Plain Language Summary

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FEASIBILITY STUDY

Reintroduction of the Cinereous vulture *(Aegypius monachus)* and the Bearded vulture *(Gypaetus barbatus)* in the central Apennines

Photographs: Bruno D'Amicis; Magnus Elander; Luca Melcarne; Juan Carlos Muñoz; Georgi Kurtev; Rewilding Apennines; Stefano Scivola; Marcus Westberg; Staffan Widstrand.

Adaptation and Design: Daniela Gentile/Rewilding Apennines.

This report has been created under the framework of the "Wildlife comeback initiative" by Rewilding Europe.

The feasibility study was sponsored by Rewilding Europe and realised by their Italian partner organisation Rewilding Apennines.The study was coordinated by Mario Posillico (ARDEA APS), Nicolò Borgianni (Rewilding Apennines), Enrico Bassi (Italian Centre for Ornithological Studies, University of Palermo) and Fulvio Genero (Lago di Cornino Nature Reserve), with Mario Cipollone (Rewilding Apennines) as overall project coordinator.

Sixteen authors contributed from Italian and European institutions and organisations: Rewilding Apennines, ARDEA APS, the Centro Italiano Studi Ornitologici, University of Palermo, the Riserva del Lago di Cornino, the Instituto de Estudios Sociales Avanzados, Planckendael Zoo (Belgium), LPO Birdlife France, Dresden University of Technology, and the Forest Research Institute of Baden-Württemberg.

Feasibility study for the reintroduction of the Cinereous vulture (Aegypius monachus) and the Bearded vulture (Gypaetus barbatus) in the central Apennines

Plain Language Summary
July, 2026

Coordination: Rewilding Apennines

Full study

rewilding-apennines.com

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Introduction

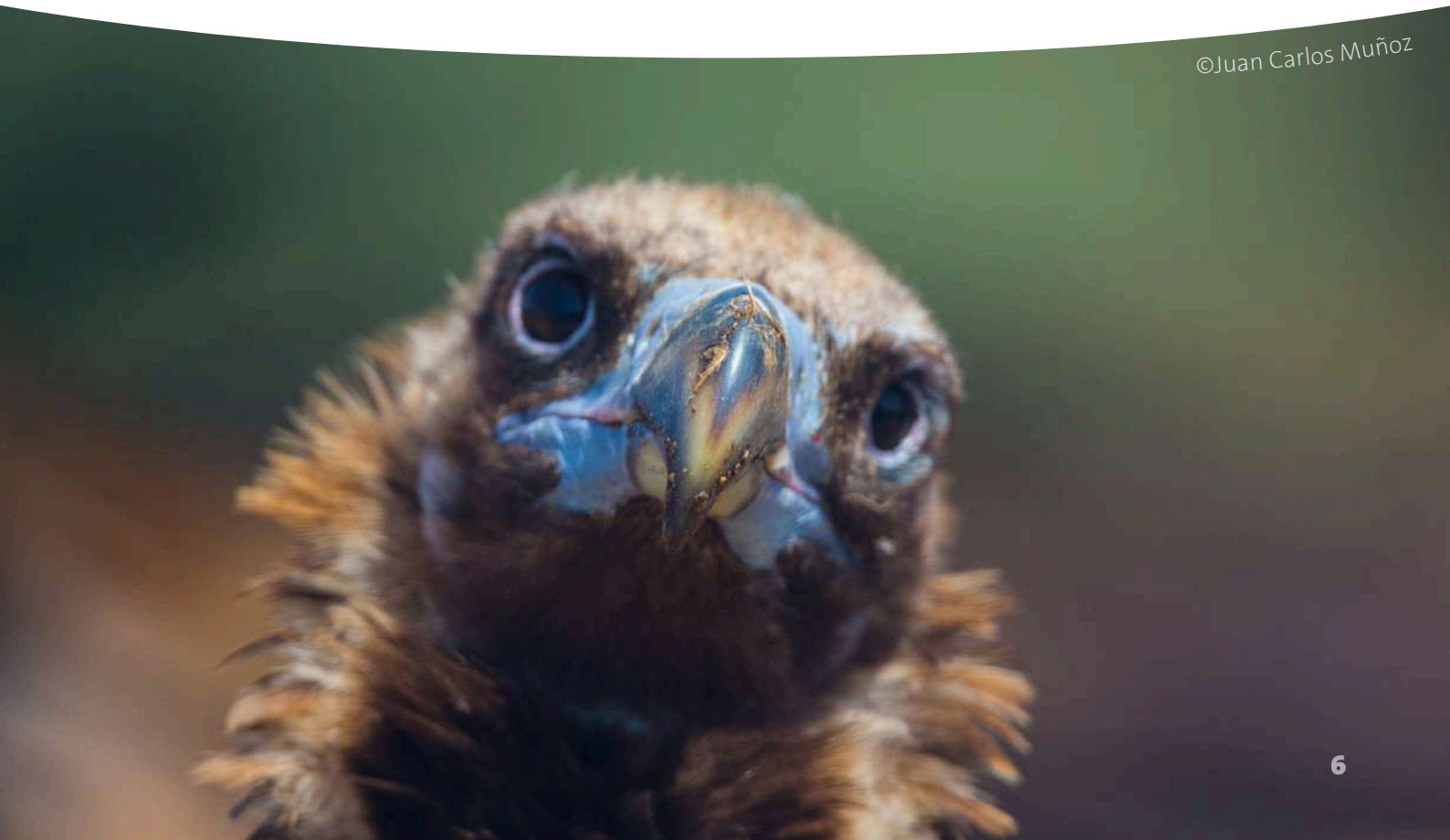
Cinereous vultures and Bearded vultures have been absent as breeders from the Italian Apennines for hundreds of years.This feasibility study analyses whether the environmental and social conditions now exist to bring both species back to the Central Apennines.

This feasibility study forms part of a process initiated by Rewilding Apennines over recent years through a series of preparatory studies on the possibility of restoring the vulture community in the central Apennines, where currently only the Griffon vulture is steadily present, thanks to reintroduction carried out in the 1990s by the State Forest Service. The European obligate scavenger community comprises four species: Griffon vulture *(Gyps fulvus)*, Cinereous vulture (*Aegypius monachus)*, Egyptian vulture *(Neophron percnopterus)* and Bearded vulture *(Gypaetus barbatus)*. In the Apennines, this community remains largely incomplete.

Commissioned by Rewilding Apennines, the feasibility study assesses the conditions for the reintroduction of the Cinereous vulture and the Bearded vulture in the central Apennines. It also updates the 2010 assessment by Genero and collaborators, which covered the Gran Sasso and Monti Sibillini National Parks, and it sits within a broader Rewilding Apennines' strategy that already includes the restocking of the Griffon vulture.

The study was built in line with the IUCN/SSC Guidelines for Reintroductions and Other Conservation Translocations (2013) and the criteria set out in the Italian Ministerial Decree of 2 April 2020. Eighteen chapters examine every dimension of a reintroduction effort: legal framework, historical distribution, current threats, habitat suitability, food availability, livestock health, population viability and social acceptance.

The question the study seeks to answer is practical. Are habitat, food base, institutional support and social attitudes in place to make reintroduction realistic? The evidence, gathered over two years of fieldwork and modelling, points to a qualified yes.



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A griffon vulture soaring above a mountain slope in the Central Apennines

The only vulture species with a stable presence in the central Apennines, the Griffon vulture disappeared from peninsular Italy before returning through a reintroduction programme led by the State Forest Service in the 1990s.

