.0
2013	15.6	84.4

Key: ■ Agricultural jobs (as % of all jobs)
■ All other jobs (as % of all jobs)

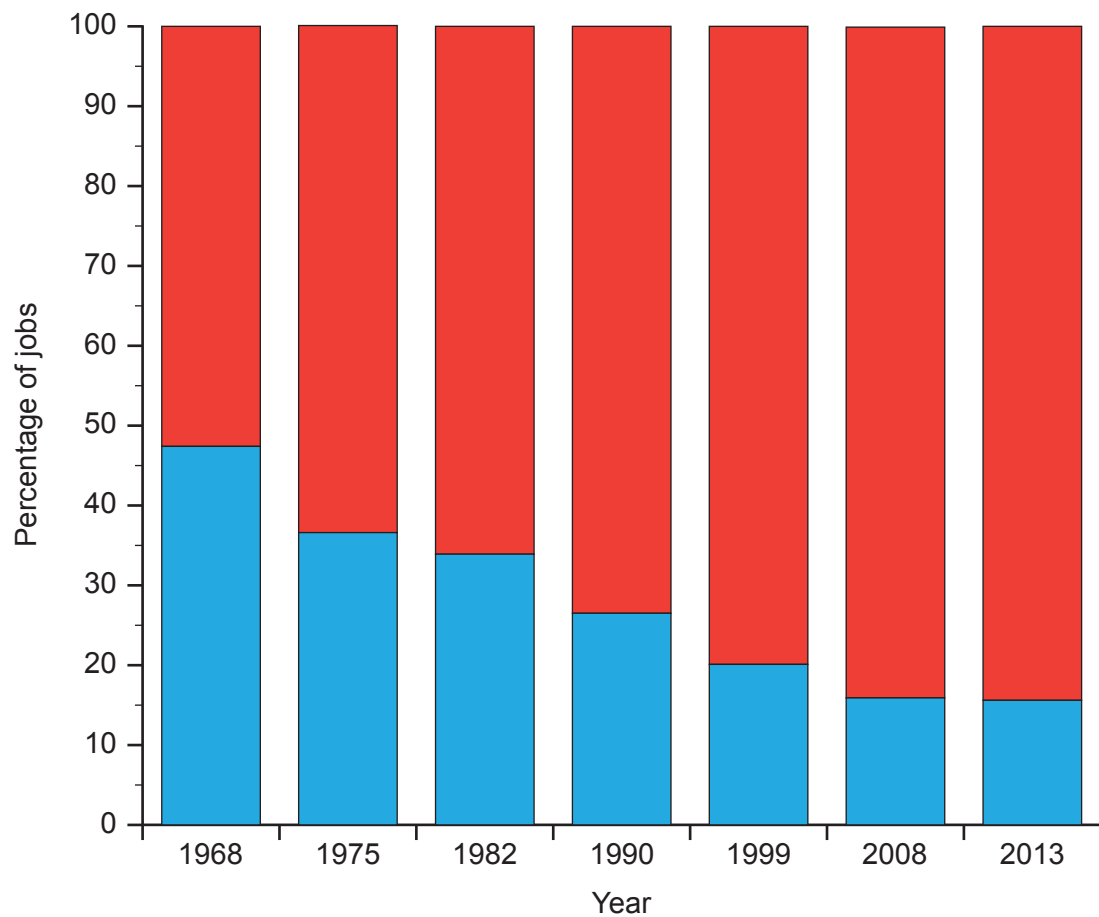


Figure 3(c): Agricultural output in France, 1961–2019

