ABSTRACTS OF PRESENTATIONS

Seville, 25–27 November 2025

INTERNATIONAL CONFERENCE ON THE

IBERIAN LYNX

Shared vision, cordinated action:
Conservation of the iberian lynx in the Iberian Peninsula.

lynxconnect

In collaboration with:

Junta de Andalucía

Comité Europeo de las Regiones

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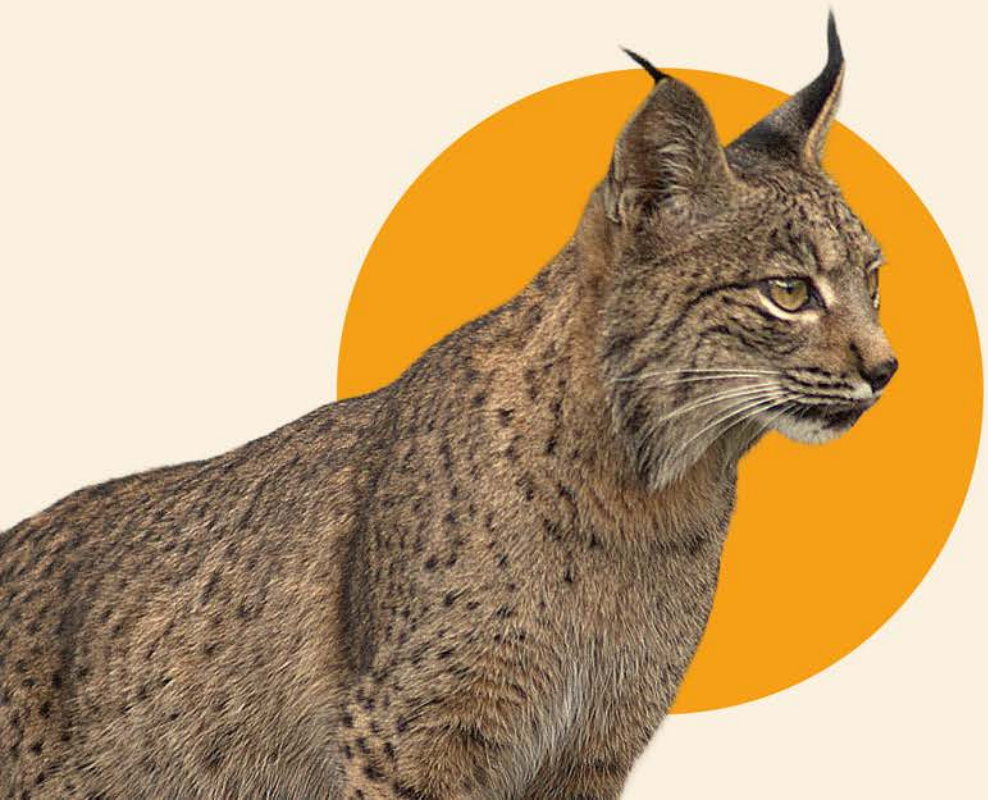
PRESENTATION OF THE LIFE LYNXCONNECT PROJECT



SESSION / 01

Presentation of the LIFE LynxConnect Project

JAVIER SALCEDO /

LIFE LynxConnect Coordinator

The presentation summarizes the evolution, objectives, challenges, and achievements of the LIFE LynxConnect project, whose purpose is to create a genetically and demographically functional metapopulation of the Iberian lynx. Since 2002, several consecutive LIFE projects have been implemented, preventing the species' extinction, consolidating the remnant populations in Doñana and Sierra Morena, initiating and expanding reintroductions in Spain and Portugal, and enhancing collaboration among administrations, scientists, NGOs, landowners, hunters, and civil society.

The project starts from an initial situation characterized by one of the lowest known genetic diversities in a feline, with isolated and poorly connected populations, an estimated 882 individuals in 2019, of which 186 were reproductive females, and insufficient natural migration compromising the species' long-term viability. Additional threats included non-natural mortality (roadkill and illegal persecution), prey availability, and the risk of inbreeding.