THE GRIFFON POPULATION IN THE CENTRAL APENNINES

AROUND

350

INDIVIDUALS

BREEDING PAIRS

~65

SINCE 2021 AROUND

90 GRIFFONS ARE CAPTURED AND TAGGED EACH YEAR

14th-20th

BREEDING GRIFFONS VANISH FROM PENINSULAR ITALY AND SICILY, SURVIVING ONLY IN SARDINIA

FIRST REINTRODUCTIONS

1990s

2020-2025

95 GRIFFONS HAVE BEEN FITTED WITH GPS TRANSMITTERS TO BE TRACKED AND MONITORED.

GPS


©Bruno D'Amicis

Since June 2021, a formal agreement between Rewilding Apennines and the Carabinieri Biodiversity Group has supported a range of research and management activities on Griffon vultures in the central Apennines.

Under this framework, individuals have been fitted with GPS transmitters to track movements, identify feeding sites through cluster analysis, and respond promptly to suspected poaching and poisoning events. The agreement also covers reproductive monitoring, assessment of wind farm impacts, and the construction of supplementary feeding stations.

Together, these activities provide the basis for a more robust and coordinated monitoring programme for the species across the region.

2021-2025

MONITORING THE POPULATION

2931
INSPECTIONS AT FEEDING SITES TO REDUCE THE RISK OF POISONING

WEEKLY TRANSECTS
AT WIND FARMS TO MONITOR CASUALTIES

42 SIMULTANEOUS COUNTS AT THE NESTING SITES

8 SIMULTANEOUS SUMMER COUNTS

2 **FEEDING STATIONS MANAGED**

Why are we supporting vulture comeback?

Vultures are the only vertebrates in Europe that depend entirely on carrions, and their disappearance leaves a gap that no other species fills cleanly.

Every ecosystem works as a circuit. A herbivore grazes, a carnivore preys on it or old age does the job, the carcass is dismantled by scavengers and decomposers, nutrients return to the soil, and the plant that grows next closes the loop. This is the circle of life that Rewilding Europe has placed at the heart of its work: a process simple to describe and hard to keep turning on a continent where wild carcasses have become a rare commodity.

Vultures occupy a unique position within this circuit. Of all the terrestrial and marine scavengers out there, they are the only ones that feed exclusively on carrions. A group of griffons can strip a carcass to the bone in a matter of hours, a disposal capacity no other scavenger matches. Their stomach produces one of the most corrosive acids in the animal kingdom, capable of neutralising lethal pathogens such as those responsible for anthrax, cholera and botulism.

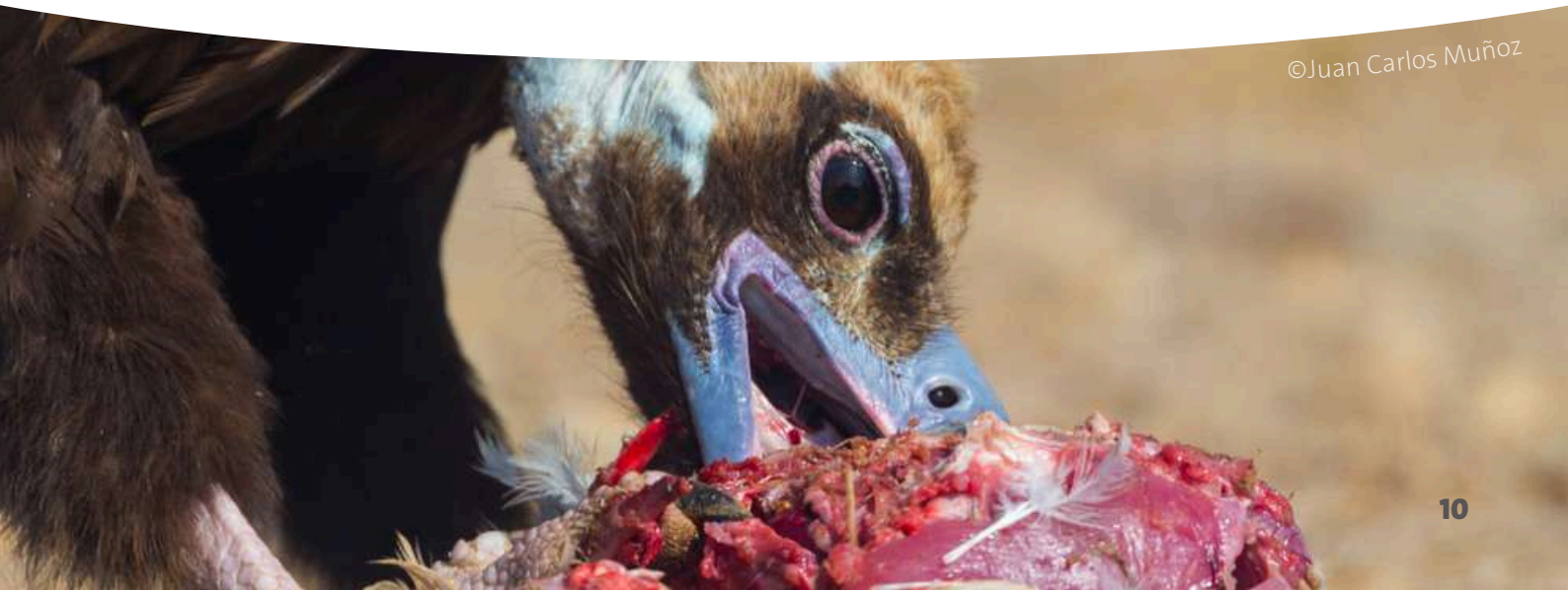
Where vultures arrive, a potential disease outbreak is shut down before it can spread to wildlife, livestock, pets and, ultimately, people.

The problem is that across most of Europe the circle broke a long time ago. The disappearance or sharp decline of large wild herbivores, post-Bovine Spongiform Encephalopathy regulations requiring the prompt removal of livestock carcasses, and centuries of direct persecution have nearly wiped out vultures. Numbers are climbing back, but populations remain fragile and isolated.

Rewilding Europe is supporting vultures comeback across the continent: from the reintroduction of Cinereous vultures in Spain's Iberian Highlands and Bulgaria's Rhodope mountains, to the Griffon vulture restocking in Italy's central Apennines. In parallel, a number of initiatives have been carried out, and others are still under way, to release large herbivores such as red deer, fallow deer and bison, providing vultures with a natural food base.

Since the 1970s, supplementary feeding stations have been set up across southern Europe to support recovering vulture populations. Rewilding Europe operates such stations in the Rhodope Mountains, the Greater Côa Valley in Portugal, the Central Apennines and the Velebit Mountains in Croatia. As a means to an end they are useful: they stabilise food supply during the early phases of reintroduction, improve breeding success where populations are still fragile, and help attract birds to new areas. Feeding stations are also a useful tool for involving local stakeholders, and livestock farmers in particular, in the process of vulture conservation.

The real goal is not to feed vultures artificially forever, but to rebuild the food web upstream: more wild herbivores, more predation, more natural carcasses, more scavengers.



Cinereous vulture

European and Global Status
IUCN: Near Threatened (NT); in Europe Least Concern (LC)
Italian Red List: Regional Extinct (RE)

Protection
EU Wild Birds Directive: Strictly Protected (Annex I)
Bern Convention: Strictly Protected (App. II)
Bonn Convention: Require International Agreements (App. II)

Breeding pairs in Europe
2,900 – 3,400

Population trend
Globally decreasing.
In Europe stable or slightly increasing.

Range
Europe, Asia.