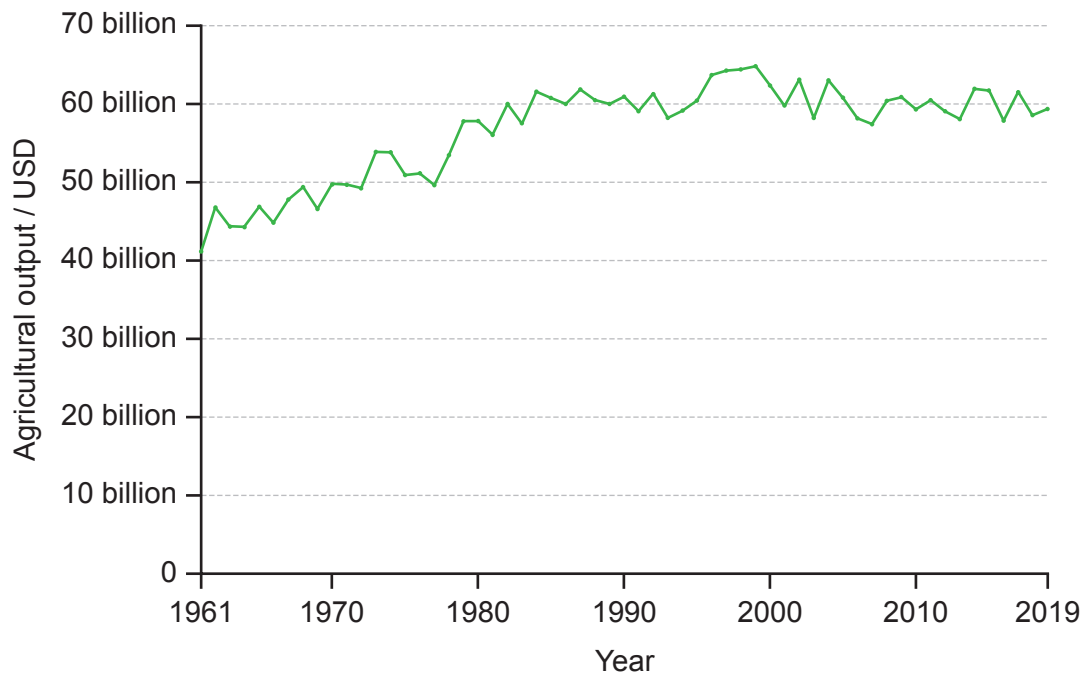


Figure 3(d): Fertilizer use per hectare of cropland in France, 1961–2021

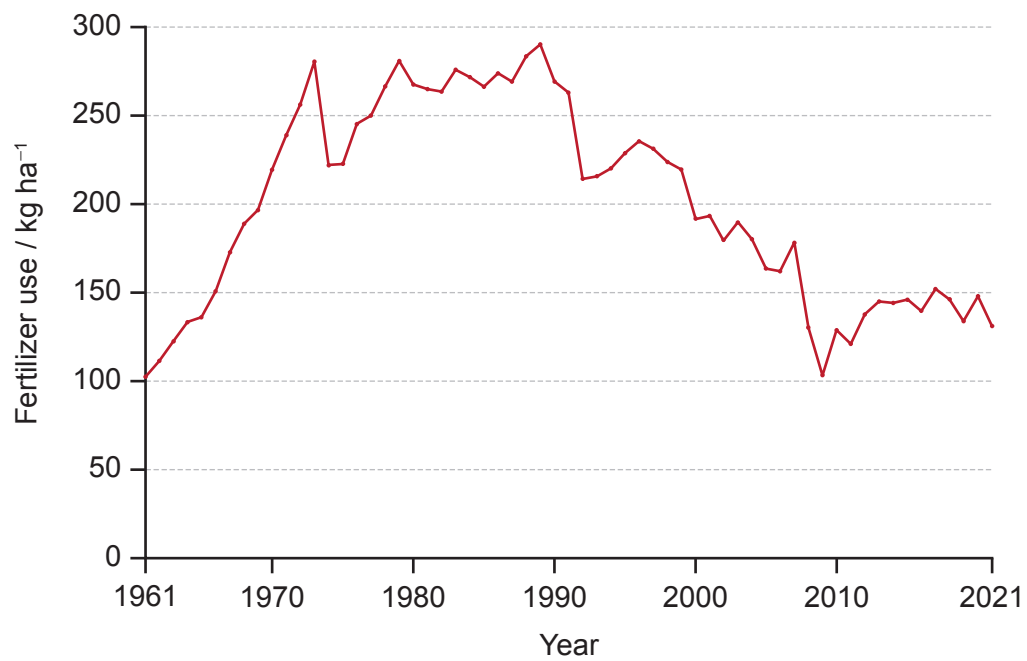
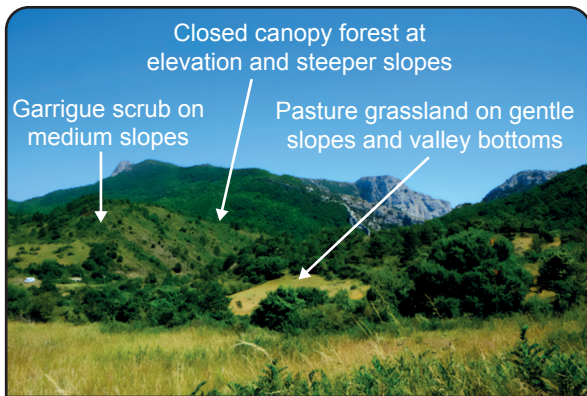