To reverse this situation, LIFE LynxConnect establishes several fundamental objectives. Regarding population expansion, it aims to consolidate the four existing nuclei and create two new reintroduction areas. In terms of genetic viability, it includes the creation of ten "stepping stones" to promote gene flow, along with the implementation of an innovative system for individualized genetic monitoring and management. The project also aspires to achieve a more secure conservation status, reaching at least 250 reproductive individuals and moving toward the "Vulnerable" category on the IUCN Red List.

Another essential aspect is the reduction of non-natural mortality through interventions on roads using physical and virtual fencing, the repair of agricultural structures, the adaptation of water reservoirs and wells, and the formalization of agreements with landowners, hunters, and farmers. Efforts also focus on ensuring adequate prey availability, especially in the stepping stones and new populations; strengthening social awareness through actions with communicators, journalists, and influencers; and updating the strategic framework to maintain a stable and adaptable monitoring system over time.

Overall, LIFE LynxConnect represents a decisive step toward the recovery of the Iberian lynx as a viable and self-sustaining species. By 2024, pending the 2025 census, a minimum of 2,401 individuals had been recorded, of which 470 were reproductive females, and the connectivity of the Iberian population had been improved through the creation of more than ten stepping stones. Its long-term success will depend on maintaining ecological connectivity, genetic variability, the continuous establishment of new populations, and strong societal commitment.

SESSION / 02

THE ORIGINS OF THE IBERIAN LYNX

This scientific session will provide an overview of the origins, evolution, and historical distribution of the Iberian lynx (Lynx pardinus), integrating data from the fossil, taphonomic, and documentary records. Through a multidisciplinary approach, researchers specializing in different areas will offer a continuous perspective of the Iberian lynx from its origins to historical accounts.

The Iberian lynx lineage originated from Lynx issiodorensis in a context of pronounced climatic fluctuations marking the onset of the Pleistocene. For much of this period, Lynx pardinus was widely distributed across Europe, exhibiting remarkable adaptability to diverse environments before becoming restricted to the Iberian Peninsula.

The oldest and most complete fossil record of the species comes from the Quibas site (Abanilla, Murcia), dated to one million years ago. The discovery of an almost complete skeleton provides valuable insight into the morphology and ecology of the earliest Iberian lynxes, which were slightly larger and had a more generalist diet than the current lynx.

Taphonomic studies on the origin and accumulation of their remains at various sites have identified different models of Iberian lynx presence, ranging from breeding dens to natural traps, aiding the reconstruction of their paleoecology and the historical dynamics of their populations.

Finally, the analysis of their historical distribution shows that, after achieving a wide range across the Iberian Peninsula during historical times, the species experienced a gradual decline over the past centuries, influenced by environmental, social, and economic factors.

SESSION / 02

The Origins of the Iberian Lynx

The Oldest Iberian Lynx Skeleton: An Exceptional Discovery at the Quibas Site

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The Quibas site (Abanilla, Region of Murcia), dating back one million years, represents a unique time capsule in Europe due to its age. Excavation and research work provide a window into the past, revealing what the Iberian Peninsula was like at the end of the Early Pleistocene. The site has yielded remains of more than 80 different species, including macaques, rhinoceroses, saber-toothed tigers, ancestors of wolves, bison, horses, and musk oxen, among many others. However, undoubtedly the most remarkable and significant discovery is that of the oldest known Iberian lynx skeleton to date, consisting of up to 60 bone remains belonging to a single individual, recovered during the 2021 and 2024 excavation campaigns. Notable elements include parts of the skull, preserving several canines and molars, as well as various ribs, vertebrae, and numerous bones from the forelimbs and hindlimbs. This represents the most complete Early Pleistocene record of this endemic feline from the Iberian Peninsula.