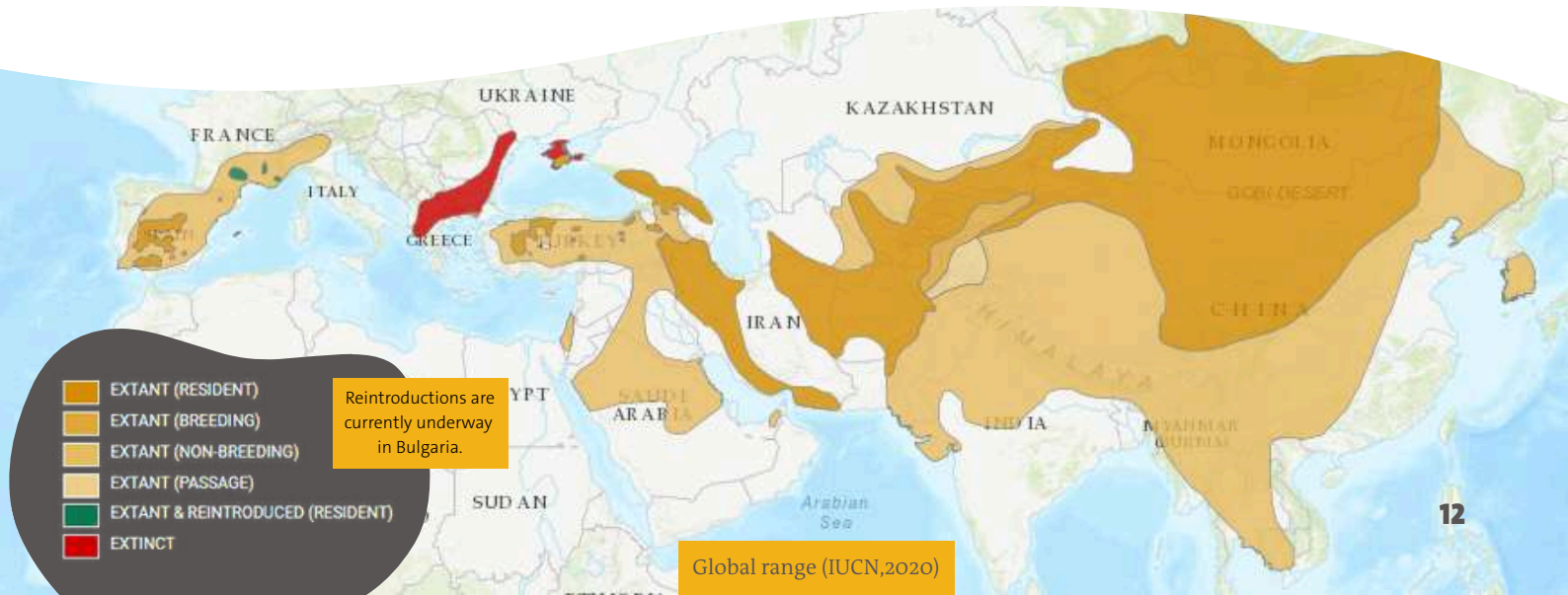
About the Cinereous vulture

The largest bird of prey in Europe. Wingspan close to three metres, a dark silhouette against ridge skies, a tree-nester in a family of cliff specialists.

The Cinereous vulture (*Aegypius monachus*) is globally classified as Near Threatened on the IUCN Red List (2020). In Italy it is extinct as a breeding species, with the last extant individual disappearing from Sardinia in the '60s-'70s of the last century. Aside from the sporadic presence of dispersing individuals from the nearest European populations, the Cinereous vulture has not bred in the Apennines for roughly 500 years.

At the European level, populations have recovered to the point where the species is now assessed as Least Concern (2020): a result of dedicated reintroduction programmes in Spain and France since the 1980s and 1990s and, more recently in Bulgaria and Portugal.

The species inhabits forested hills and mountains, typically between 300 and 1,500 metres, foraging over many kinds of open terrain. It nests in mature trees, usually pines and oaks, on slopes that offer both shelter and open flight access. It feeds on medium and large carcasses, with a preference for the soft tissues of ungulates. The Cinereous vulture typically raises a single chick per year, and, unlike the Griffon vulture, is a relatively solitary nester.



Global range (IUCN,2020)

Bearded vulture

European and Global Status
IUCN: Near Threatened (NT)
Italian Red List: Critically Endangered (CR)

Protection
EU Wild Birds Directive: Strictly Protected (Annex I)
Bern Convention: Strictly Protected (App. II)
Bonn Convention: Require International Agreements (App. II)

Breeding pairs in Europe
220-250 pairs.

Population trend
Decreasing globally. Increasing in Europe.

Range
Africa, Europe, Asia.

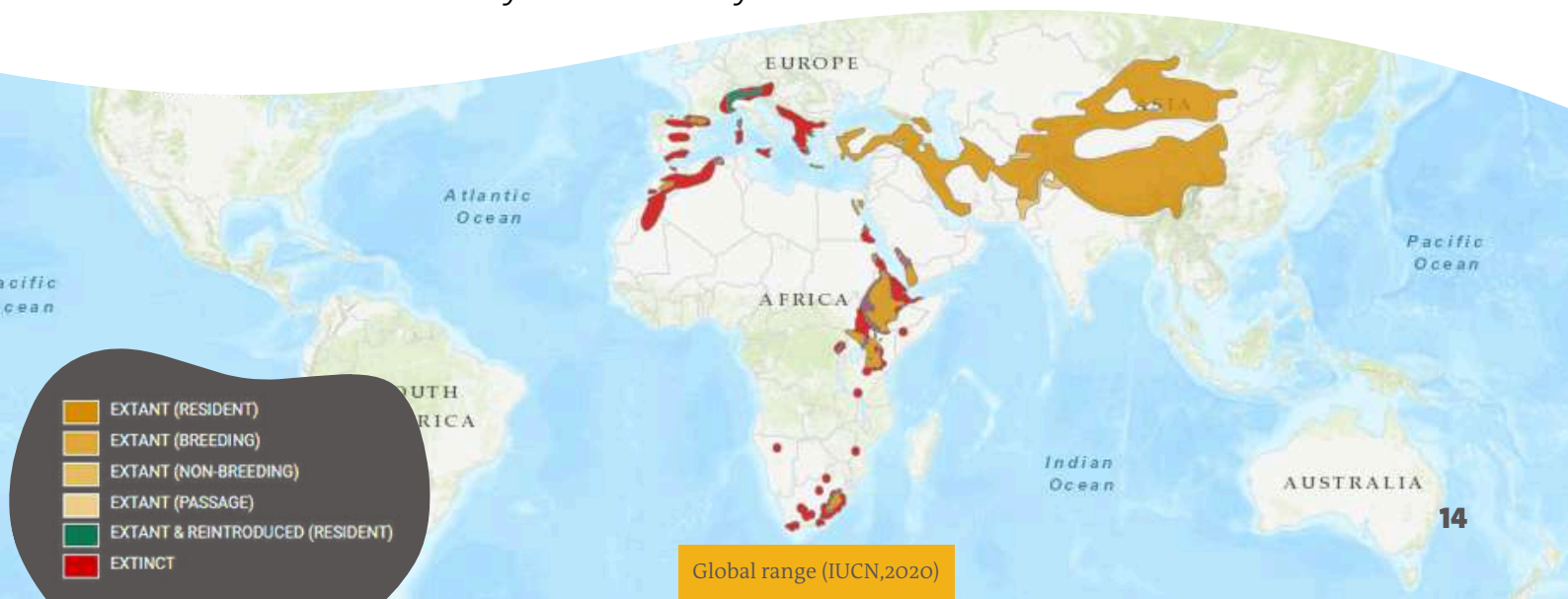
About the Bearded vulture

The only bird in the world to specialise in bone: a scavenger of what other scavengers leave behind.

Gypaetus barbatus is listed as Near Threatened (2021), reflecting a moderately rapid population decline over the past three generations. While numbers have stabilised or increased in some areas thanks to conservation action, significant reductions are suspected in parts of the Himalayas, India and the isolated South African population.

Efforts to reintroduce the Bearded vulture in the Alps began in the late 1970s with the Alpine Reintroduction Project, and within four decades a self-sustaining population had been firmly re-established, in what stands as one of the world's most successful wildlife comeback stories. The Apennines, however, have been without a breeding pair for around 500 years, and the species remains Critically Endangered.