Figure 3(e): Habitats of the low mountain and valley areas of the Corbières-Fenouillèdes Natural Park



Habitats of the low mountain and valley areas of the Corbières-Fenouillèdes Natural Park



Degraded pasture where grazing has been **reduced** for a number of years



Degraded garrigue scrub where grazing by goats and cattle has been **absent** for a number of years



Abandoned farm in the Corbières-Fenouillèdes Natural Park

Figure 3(f): Fact file: Semi-natural habitats of the low mountain valley areas of the Corbières-Fenouillèdes Natural Park

Vegetation type: Semi-natural grassland (pasture)		
Maintained by:	Characteristics:	Biodiversity value:
Low-intensity / low-profit traditional grazing – sheep, cattle and goats from spring to autumn, who fertilize the grass with animal dung. Removal of a flower-rich grass crop as hay in the summer prevents the growth of bushes and trees. Little or no use of chemical fertilizers. Supports difficult-to-farm small fields and herds compared to high-yield intensive agriculture.	Small fields of open grassland with a diverse mix of wildflowers with many endemic and rare orchids in the spring.	HIGH
Vegetation type: Scrubland (garrigue) with little grass		
Maintained by:	Characteristics:	Biodiversity value:
Traditional low-yield seasonal grazing by goats, sheep and cattle. Goats graze and browse on all plants other than those with the toughest spines or chemical defences, including young trees. Sheep and cattle only graze on the softer vegetation. Requires clearance by cutting and burning if the scrub becomes dense to maintain an open habitat. Animals disperse seeds in dung.	Large areas of highly diverse community of sparse thorny vegetation or plants with chemical defences survive as an open patchwork of many different small bushes and flowering herbs, such as thistles, lavender, rosemary and juniper.	VERY HIGH
Vegetation type: Closed-canopy climax forest		
Maintained by:	Characteristics:	Biodiversity value:
Climax community of the Corbières-Fenouillèdes mountain valleys of mainly evergreen holm oak (<i>Quercus ilex</i>) and kermes oak (<i>Quercus coccifera</i>) tree species.	Dark closed canopy with a very limited number of plant species under the closed canopy and low primary productivity.	LOW

Figure 3(g): System diagram showing the maintenance of grassland (pasture) and scrub (garrigue) communities through natural change and human influences