The Iberian lynx is a common carnivore in Paleolithic sites across the peninsula, although remains from the earliest populations are very scarce. The discovery of the Quibas skeleton will allow for a better understanding of the morphology and habits of the first Iberian lynxes, as well as contributing to elucidating their evolutionary history. Preliminary results from its study indicate that the specimen was somewhat larger than modern Lynx pardinus. Another interesting finding is that morphometric analysis of the calcaneus suggests that these early lynxes had a less specialized diet regarding European rabbits than the current Iberian lynx, implying that they hunted larger prey more frequently, such as juvenile goats or fallow deer, also found at Quibas.

The lynx remains come from a layer deposited during a glacial period (MIS-30), indicating that it lived in a relatively arid environment, dominated by open shrubland with scattered forested patches. Its presence at the Murcian site confirms that this emblematic feline, recently reintroduced in the Region of Murcia through collaboration between the LIFE LynxConnect project and the Regional Ministry of Environment, already inhabited southeastern Iberia one million years ago. Since then, it occupied the area almost continuously until its extinction at the end of the 20th century.

SESSION / 02

The Origins of the Iberian Lynx

Origin and Evolution of the Iberian Lynx

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The modern Iberian lynx belongs to an evolutionary lineage comprising two successive chrono-species (evolutionary stages of the same line over time): Lynx issiodorensis and Lynx pardinus. This European lineage emerged at the end of the Pliocene (approximately 3 million years ago), coinciding with the intensification of glacial and interglacial cycles of the Pleistocene in the Northern Hemisphere.

The oldest fossil remains attributable to L. pardinus have been found in Taurida Cave (Crimea) and date to approximately 1.6 million years ago. Throughout the Pleistocene, the paleogeographic distribution of this species encompassed much of southern and western Europe. Fossil records have been documented in the Iberian Peninsula, France, and Italy until the end of the Late Pleistocene. These findings indicate that the Iberian lynx historically had a much wider distribution, adapting to diverse environments during glacial and interglacial phases before becoming restricted to its current Iberian refuge.

Throughout its evolutionary trajectory and until the Last Glacial Maximum (around 20,000 years ago), the Iberian lynx had a considerably larger body size than today, comparable to that of the Eurasian lynx. This morphology suggests that its diet was primarily oriented toward medium- or small-sized prey. It was probably not until the end of the Late Pleistocene (around 12,000 years ago) that, for reasons still not entirely clarified, the species began its gradual dietary specialization in lagomorphs.

SESSION / 02

The Origins of the Iberian Lynx

Taphonomy of the Iberian Lynx

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The Iberian lynx is one of the most widely represented carnivores in the fossil record of the Iberian Peninsula. Taphonomic studies on the origin of its remains have identified four patterns: 1) occasional foraging in caves and shelters, 2) natural traps, 3) anthropogenic contribution, and 4) use of cavities as breeding dens. Each of these patterns has distinct characteristics and provides relevant information for understanding the species' paleoecology, offering a deep-time perspective. Additionally, the use of cavities as breeding dens has allowed the identification of the Iberian lynx as an accumulator of rabbit remains.

These findings provide a valuable framework for understanding the historical dynamics of Iberian lynx populations. The fossil record and taphonomic evidence reveal its remarkable adaptability and ecological plasticity, offering key references for interpreting its current habitat requirements and reproductive strategies. This information constitutes an evolutionary basis that can be useful for guiding more informed conservation policies and reintroduction programs.

SESSION / 02

The Origins of the Iberian Lynx

The Iberian Lynx in Historical Times

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Understanding the historical distribution of the Iberian lynx and the dynamics of its population over time and space allows us to improve the assessment of the challenges it faces within the context of conservation biology. Ecological history (knowledge of a species over time and space), together with environmental history (knowledge of the relationship and human impact on the environment), provides a significant contribution to the interdisciplinary strategy developed for the recovery of this species. To understand population dynamics, it is necessary to consider natural factors such as biology, climate, and ecosystem, as well as historical and social factors, including economic policy, land confiscations, armed conflicts, population dynamics, technology, and cultural trends.