Bearded vultures favour remote mountain terrain, typically above 1,000 metres. They forage over vast distances on soaring flight, with a home range that can span entire mountain massifs. Its relationship with food is unlike that of any other European bird. Bone makes up as much as 85% of its diet: fragments too large to swallow whole are carried aloft and dropped from 50 to 80 metres onto hard rock. It breeds on inaccessible rock faces, lays one or two eggs, and is a slow reproducer: sexual maturity comes at six or seven years and pairs raise one chick every one to two years.



Global range (IUCN,2020)

Historical presence and causes of extinction

Vultures are not strangers to the Central Apennines, yet their story is full of silences.

Vultures have been present in peninsular Italy at least since the Bronze Age, with even older Pleistocene traces. Yet the closer we come to recent centuries, the more fragmentary the evidence becomes. Identification in early sources is often uncertain, partly because pre-modern authors rarely drew the taxonomic distinctions we now take for granted. Part of the work is philological before it is ecological. The names used across the centuries do not always allow a species to be identified with certainty: *"voltore", "bearded eagle", "osso barbuto", "ossifrage":* terms that overlap, sometimes indicating different species within the same text. Yet natural history, literary references and place names converge on a consistent picture: all three vulture species inhabited the Apennines until recent centuries, even if it is not always possible to tell whether they were resident or breeding.

Naturalist Costanzo Felici of Piobbico, in a 1563 letter to Ulisse Aldrovandi, describes vultures nesting both in trees and on rock faces in the Monte Nerone area (Pesaro-Urbino). The detail is telling: tree nesting is consistent with the Cinereous vulture, cliff nesting with the Griffon. Felici also records a vulture that breaks bones by dropping them from rocks, an unmistakable description of *Gypaetus barbatus* behaviour. **This letter is among the earliest pieces of natural history evidence for the sympatric presence of three vulture species in the Apennines.**

> *It is of greater body than the eagle, mostly black feathered. It willingly follows the eagle to serve itself with the remains of this bird's food and throws away the bones, which it takes and sometimes, if they are too big and cannot be used, it lifts them up by talons and lets them fall on rocks and breaks them, then eats them.*
>
> **Costanzo Felici, letter to Ulisse Aldrovandi, 21 July 1563.**

Six centuries of scattered records

1473 — Guerrin Meschino

The chivalric romance, set partly in the Sibillini Mountains, mentions *"very great and fierce griffon vultures"* around Monte Vettore. Literary rather than scientific, but it records a presence perceived in the landscape.

1573 — Francesco De Marchi,

In his Chronicle of the first ascent to the peak of Gran Sasso, Marchi reports the presence of the Bearded vulture in the area..

1599–1603 — Ulisse Aldrovandi, Ornithologiae

Reports a letter from Francesco Patrizi describing a vulture nest near Monte Averna in Etruria.

1842 — Leonardo Dorotea, on the chamois

The naturalist from Villetta Barrea, in the Upper Sangro valley, writes of the Bearded vulture as a predator of the Apennine chamois: *"the chamois could fear nothing from voracious animals and little from man, if the bearded falcon, the Ossifrage of the Latins, did not hunt them down".*

1859 — Marradi (Florence)

A griffon vulture is caught and later kept in Salvadori's private collection.

May 1863 — Ripatransone (Ascoli Piceno)

Two Cinereous vultures are observed. One is shot and donated to Tommaso Salvadori. Reported by Salvadori in 1872.

1869 — Doderlein / 1873 — Savi

The two naturalists agree on the presence of the Cinereous vulture in Sardinia but disagree on Sicily.

1908 — De Leone

On the vultures of the Abruzzi, writes laconically: *"I have never seen them in Abruzzi, I don't know if anyone else has."* A passage that probably marks the extinction of the species in the area.

1997 — De Curtis, Gola della Rossa (Ancona)

During the study of osteological material from an ancient eagle nest, 23 bone fragments are identified as belonging to an adult Griffon vulture, probably dating to the turn of the XIX and XX centuries. The finding provides objective physical evidence of the species' presence in the Marche Apennines before extinction, though the author concludedthat there was no evidence to support the hypothesis of a breeding site.

XIII century - Frederick II, De Arte Venandi cum Avibus

The emperor's treatise on falconry features numerous illuminations of what he refer to as the Cinereous vulture, suggesting that the species was once abundant in southern Italy. But a passage describing gregarious feeding at a carcass (*"Et si unus de ipsis subito descenderit ad cadaver [...] congregant se multi"*) could be interpreted more as a reference to the Griffon vulture.

1563 — Costanzo Felici to Ulisse Aldrovandi

Naturalist Felici describes what are recognisably four species: the Cinereous vulture (nesting on treetops), the Griffon vulture (on cliffs and precipices), the Bearded vulture, called bone-bearded (feeding on remains left by eagles, dropping bones onto rocks to break them) and the Egyptian vulture.

1644 — Oratio Avicenna

Records the Griffon vulture nesting alongside the golden eagle on Monte Acuto and Monte Sant'Angelo (Ancona province).

1844 — Zuccagni-Orlandini

Cites the Cinereous vulture for the Terra di Lavoro (northern Campania, southern Lazio, western Molise). The report is brief and unconfirmed.

1857 — Costa

Reports a Cinereous vulture caught on Monte Tifata (Caserta) and taken to Naples, and another killed near Reggio Calabria, which he suggests came from Sicily.

1863 (circa) - Monte Corno, Alessandro Spada

The geologist sees the head of a bearded vulture killed on the Gran Sasso massif at Monte Corno. The account is later reported by Salvadori (1872).

1876 — Girolamo Orsi, Italian Alpine Club

One of the last records of the Griffon vulture as a resident of the Sibillini. In his account of the mountaineering excursion to Monte Vettore, Orsi writes: *"It is more frequent that the eagle and the griffon vulture nest in those rocks."*.

1920 — Giuseppe Altobello, Essay on Italian Ornithology

in his essay Altobello reports only one historical account related to the Bearded vulture in Abruzzi: it suggest a feeble probability that its occurrence in the central Apennines could be related to breeding individuals in the XIX century.

"It was about ten o'clock: beyond the pass between Madonna di Rosa and Monte delle Scalelle, our outpost no. 2 had just clashed with a Piedmontese patrol, and the sound of gunfire had flushed out five or six vultures perched on the corpse of the spy (note: a traitor shot a few days earlier), not far from there. Rising with sharp and wild shrieks and tracing wide circles above us, they seemed ready to resume the interrupted meal at any moment or to secure a new one that the men down there shooting at each other would provide... Closer, ever closer, the vultures now traced their circles around the peak of Madonna di Rosa and, in the end, swooped down quickly to quickly finish the interrupted feast."

Ludwig Richard Zimmermann, Berlin 1868.

Not a reliable source on vulture presence in the XIX-century Apennines, but a rare first-hand account. Ludwig Richard Zimmermann was a German officer who joined the pro-Bourbon brigand Luigi Alonzi, known as Chiavone, as his lieutenant in the mountains above Sora during the early 1860s, when the unification of Italy had turned much of the southern Apennines into a theatre of guerrilla warfare. His memoirs, published in Berlin in 1868, describe a clash with a Piedmontese patrol in the Ernici Mountains, and the birds it disturbed. The species is almost certainly the griffon vulture, though it cannot be confirmed from the text.

The causes of disappearance follow a pan-European pattern. Soppelsa and Tancredi (2023) have shown that Griffon and Cinereous vultures became rare and eventually disappeared at the end of the **Angevin wars**, in the thirteenth and fourteenth centuries, as their plumage was the main source of fletching for bolts, especially crossbow quarrels, and were exploited to a great extent. Firearms, poisoned baits, the decline and transformation of pastoralism, and generalised human impact completed the local extinction in the centuries that followed. The possible role of the Little Ice Age, which stretched from the mid-fourteenth to the mid-nineteenth century, as a direct and indirect driver of decline and even extinction of such vultures in the central Apennines, remains largely unexplored.