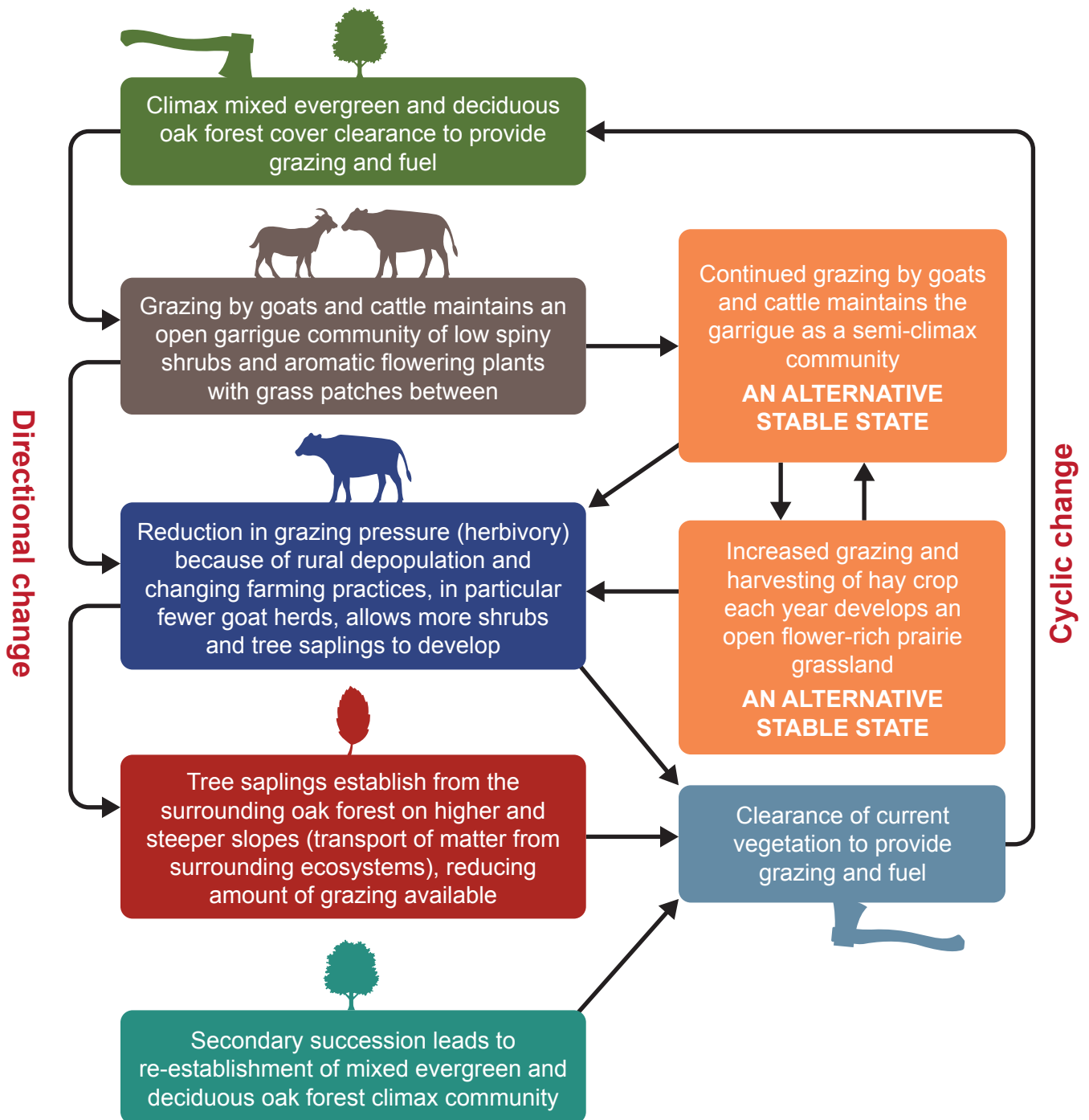


Figure 3(h): Natural zonation of the two main biomes found in the Corbières-Fenouillèdes Natural Park