Broadly speaking, the evolution of the Iberian lynx in historical times can be examined in some depth over the last 500 years. Between 1500 and 1600, it is recorded in all provinces of Castilla-La Mancha, Madrid, the entirety of Extremadura, and northwestern Andalusia. Additional records include Doñana, Salamanca, and Portugal, along with sightings in the north, in the Basque Country, the Pyrenees, and the province of Zaragoza. The 17th century represents a period during which data on the Iberian lynx become very scarce. Only a few references exist in the Central Mountain Range, Montes de Toledo, Doñana, Eastern Sierra Morena, and some isolated points in the north (perhaps some confused with the Eurasian lynx) in Galicia/El Bierzo, the Pyrenees, and Alcubierre/Los Monegros. Records from the early 18th century are rare. The scarcity of references and other factors suggest a critical situation for lynxes during this period.

From approximately 1760 onwards, sightings reappear, with more than 240 references to lynxes by the early 19th century, when the Iberian lynx reached its highest documented numbers, primarily inhabiting the area between Sierra Morena and the Sistema Central, including Malcata, Algarve, and Serra da Estrela in Portugal, with extensions into the Betic Systems, Sierra Morena/Filabres, and the Sistema Ibérico, and northward extensions into the Galician Massif, La Demanda, the Ebro Valley, and the Pre-Pyrenees.

Some records of lynxes in the Cantabrian Cornice and the High Pyrenees are likely attributable to the Eurasian lynx. From that point onwards, the Iberian lynx steadily declined in numbers and territory until it became confined to two nuclei: eastern Sierra Morena (between the Arenoso and Jándula rivers) and the "Lacedemonian" nucleus, a continuously occupied area in Doñana-Coto del Rey. Recovery projects begin from this point, but that is another story.

SESSION / 03

SPATIAL PATTERNS OF THE IBERIAN LYNX AND THEIR IMPLICATIONS FOR CONSERVATION

This session presents an analysis of the evolution and major advances achieved in the study of the spatial patterns of the Iberian lynx and their implications for its conservation over the past twenty-five years.

The contributions included in the session present the most recent results regarding habitat selection patterns, movement ecology, and landscape connectivity for the Iberian lynx.

Finally, some challenges and perspectives are discussed concerning the future development and improvement of knowledge in this field, as well as its application to land management and connectivity for the Iberian lynx.

SESSION / 03

Spatial Patterns of the Iberian Lynx and Their Implications for Conservation

Movements and Ecological Connectivity of the Iberian Lynx: Advances and Perspectives

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At the beginning of the century, the Iberian lynx was critically endangered, confined to the Doñana and Andújar populations. Since then, its population numbers and presence in other areas of the Iberian Peninsula have increased substantially, thanks to the success of the conservation efforts and projects developed for the species' recovery.

In parallel, over the past twenty-five years, and within the framework of these efforts and projects, monitoring programs for the species have been progressively improved, along with the technologies available to study its habitat preferences and movements (particularly GPS collars), the methods for spatial and statistical analysis of the collected data, and the level of detail and quality of the resulting information.

This contribution first reviews the evolution and major advances achieved in the study of habitat selection, movements, and connectivity of Iberian lynx populations, as the species has recovered demographically and expanded into a wider variety of territories and landscapes.

Second, it describes the main practical results that have supported decision-making in the conservation of the Iberian lynx and the management of its habitats, ranging from the prioritization of reintroduction areas or stepping-stone areas to the reduction of mortality caused by transport infrastructures.

Third, some challenges and perspectives are presented regarding the future development and improvement of knowledge in this field and its application to land management and connectivity for the Iberian lynx, considering its current and potential new distribution areas, its increasing presence in more humanized landscapes, and the goal of ensuring spontaneous and sufficient rates of individual exchange between populations across Spain and Portugal.