In 2015, 2021 and 2022, three tagged Cinereous vultures, two of them fitted with GPS transmitters, crossed the Apennines. Two of these individuals, in 2021 and 2022, also entered the feeding station managed by the Carabinieri Biodiversity Department Castel di Sangro. Several sightings of Cinereous vultures, likely referring to the same individual, were recorded in the south-central Apennines in 2022, suggesting that the bird remained in the area for about two months.

After five centuries, they are at the door.

The study in NUMBERS

PROJECT AREA

+25,000 KM²

COVERED

6 ITALIAN REGIONS

78 PROTECTED AREAS

297 NATURA 2000 SITES

THREAT DATA FROM GRIFFON POPULATION MONITORING

67% ANTHROPOGENIC MORTALITY OF GRIFFON VULTURES IN THE CENTRAL APENNINES (1994–2020)

53% GRIFFONS MORTALITY FROM INDIRECT POISONING

37% GRIFFONS WITH SUBCLINICAL BLOOD-LEAD LEVELS

10% TO **20%** MORTALITY DUE TO COLLISIONS WITH WIND TURBINES

GLOBAL VULTURE MORTALITY

40% ELECTROCUTION

22% ILLEGAL KILLING

16% POISONING

53% OF PROJECT AREA IN MEDIUM-TO-HIGH WIND-TURBINE COLLISION RISK CLASS

FOOD BASE

1,388 t/year BIOMASS FROM EXTENSIVELY REARED LIVESTOCK

63 t/year BIOMASS FROM WILD UNGULATES

VULTURE FOOD REQUIREMENTS **79 -115 t/year**

RESOURCES

€252,000

REWILDING APENNINES INVESTMENT IN VULTURE CONSERVATION (2021–2023)

16% SHARE OF REWILDING APENNINES ANNUAL BUDGET DEDICATED TO VULTURE WORK

€467 IN-KIND VOLUNTEER CONTRIBUTION OVER THREE YEARS

62–84 VOLUNTEERS ENGAGED PER YEAR

Geographical scope

The project area spans more than 25,000 km² of the central and upper-southern Apennines following the griffon's stable range.

The boundaries of this study follow the Griffon vulture's stable range, the benchmark against which every analysis in the study has been calibrated. Within it lie six regions, 19 provinces, 78 protected areas and 297 sites in the Natura 2000 network. Together, these protected areas cover 10,697 km², roughly **42 per cent** of the total area.

The landscape is stratified vertically and horizontally. In the south, Mediterranean influences shape a mosaic of mixed sclerophyllous and deciduous oak forests, pastures and olive groves. Climbing towards the central sector, oceanic conditions bring pure and mixed beech woods, opening at higher elevations into primary and secondary grasslands, shrubland and rocky massifs. The continental climate of the highest ridges closes the gradient.

Habitat suitability

The habitat is there. The data come both from expert feet on the ground and from statistical models calibrated on climate and terrain.

In spring and autumn 2023, an international team of field experts carried out two survey campaigns across the Central Apennines, moving from south to north: from the Abruzzo, Lazio and Molise National Park to the Monti Sibillini. Their task was to assess what habitat models cannot capture from a desk: the actual condition of potential nesting trees, the degree of human disturbance, and proximity to known threats on the ground.

The potential distribution and to a certain extent habitat suitability were also assessed statistically through species distribution modelling. **The analysis produced high suitability across the study area for both species.**

20 SITES ASSESSED

14 Suitable for the Cinereous vulture

10 Suitable for the Bearded vulture

5 Suitable for both species

La Camosciara, inside Abruzzo, Lazio and Molise National Park, scored the maximum 5 out of 5 for the Cinereous vulture. It also shows reproductive potential for the Bearded vulture.

Steep rocky slopes with pines
→ suitable nesting sites

Integral biosphere reserve
→ no human disturbance

Livestock present
→ ready food base

As with any modelling approach, outputs should be interpreted alongside field survey data, risk assessments, and additional variables including land use, food availability, and human disturbance patterns.

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Key suitability drivers

CINEREOUS VULTURE		BEARDED VULTURE
Low temperature seasonality		Low temperature seasonality
High winter precipitation / Moderate dry-season rainfall		Annual precipitation <2,000 mm. Low dry-season precipitation
Low elevations - gentle slopes (tree-nesting)		Higher elevations

93% % OF THE STUDY AREA HAVING SUITABILITY VALUES ABOVE 0.8 **86%**

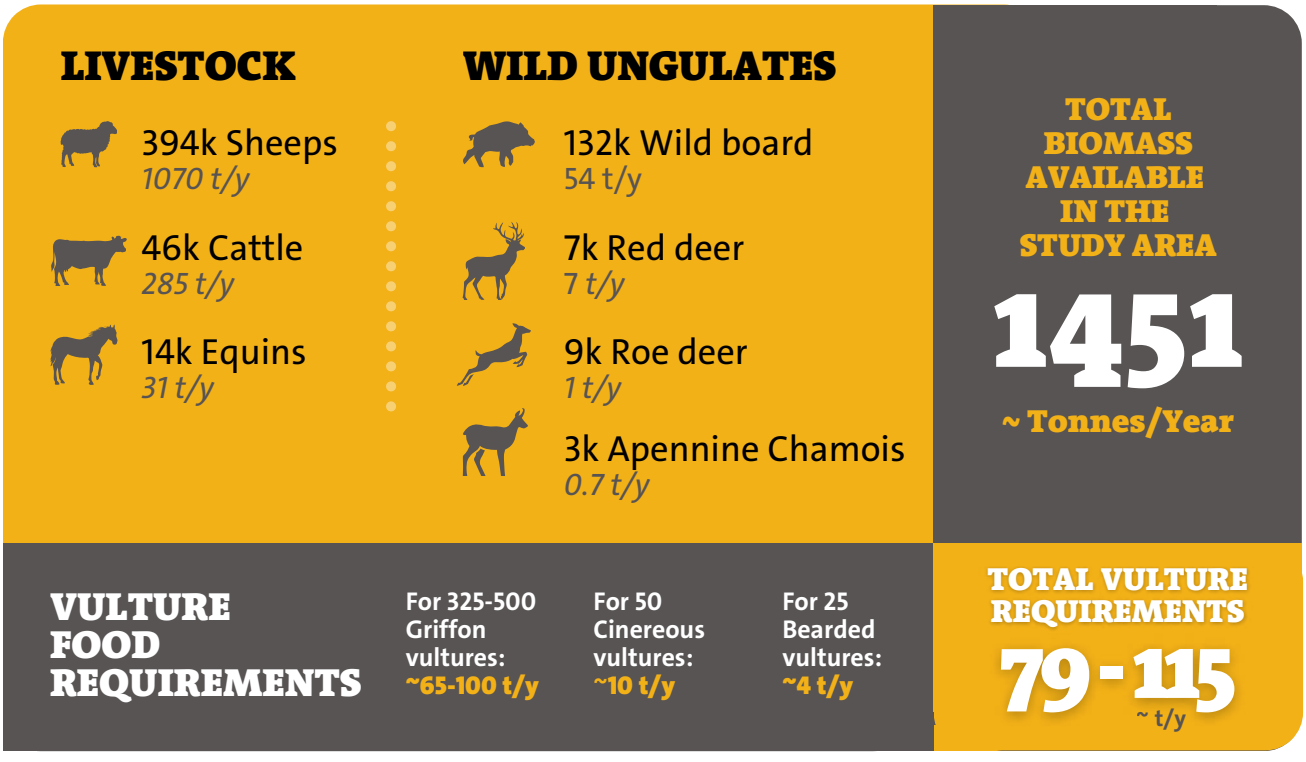
Food base and livestock health

Food is not the limiting factor. The biomass available to vultures in the central Apennines exceeds the needs of the current Griffon vulture population by an order of magnitude.

Livestock rearing is widespread, though patchily distributed, under extensive or semi-extensive systems that remain well suited to the vulture's food. The region also supports significant populations of wild ungulates. Red deer, Roe deer and Wild boar are the three species most relevant to vultures, with Wild boar by far the most abundant.