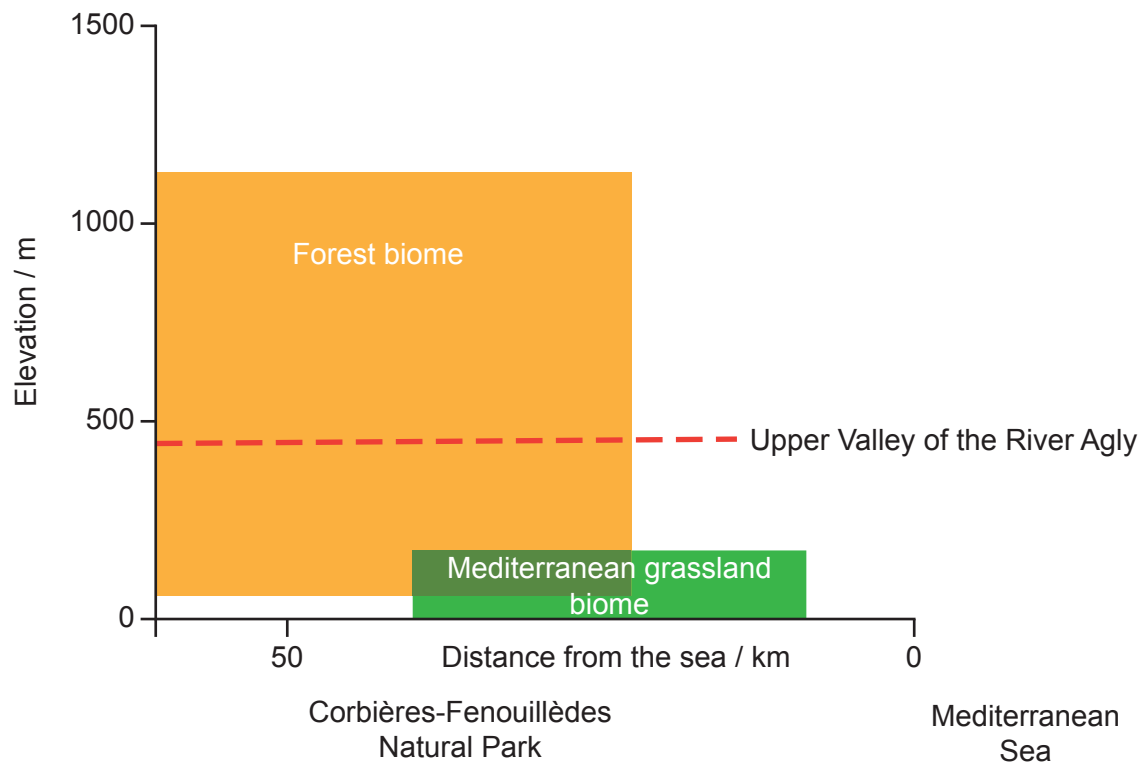


Figure 4(a): Egyptian vulture (*Neophron percnopterus*)



Figure 4(b): Fact file of Egyptian vulture (*Neophron percnopterus*)

Range	Large geographic range across Africa, India, the Mediterranean and Middle East
Habitat	Sparsely vegetated ecosystems
Food	Carrion (dead animals) – small rodents and reptiles to large farm animals; will also eat live prey, eggs, fish and even fruit
European population and conservation status	Migratory breeding population from Africa found mainly in Spain with small populations in France and Italy Endangered (IUCN Red List) across its entire range and Critically Endangered in Europe where it is protected by European Birds Directive and National Wildlife Protection law in France
Historic population	Declined rapidly in 20th century through persecution and accidental poisoning following increased use of pesticides after World War II
France and Spain	European population is mainly found in Spain with 1500 breeding pairs Two populations in France: Western Pyrenees, 50–60 breeding pairs. Small isolated populations in the Eastern Pyrenees and Alps – less than 12 breeding pairs
Threats	Land use change from declining livestock (animal) farming Accidental and illegal poisoning – 53 % of all vulture deaths from poisoning are the result of the use of banned pesticides
Bovine spongiform encephalopathy (BSE) – problem	Following the European outbreak of the disease bovine spongiform encephalopathy (BSE) in cattle, in the early 1990s, farmers across Europe were banned from leaving cattle and sheep, which had died naturally in fields, to decay and decompose – this removed a major food source for Egyptian vultures in conflict with the European Birds Directive

Figure 4(c): European Red List designation and niche characteristics of vultures in the Corbières-Fenouillèdes Natural Park

Common name	Scientific name	European Red List status	Habitat requirements	Nesting sites	Feeding
Cinereous vulture	<i>Aegypius monachus</i>	Critically Endangered	Woodland and forests as well as sparsely vegetated ecosystems	Solitary on trees	Carrion of medium to large animals – live prey rarely eaten
Bearded vulture	<i>Gypaetus barbatus</i>	Critically Endangered	Sparsely vegetated mountain areas above 1000 m	Solitary on rock ledges in the high mountains	Carrion, in particular bones and soft tissue – will occasionally hunt live mammals and birds
Egyptian vulture	<i>Neophron percnopterus</i>	Critically Endangered	Sparsely vegetated ecosystems of open hills and low mountains	Solitary on cliff ledges and rocky outcrops as well as ledges and tops of tall buildings	Feeds mainly on carrion but will also eat live prey, eggs, fish and even fruit
Griffon vulture	<i>Gyps fulvus</i>	Vulnerable	Sparsely vegetated mountain areas to semi desert	Breeds in colonies of up to 100 pairs on large cliffs and ravines	Forages for carrion in family groups

Figure 4(d): Number of breeding pairs of Egyptian vulture (*Neophron percnopterus*) in France between 1935 and 2011