SESSION / 03

Spatial Patterns of the Iberian Lynx and Their Implications for Conservation

Behavioral Plasticity of the Iberian Lynx: Key for Its Conservation and Adaptation to Fragmented Landscapes

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Wildlife conservation requires a comprehensive understanding of the habitat and landscape conditions that sustain viable and well-connected populations, especially in the context of reintroduction programs. Species may exhibit different habitat selection patterns throughout their life cycle, but habitat models typically consider all species records together or, at best, differentiate only between locations inside and outside the home range.

In this study, a more detailed characterization of movements is proposed, focusing on five distinct phases: home-range areas, temporary residences, excursions, and dispersals (separating those occurring post-release). GPS telemetry data from 124 Iberian lynxes (Lynx pardinus), obtained within the framework of reintroduction programs, were used to analyze habitat selection and adaptation to heterogeneous, fragmented, and highly human-modified landscapes. Context-dependent habitat selection models with mixed effects were developed for each movement phase, considering both local- and landscape-scale selection.

The results show that lynxes systematically avoided intensive herbaceous crops and selected mosaics of natural vegetation, including tree cover, shrubland, and grasslands. Resident individuals chose areas with low densities of roads and human infrastructures at the local scale, although this pattern was not observed at the landscape scale, likely due to limitations in establishing extensive home ranges in environments where infrastructures are abundant and intermixed with natural cover. During excursions, lynxes avoided areas with high densities of human infrastructures, while this avoidance was less pronounced during dispersal events, demonstrating high behavioral plasticity. The post-release dispersal phase showed patterns similar to other dispersals but with greater avoidance of infrastructures and a stronger preference for refuge elements such as rugged terrain and shrub cover.

These findings highlight the importance of differentiating movement phases when assessing habitat selection, particularly those occurring outside home-range areas and especially in translocated individuals establishing in new territories. This differentiation is essential to: (i) identify suitable reintroduction areas that provide favorable habitat features for post-release movements and settlement; (ii) evaluate habitat conditions in temporary residence areas that facilitate long-distance dispersal; and (iii) obtain accurate estimates of connectivity between populations. Dispersal events themselves, as key movements for gene flow and range expansion, should be considered independently in landscape permeability studies to effectively guide conservation strategies.

SESSION / 03

Spatial Patterns of the Iberian Lynx and Their Implications for Conservation

Temporal Dynamics of Ecological Connectivity of the Iberian Lynx in the Iberian Peninsula: 2004–2024

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A crucial aspect for the long-term persistence of species is connectivity between population nuclei, that is, the degree to which the landscape facilitates or impedes individual movements, allowing gene flow and enhancing population resilience. The success of Iberian lynx conservation programs presents a unique and rare opportunity to study connectivity, as few species have been monitored and studied with such intensity. This large amount of high-quality data enables the development of highly realistic connectivity models, providing valuable information for future conservation planning. Using data collected from 2004 to the present, changes in connectivity between population nuclei over the years in which numerous conservation measures were implemented have been analyzed. More specifically, the contribution of reintroduced populations to increased connectivity and, consequently, population resilience over the last 20 years has been quantified, taking into account the minimum migration rate required to avoid genetic problems as determined in previous studies.

To assess these changes, the temporal dynamics of ecological connectivity between lynx populations from 2004 to 2024 were modeled. By integrating long-term monitoring data with least-cost path analyses, habitat availability indices, and minimum required migration rates, the evolution of the spatial structure and functional connectivity of the Iberian lynx population over time has been quantified.

Preliminary results suggest that connectivity has improved significantly following the reintroduction programs. The improvement in connectivity has been the result of both the increase in population size of the main nuclei and the creation and emergence of smaller population nuclei (stepping stones) that have facilitated connections between distant main nuclei.