Based on available data, we estimate an annual biomass availability of approximately 1,451 tonnes in the study area, combining domestic livestock and wild ungulates. Domestic livestock accounts for the large majority (~96%), while wild ungulates contribute a further 63 tonnes (~4%).

Some of this biomass is not fully accessible: impassable terrain and dense vegetation cover put certain carcasses beyond the vultures' reach, other scavengers take a share, and veterinary collection removes a further portion. The wild ungulate estimate is itself probably conservative.



One gap stands out.

During the early phases of a translocation, supplementary feeding stations remain essential. In the longer term, farm-based feeding stations offer a dual benefit: a reliable food source for vultures and a free carcass disposal service for livestock keepers. European regulations already allow carcasses to be left in situ on mountain pastures, and the Abruzzo Region formally provides for this in remote areas.

Health-side data reinforce the case. Livestock health in Abruzzo is monitored annually by the four provincial health authorities (ASL) within the Regional Integrated Control Plan and the National Residue Plan. The most recent regional report covers **6,664** equine holdings, **5,897** sheep and goat holdings, and more than **1,377** bovine and pig holdings. For all notifiable pathologies, no concerns emerge that would limit the use of carcasses for supplementary feeding.

Yet Residues of non-steroidal anti-inflammatory drugs (NSAIDs), such as diclofenac, ibuprofen, and ketoprofen, **are not included in current surveillance plans**, which are designed to protect human rather than wildlife health.

The issue is not abstract: in the 1990s, diclofenac residues in cattle carcasses drove the collapse of three *Gyps* vulture species across the Indian subcontinent, with population declines exceeding 95 per cent.

Implementing targeted surveillance for non steroidal anti-inflammatory drugs is a priority action.

Population viability

How many individuals need to be released, over how many years, to give a reintroduced population a reasonable chance of persistence?

The study used **Population Viability Analysis** to model reintroduction success under different scenarios of release effort, anthropogenic mortality and carrying capacity. For the Cinereous vulture, the total number of released individuals matters more than release rate or duration of the release phase.

In nearly all simulated scenarios, the extinction probability of the Cinereous vulture over a 100-year period is negligible, provided that at least 6–8 individuals are released annually over a period of 6–10 years.

Under **low carrying capacity**, however, the population begins to decline 20 to 35 years after translocation. Under **high carrying capacity**, it fails to reach an asymptote within the 100-year horizon, which suggests that the species requires a long time to stabilise in a recovering system.

The critical variable is additional anthropogenic mortality. As both the frequency and, especially, the severity of mortality events increase, the population declines significantly even when carrying capacity is high.

The study recommends a release effort comparable to the Bulgarian programme for the Cinereous vulture, rather than the French one, in order to buffer demographic and environmental stochasticity more effectively.

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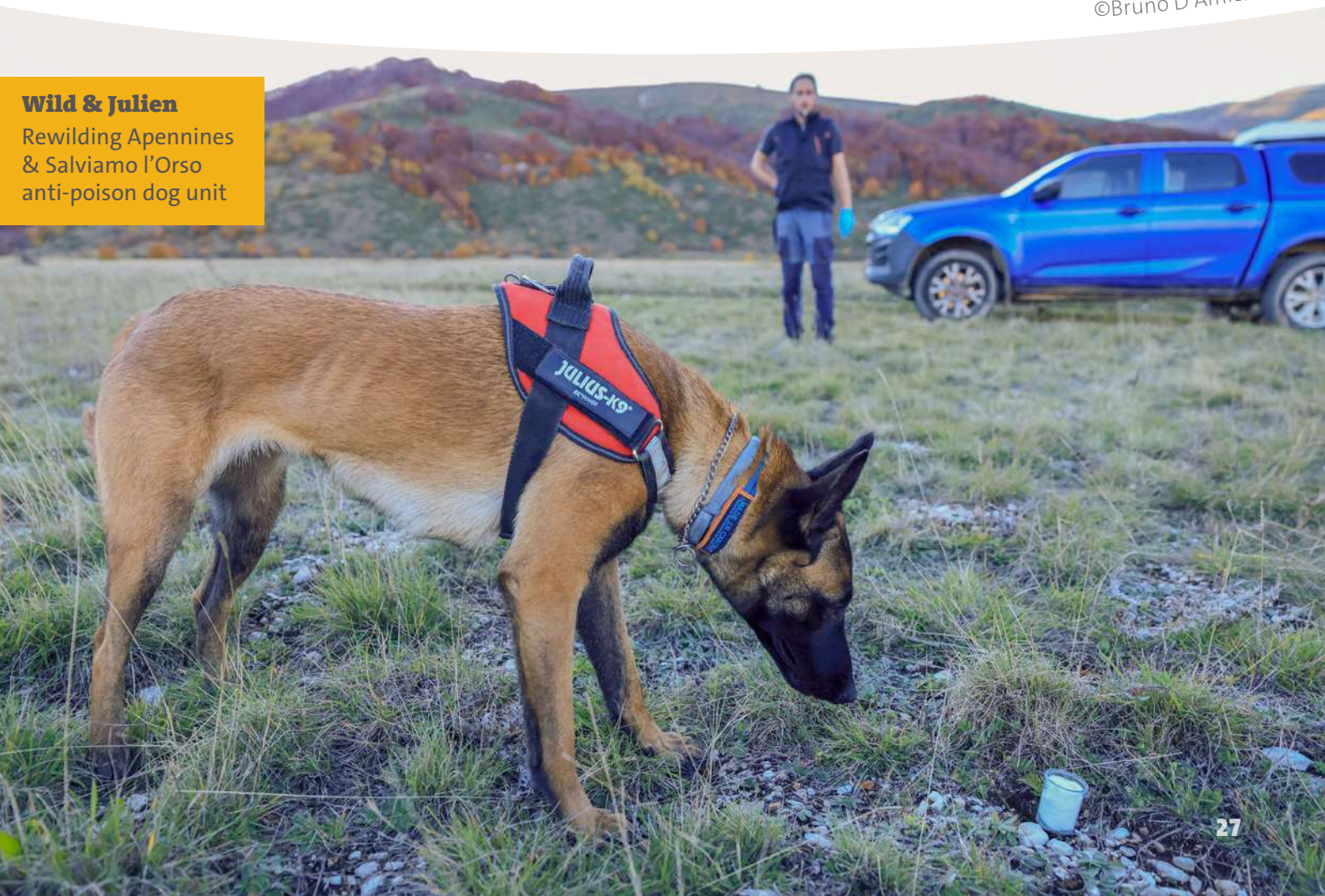


Wild & Julien
Rewilding Apennines & Salviamo l'Orso anti-poison dog unit

©Luca Melcarne

For the Bearded vulture, a minimum of 60 to 80 individuals released over 15 to 20 years is required for positive stochastic growth, regardless of carrying capacity. However, increasing the environmental carrying capacity would allow for a higher number of individuals to survive

Extinction probability rises substantially, between two and more than tenfold, with increasing severity of catastrophic mortality events.

As with the Cinereous vulture, reintroduction success is more closely tied to the total number of released individuals than to the duration of the release period: for the same total, a shorter period saves resources. Annual frequency of releases has a less pronounced effect

The Cinereous vulture recovery programme in the Rhodope Mountains is being carried out by the Bulgarian Society for the Protection of Birds, in cooperation with the Rewilding Rhodopes team, and is being funded by Rewilding Europe. The birds were provided by the Spanish NGO GREFA - Grupo de Rehabilitación de la Fauna Autóctona.

Current threats

The threats that drove vultures out of the Apennines have not gone away. Some have taken new forms.

The study analyses five main threats, each in its own chapter. Together they set the limits of what any reintroduction can realistically achieve.

GLOBAL VULTURE MORTALITY

ELECTROCUTION
40%

ILLEGAL KILLING
22%

POISONING
16%

Worldwide, anthropogenic causes account for the majority of vulture mortality along the Afro-Eurasian flyways: electrocution leads at 40.5 per cent, followed by illegal killing and poisoning.