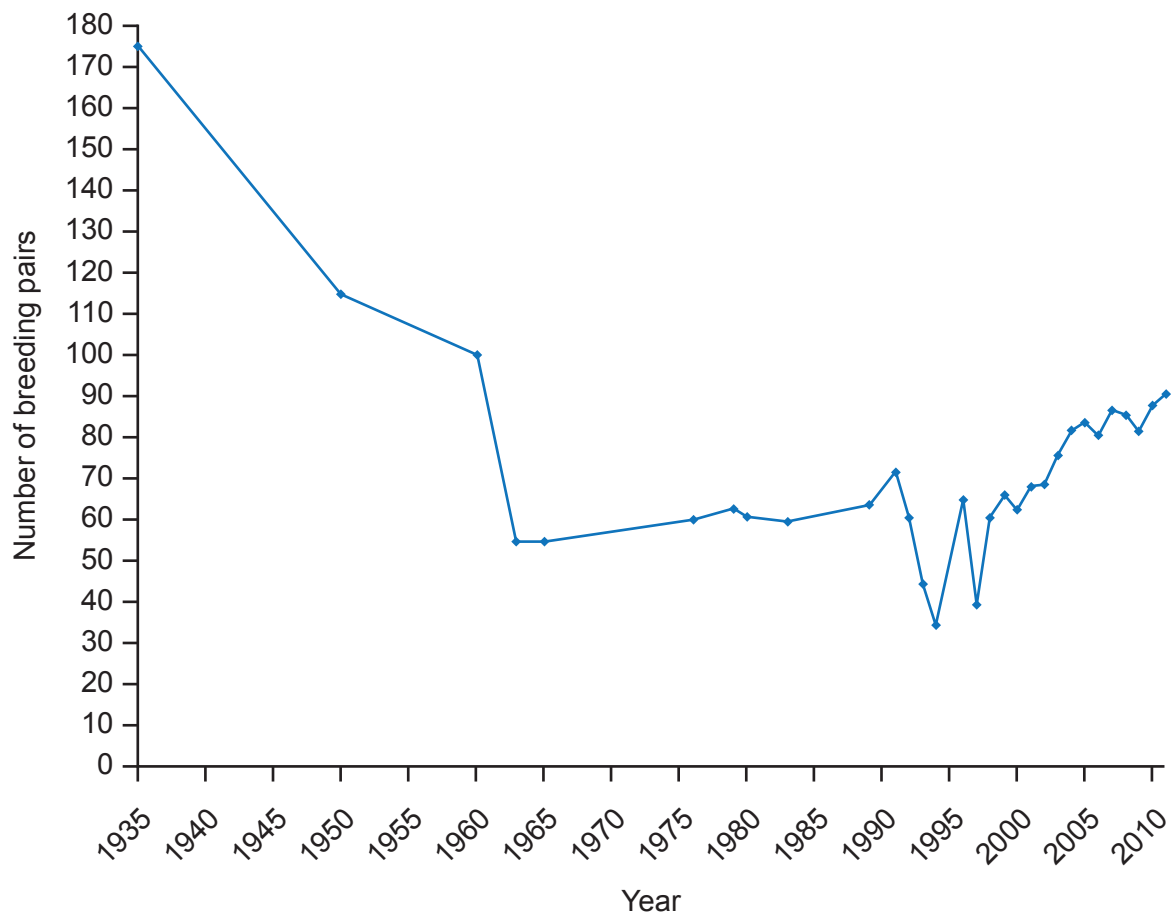


Figure 4(e): Conservation strategies for vulture populations in the south of France

In 2003, European Union Natura 2000 programme protected areas were set up to save the small Egyptian vulture population in the Corbières-Fenouillèdes region.

Six feeding stations were set up across the Mediterranean area to:

- minimize the effect of food source loss because of BSE
- help monitor the population for future conservation.