SESSION / 03

Spatial Patterns of the Iberian Lynx and Their Implications for Conservation

Assessment of Space Use and Release Strategies in Iberian Lynx Reintroduction Programs

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One of the main conservation actions that has promoted the recovery of Iberian lynx (Lynx pardinus) populations has been the creation of new populations through the reintroduction of individuals, carried out with both captive-born and translocated wild-born animals. These animals are released either into acclimation enclosures (soft release) or directly into the natural environment (hard release). To analyze movement ecology and evaluate the influence of individual origin, release strategy, and acclimation period duration on post-release patterns, GPS telemetry data from 161 lynxes belonging to nine reintroduced populations were analyzed. Five movement phases were identified (stable and temporary residences, excursions, post-release dispersals, and transitions), applying continuous-time movement models to estimate home-range size, daily speed, and off-territory distances.

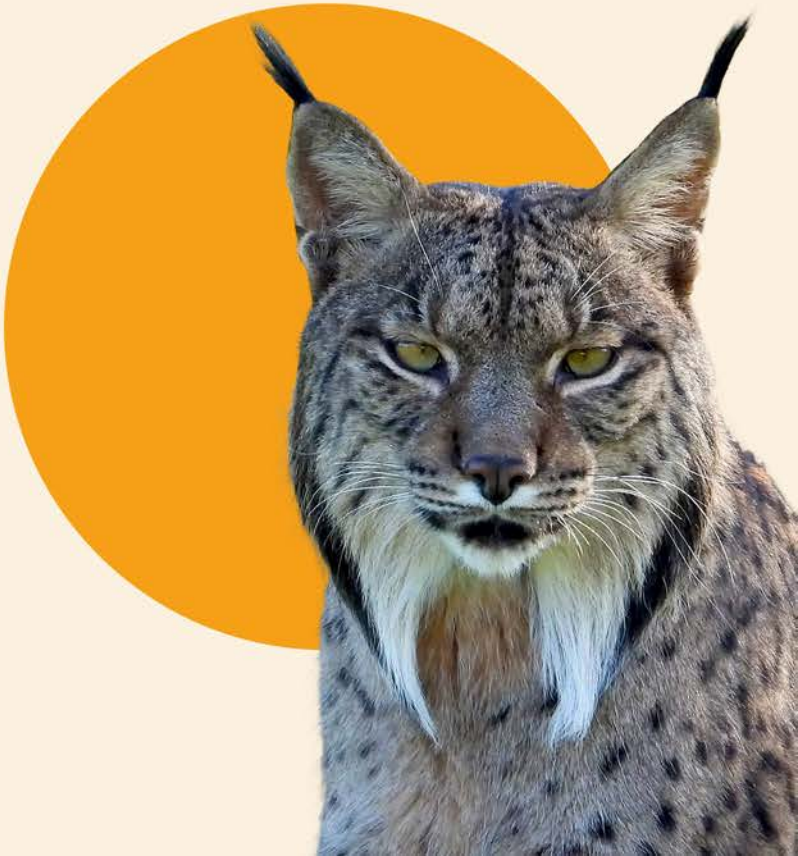
The results indicate that most lynxes, regardless of origin, established stable territories, fulfilling reintroduction objectives. Captive-born subadults exhibited similar territory sizes for males and females until reaching maturity, as well as slower movements, a higher propensity for post-release dispersal, and smaller temporary residences compared to wild-born individuals.

Regarding the release strategy, the type of release (soft or hard) had no significant effects, whereas the duration of the acclimation period was decisive: acclimation periods longer than 45 days reduced exploratory movements and increased the likelihood of settlement in the target area.

Overall, these results support the use of captive-bred individuals in reintroductions, the prioritization of wild-born specimens for population reinforcement, and the need to define minimum acclimation periods based on empirical evidence.

SESSION / 04

ADVANCES IN POPULATION MONITORING TECHNIQUES OF MAMMALS



SESSION / 04

Advances in Population Monitoring Techniques of Mammals

Artificial Intelligence in the Service of Iberian Lynx Conservation

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Artificial Intelligence is becoming a key tool for wildlife conservation, enabling the massive processing and analysis of images obtained through camera trapping. In the case of the Iberian lynx, this transformation is articulated through an ecosystem of complementary platforms: Wildlife Insights, focused on automatic species classification, and LynxWildbook, dedicated to individual re-identification of specimens.