67% of confirmed Griffon vulture deaths in the Central Apennines between 1994 and 2020 are attributable to human action.

Poisoning

Indirect or secondary poisoning is the single largest cause of vulture mortality in the region, accounting for **53%** of Griffon vulture deaths. It is predominantly linked to poisoned baits laid in retaliation against predators, above all wolves, in the context of longstanding conflicts with rural economies. The study drew on poisoning data from central-southern Italy for the period 2020–2023, supplied by the Istituto Zooprofilattico Sperimentale Lazio e Toscana. More than half of the events involved poisoned baits, followed by carcasses of dogs, domestic cats, foxes, wolves and griffon vultures.

Two spatial risk models were developed. The first, using all documented cases, shows that risk near settlements is strongly associated with paved roads and urban areas. The second, excluding cases near settlements, reveals that **unpaved roads and paths are the strongest drivers of risk, with large at-risk areas emerging even within protected areas.** Tree cover is negatively associated with poisoning risk, consistent with the fact that poisoning occurs primarily in open grazing areas.

Countering poisoning requires action on multiple fronts: law enforcement, prosecution of perpetrators, preventive measures, and educational work in the communities where conflicts arise.

Wind farms

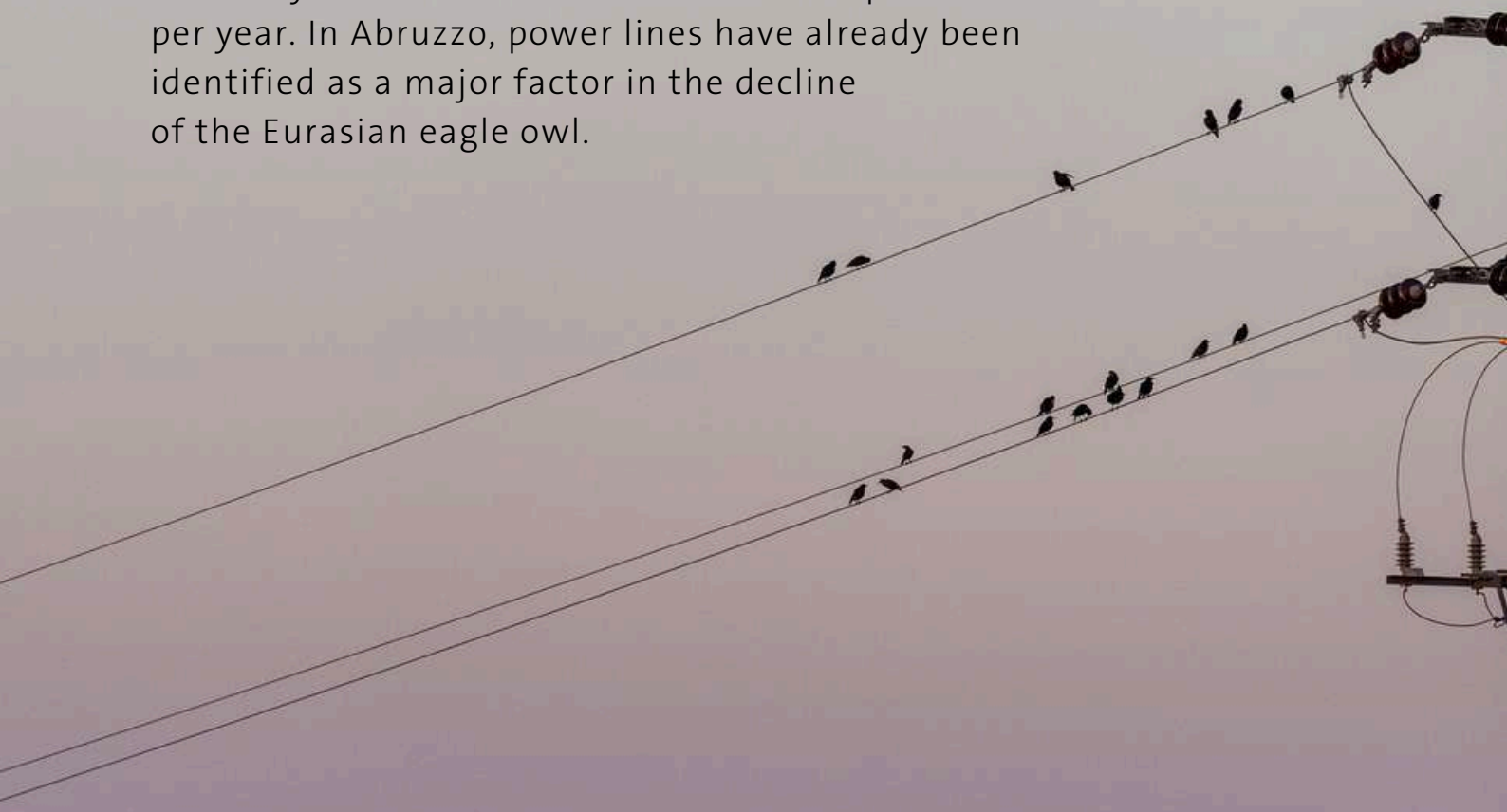
Sassi et al. (2024) demonstrated that Griffon vultures, unlike many other species, do not display avoidance behaviour in the presence of wind farms. Collisions with wind turbines account for **15 to 20 per cent** of known Griffon vulture mortality in the central Apennines. The overlap between vulture flight requirements (thermal currents, prevailing winds) and the siting preferences of wind farms makes the conflict structural. A collision-risk model was built. The result: **53% of the project area falls within medium-to-high risk classes**. Griffon vultures moving southward face particularly high risks in Campania, Basilicata and Calabria.

The study's recommendations are clear. No new installations should be permitted within the griffon vulture's stable range.

Existing installations require **urgent mitigation** through remote-sensing systems combined with shutdown protocols. Flyways along the Apennine mountain chain must be protected. Management should be adaptive, taking into account power production by turbines and the evolving distribution of wildlife.