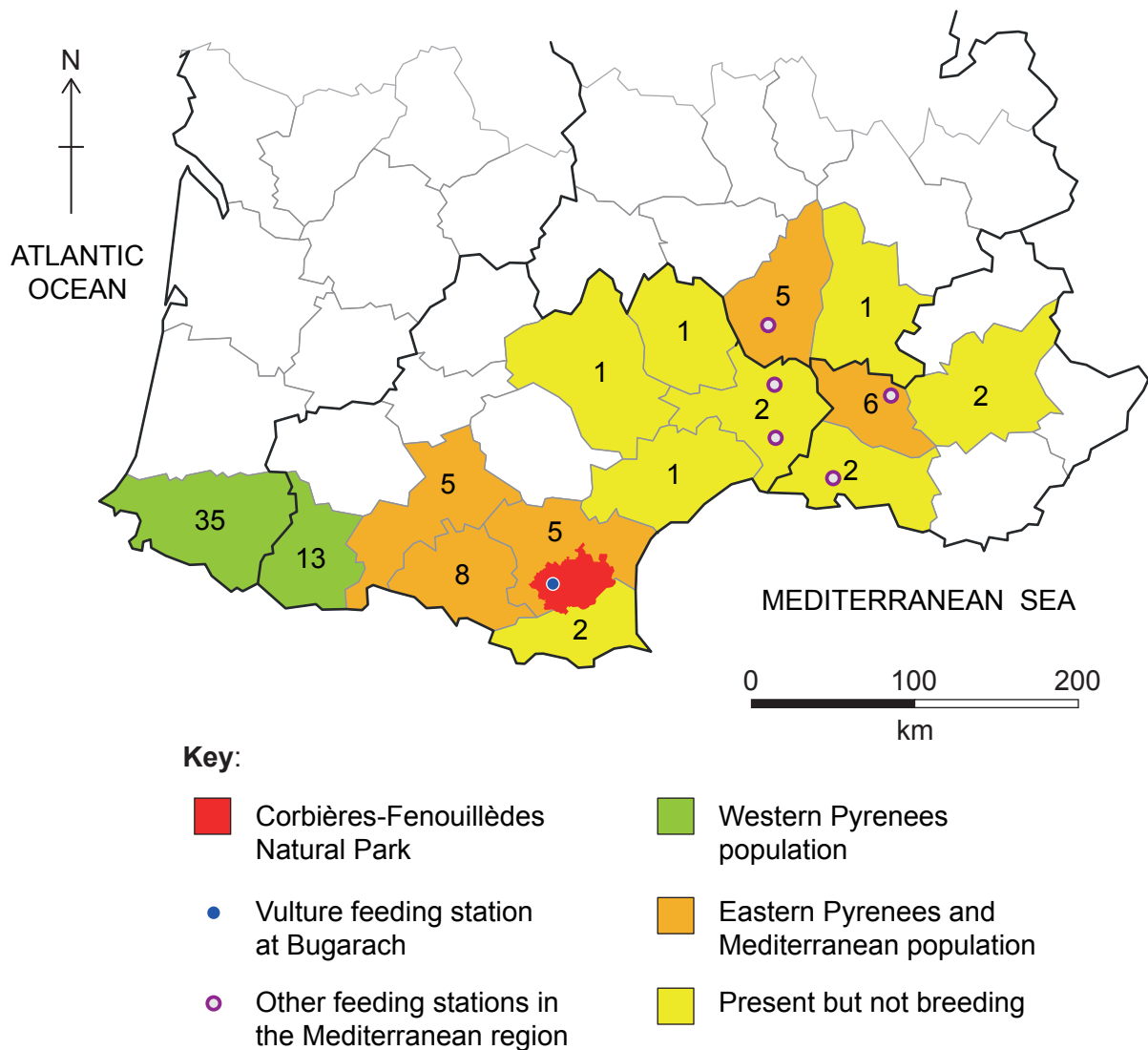
One is at Bugarach in the heart of the natural park – it also acts as an education centre.

The sites were established for the conservation of all vulture species in the region.

All sightings of vultures are logged using a GPS system.

Dead farm animals which have been tested by vets are placed out every day at each site.

Map of pairs of Egyptian vultures and feeding sites in the south of France:



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References:**Figure 1(g):**

Vinci, G.; Prencipe, S.A.; Abbafati, A.; Filippi, M. Environmental Impact Assessment of an Organic Wine Production in Central Italy: Case Study from Lazio. *Sustainability* **2022**, *14*, 15483. <https://doi.org/10.3390/su142215483>. Open access article, licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.

Bonamente, E.; Scrucca, F.; Asdrubali, F.; Cotana, F.; Presciutti, A. The Water Footprint of the Wine Industry: Implementation of an Assessment Methodology and Application to a Case Study. *Sustainability* **2015**, *7*, 12190-12208. <https://doi.org/10.3390/su70912190>. Open access article, licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.