These platforms are integrated into an optimized workflow via LynxAutomator, which seamlessly connects Wildlife Insights with LynxWildbook, ensuring smooth image transfer and efficient processing. This synergy is establishing a unified system for species monitoring.

The LynxWildbook project (lynx.wildbook.org), the first Wildbook developed for a feline species, represents a milestone in the application of AI to Iberian lynx monitoring. From its beginnings with a basic interface and the Hotspotter algorithm, LynxWildbook has undergone significant technological evolution: it now includes bulk image import, automatic detection with bounding boxes, and advanced deep-learning-based algorithms. The transition to feature vector–based models, such as PIE and subsequently MIEW-ID, has represented a qualitative leap in the speed of re-identification.

The future of LynxWildbook is promising: the consolidation of more accurate, interoperable, and scalable models will strengthen long-term monitoring of the Iberian lynx, consolidating AI as a strategic ally in data-driven conservation.

SESSION / 04

Advances in Population Monitoring Techniques of Mammals

Nationwide Mammal Monitoring: Lessons Learned from the Terrestrial Mammal Monitoring Project (MOMAT) of the Iberian Society for the Conservation and Study of Mammals (SECEM)

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The MOMAT project (Terrestrial Mammal Monitoring of Spain), developed by SECEM following a commission from TRAGSATEC for MITECO, within the framework of the project "Improving Knowledge of the Conservation Status of Terrestrial Fauna and Seabirds in Spain" and funded by the European NextGenerationEU program, aims to establish a national monitoring system for all mammal species in the country. To this end, during 2025, various methodologies have been evaluated: some aimed at monitoring a wide range of species (such as camera trapping, track and sign surveys, or pellet analysis), and others focused on specific species, such as Cabrera's vole (Microtus cabrerae) or the water rat (Arvicola sapidus). The information obtained is used for international reports under the Habitats Directive, the updating of the Atlas and Red Book of Mammals of Spain, and the preparation of the first national IUCN Red List.

Although the analysis of the results is still ongoing, as of September 1, coverage reached 6,341 surveys across 2,027 10 × 10 km grid cells (approximately 40% of the national territory), of which 942 correspond to camera trapping (63 species detected), 444 to pellet analysis (39 species detected), 493 to track and sign surveys (57 species detected), 616 to aquatic protocols (46 species detected), 365 to Arvicola sapidus surveys, and 333 to Microtus cabrerae surveys. This has resulted in the detection of all species present in the national territory and the collection of 29,834 field records, in addition to 532,642 records from other sources.

One of the main conclusions is that, while for medium- and large-sized mammals (carnivores, ungulates, and lagomorphs) the generalist methods employed have achieved more than adequate coverage in terms of species and distribution (with very specific exceptions, such as Mustela erminea, M. nivalis, or M. lutreola, due to their particular habitat requirements, behavior, and, in the latter case, critical status), micromammals presented greater limitations. Among micromammal monitoring methods, live trapping is quite invasive and costly, and therefore not considered feasible for large-scale monitoring. On the other hand, pellet analysis significantly expanded knowledge of fauna but depends heavily on the presence of predators, which biases sampling toward agricultural areas and creates gaps in mountainous or forested zones where less generalist species live.

In light of this, it may be advisable to test complementary methods for large-scale micromammal monitoring, such as adapted camera trapping or environmental DNA (eDNA) sampling. While eDNA techniques require less field effort and allow for greater territorial coverage, they do not provide abundance data, which could instead be obtained through a standardized, modified camera trapping protocol.