Power lines

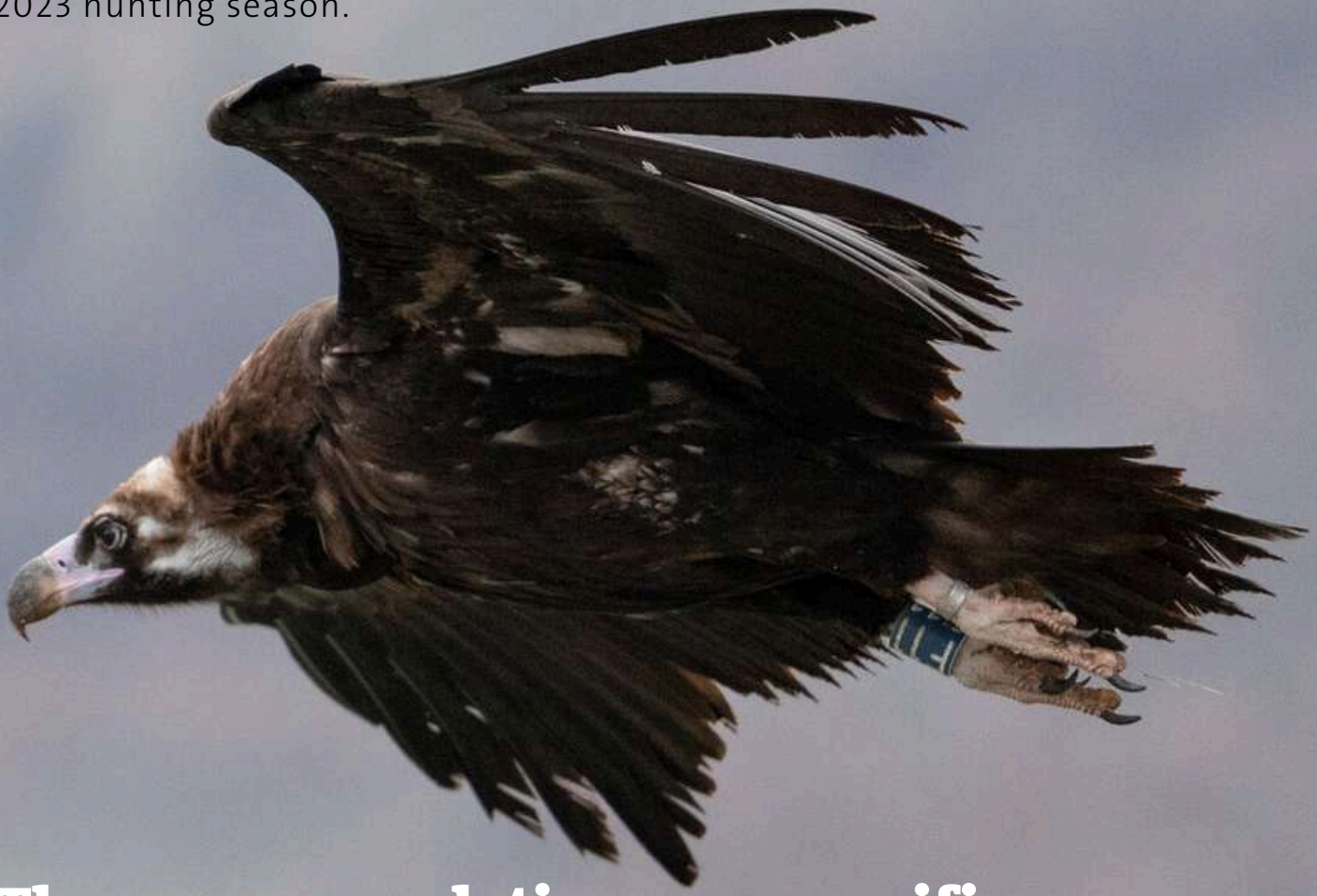
Power lines cause mortality through electrocution, collision and a combination of the two. In the study area, **6** Griffon vultures died from electrocution in the province of L'Aquila between 2000 and 2018, roughly one every three years. The real toll is almost certainly higher: in Italy, estimated mortality runs between 2.1 and 20.5 birds per kilometre of line per year. In Abruzzo, power lines have already been identified as a major factor in the decline of the Eurasian eagle owl.



The study recommends mapping potentially dangerous lines against sensitive sites such as breeding, release and feeding areas; installing insulating sheaths on supports alongside visual deterrents such as spirals and buoys; and signing formal agreements with electricity grid operators for systematic mitigation.

Lead from hunting ammunition

Lead poisoning from hunting ammunition is a significant and growing threat. Former studies and data from this feasibility report show that around **37%** of Griffon vultures and Golden eagles sampled in the Apennines show subclinical blood-lead levels, with 12.5 and 10% respectively reaching clinical levels. The risk is set to increase further with the possible opening of red deer and roe deer huntingi n Abruzzo.The study cross-referenced the daily movements of 53 GPS-tagged griffon vultures with regional hunting methods during the 2023 hunting season.



The recommendations are specific: progressive and definitive replacement of lead ammunition with non-toxic alternatives, in line with research results and with the European Chemicals Agency

Social feasibility

Technical feasibility is necessary but not sufficient. A reintroduction without local support does not hold.

THE SURVEY IN NUMBERS

552	**Total respondents**
376	In-person interviews with farmers
176	Online questionnaires (general public)
4	Priority protected areas surveyed
47	Municipalities covered

A sociological survey, adapted from the LIFE Safe for Vultures initiative in Sardinia, assessed knowledge, attitudes and willingness to collaborate among farmers and the general public in the project's priority areas. Questionnaires were administered in the field by volunteers from Rewilding Apennines and Salviamo l'Orso, with support from the protected areas involved.

The results are neither alarming nor complacent.

The Griffon vulture is well known to the local population, thanks to the reintroduction of the 1990s and the spread of such vultures. Awareness of the Cinereous and Bearded vultures, by contrast, is low. Overall attitudes towards vultures are neutral, without strong positive or negative polarisation. Among farmers, interest in installing feeding stations is driven primarily by economic considerations: the possibility of free, compliant carcass disposal.
Spatial analysis identified areas with high acceptance rates and areas where misinformation and fears emerge, particularly around the interaction between vultures, large carnivores and wildlife management.

The study recommends targeted communication campaigns differentiated by audience - farmers, residents, tourists - and deep engagement with local communities from the earliest stages of the project, including participatory monitoring.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3.5% of farmers
Could recognise the Cinereous and Bearded vulture in pictures.
51% of them
View poison as a threat.
Among the general public, 97% see poison as a threat to wildlife

Conclusions & moving forwards

The conditions for the reintroduction of the Cinereous vulture and the Bearded vulture in the central Apennines are in place.

Habitat is suitable, confirmed independently by field surveys and by modelling. The food base is abundant, with available biomass exceeding the current Griffon vulture population's needs by an order of magnitude. Institutional support is tangible, with interest expressed by ISPRA, National and Regional parks, the Carabinieri Forestali and the Lazio Region. Social attitudes are not hostile, although they require targeted communication.

The main concerns relate to anthropogenic threats

Indirect poisoning remains the leading cause of vulture death in this area. Countering it requires prosecution of perpetrators, diversified preventive measures on the ground, and actions that address the human dimension of wildlife conflict. Lead ammunition must be progressively phased out, along the lines already set by ECHA, with effective enforcement. Wind farms require strategic planning that avoids sensitive areas and mitigates existing installations where they stand.

SUCCESS WILL DEPEND ON

1 The ability to build durable, professional **partnerships** between NGOs, public agencies and stakeholders

2 Long-term **funding,** since vulture reintroduction is a multi-decadal commitment.

3 Effective action on **threats** before and during release.

Steps

1

Preliminary restocking of the Griffon vulture, to consolidate the species across the project area (ongoing).

2

The first species to be released should be the Cinereous vulture, at a release rate closer to the Bulgarian experience, to buffer demographic stochasticity.

3

Assessment of the founder pool's genetic composition, individual availability, monitoring design, and animal welfare and veterinary health.

Five centuries after Costanzo Felici described a “voltore” on Monte Nerone, the central Apennines may be ready for that sight again

Glossary

Carrying capacity — The maximum number of individuals a given environment can support over the long term.

ECHA — European Chemicals Agency. Proposed a progressive European ban on lead in hunting ammunition.

Facultative scavenger — An animal that eats carrion opportunistically but does not depend on it. Foxes, feral dogs, wild boar and wolves are among the facultative scavengers in the central Apennines.

IUCN/SSC Guidelines — The international reference framework for conservation translocations, published by the IUCN Species Survival Commission in 2013.

LIFE Programme — The European Union's financial instrument for environment and climate action. Principal funding instrument identified for this reintroduction.

Natura 2000 — The European Union's network of protected areas. The study area includes 297 Natura 2000 sites.

NSAIDs — Non-steroidal anti-inflammatory drugs. Residues of some NSAIDs, notably diclofenac, are lethal to vultures at low doses.

Obligate scavenger — An animal that depends entirely on carrion. All four European vulture species are obligate scavengers.

PVA — Population Viability Analysis. A modelling technique that simulates population dynamics over time to estimate extinction probability.

Reintroduction — Release of individuals into an area where the species is locally extinct, to re-establish it.

Restocking — Release of individuals into an area where the species is already present, to increase population size or improve genetic diversity.

Stochasticity — Random variation in biological and environmental processes, affecting births, deaths, weather and other factors relevant to population dynamics.

Translocation — Any human-mediated movement of individuals from one place to another, including reintroduction and restocking.

Voltore — Archaic Italian term for vulture, used by Costanzo Felici in his 1563 letter to Ulisse Aldrovandi.

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Literature cited

A full list of references is available in the study

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