- Figure 2(d) and (e):** BRGM, 2023. *Nappes d'eau souterraine au 1er avril 2023 et risques de sécheresse estivale*. [online] Available at: <https://www.brgm.fr/fr/actualite/communique-presse/nappes-eau-souterraine-au-1er-avril-2023-risques-secheresse-estivale> [Accessed 6 August 2025]. Source adapted.
- Figure 2(f):** Syndicat Mixte pour la protection et la gestion des nappes de la plaine du Roussillon, 2024. *Bulletin de situation des nappes souterraines de la plaine du Roussillon*. [PDF online] Available at: <https://nappes-roussillon.fr/wp-content/uploads/2026/01/Bulletin-2024-07-04.pdf> [Accessed 6 August 2025]. Source adapted.
- Figure 2(g):** Krishna Kumar Singh, Rakesh Chandra Vaishya. Municipal Wastewater Treatment uses Vertical flow followed by horizontal flow in a two-stage hybrid constructed wetland planted with *Calibanus hookeri* and *Canna indica* (Cannaceae), 19 July 2022, PREPRINT (Version 1) available at Research Square [<https://doi.org/10.21203/rs.3.rs-1769898/v1>]. Licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/deed.en>. Source adapted.
- Figure 3(a):** The World Bank Group, n.d. Rural population – France. [online] Available at: <https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=FR>. Licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.
- The World Bank Group, n.d. Urban population - France. [online] Available at: <https://data.worldbank.org/indicator/SP.URB.TOTL?locations=FR>. Licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.
- Figure 3(b):** Borey, G., Eblé, S., Blarel, I. and Evrard, A., 2017. L'emploi agricole et industriel a fortement reculé. [online] Available at: www.insee.fr/fr/statistiques/3280515#tableau-figure1 [Accessed 6 August 2025]. Licensed under Open Licence 2.0 (Licence Ouverte) www.etalab.gouv.fr/wp-content/uploads/2018/11/open-licence.pdf. Source adapted.
- Figure 3(c):** “Data Page: Food - Gross Production Value (constant 2014–2016 thousand US\$) (thousand US Dollar)”, part of the following publication: Hannah Ritchie, Pablo Rosado, and Max Roser (2023) - “Agricultural Production”. Data adapted from Food and Agriculture Organization of the United Nations. Retrieved from <https://archive.ourworldindata.org/20260417-112857/grapher/agricultural-output-dollars.html> [online resource] (archived on April 17, 2026). Licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.
- Figure 3(d):** “Data Page: Fertilizer use per hectare of cropland”, part of the following publication: Hannah Ritchie, Pablo Rosado, and Max Roser (2023) - “Agricultural Production”. Data adapted from Food and Agriculture Organization of the United Nations. Retrieved from <https://archive.ourworldindata.org/20260417-112857/grapher/fertilizer-use-per-hectare-of-cropland.html> [online resource] (archived on April 17, 2026). Licensed under CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>. Source adapted.
- Figure 4(a):** irinabal18, 2014. *Egyptian vulture (Neophron Percnopterus) sits on the stone*. [online] Available at: <https://www.gettyimages.co.uk/detail/photo/egyptian-vulture-egyptian-vulture-sits-on-the-stone-royalty-free-image/498495147?phrase=Egyptian%20vulture&searchscope=image%2Cfilm&adppopu p=true> [Accessed 6 August 2025]. Source adapted.
- Figure 4(b) and (c):** BirdLife International (2021). Species factsheet: Egyptian Vulture *Neophron percnopterus*. Downloaded from <https://datazone.birdlife.org/species/factsheet/egyptian-vulture-neophron-percnopterus> on 6 August 2025.
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- BirdLife International (2021). Species factsheet: Bearded Vulture *Gypaetus barbatus*. Downloaded from <https://datazone.birdlife.org/species/factsheet/bearded-vulture-gypaetus-barbatus> on 6 August 2025.
- BirdLife International (2021). Species factsheet: Griffon Vulture *Gyps fulvus*. Downloaded from <https://datazone.birdlife.org/species/factsheet/griffon-vulture-gyps-fulvus> on 6 August 2025.
- Figure 4(d) and (e):** Ministère de l'Écologie, du Développement durable et de l'Énergie, 2024. Plan national d'actions en faveur du Vautour percnoptère *Neophron percnopterus*, 2015–2024. [PDF online] Available at: www.consultations-publiques.developpement-durable.gouv.fr/IMG/pdf/PNA_Percnoptere.pdf [Accessed 7 August 2025]. Licensed under LICENCE OUVERTE 2.0/OPEN LICENCE 2.0 <https://github.com/etalab/licence-ouverte/blob/master/LO.md>. Source adapted.