SESSION / 04

Advances in Population Monitoring Techniques of Mammals

Monitoring the European Rabbit in the Iberian Peninsula: Methodologies, Data Flow, and Results of the LIFE Iberconejo Project

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The LIFE Iberconejo project develops an Iberian monitoring network for the European rabbit (Oryctolagus cuniculus), a key species in Mediterranean ecosystems and of great ecological and hunting interest. The main methodologies employed are presented: analysis of hunting bags, density estimates using Distance Sampling, counts of latrines and droppings, and the use of statistical models (GLM and hierarchical models) to integrate the information. The data flow and interactive platform are described, which allow visualization of trends, maps, and automatic report generation, facilitating interpretation and coordinated management at the Iberian scale. Preliminary results show severe declines across large areas and an alarming loss of the rabbit's ecological role, which serves as a trophic base for numerous threatened species.

These methodological and analytical advances represent a decisive step toward a standardized monitoring system and more effective management of the rabbit and its associated ecosystem.

SESSION / 04

Advances in Population Monitoring Techniques of Mammals

Methodological Proposal for Iberian Lynx Population Monitoring: From Counts to Population Estimates

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LynxConnect Group on Iberian Lynx Monitoring Protocols

The Iberian lynx (Lynx pardinus) population monitoring method is fundamentally based on camera trapping as the main monitoring tool. Until recently, this system consisted of the systematic installation of camera traps distributed across nearly the entire area occupied by the species. Cameras were deployed at a predetermined density to ensure homogeneous coverage of the known distribution area. From the photographic records obtained, the minimum number of individuals detected was calculated annually, with this value considered an approximation of the actual population size. During the early years of this methodology, the high sampling intensity allowed the minimum number of identified individuals to be very close to the total number of specimens present in the study area.

However, the positive evolution of the species in recent years, characterized by exponential increases in both individual numbers and the extent of occupied area, has generated a series of logistical and methodological limitations. At present, it is unfeasible to cover the entirety of the occupied territory exhaustively through camera trapping, resulting in minimum individual counts that fall well below the actual population size.

In this new context, a methodological shift toward obtaining population estimates is necessary. For this purpose, the adoption of standardized abundance estimation methodologies based on spatially explicit capture–recapture analysis is proposed. However, given the heterogeneity in the composition of monitoring teams, the intensity of effort applied, and the different sampling designs used in various distribution areas, multiple methodological approaches will need to be implemented to adapt to the specific characteristics of each zone. From these analyses, species-specific densities for different environmental strata will be obtained and assigned to the identified presence areas. These areas will be determined using presence information collected simultaneously during monitoring campaigns. The combination of both datasets will allow for more realistic global estimates of the total Iberian lynx population in the Iberian Peninsula.

SESSION / 04

Advances in Population Monitoring Techniques of Mammals

Wildlife Population Monitoring: Alternatives for Common Species

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Wildlife population monitoring is the cornerstone for understanding population dynamics, designing programs for adaptive management, and consequently ensuring sustainability. It involves systematically and orderly collecting data on distribution, abundance, and population trends to detect changes and anticipate ecological, health, or management-related risks. While sensitive and comprehensive monitoring programs exist for species of conservation interest, they are less common for widespread species such as wild boar, roe deer, or fox. In these cases, the challenge lies less in the species' appeal (and thus access to resources) and more in the extent of their distribution and the variability of their densities. These characteristics complicate the application of the most reliable methods and the attainment of a regional or national-scale population overview, which is essential for informed management decisions.

Therefore, working with common species requires efficient, scalable, and context-adaptable indicators. Monitoring strategies may involve unstructured designs (e.g., opportunistic data from citizen science apps, hunting statistics, roadkill reports) or structured designs (e.g., monitoring programs and collaborative science). Different methodologies are applied, offering (i) indirect indicators (tracks, droppings, environmental DNA) and (ii) direct indicators, often supported by emerging technologies (camera traps, drones, passive recorders). The reliability and scalability of these indicators vary, so statistical modeling is used to: (i) control factors that may influence them, (ii) establish habitat–species relationships to generate information in data-deficient areas, and (iii) integrate all indicators to extract the most from each and obtain a more accurate approximation of population status.

In short, monitoring common species is essential for their efficient management, and the combination of indicators, innovative technologies, and statistical modeling provides a robust pathway to achieve this goal.

SESSION / 05

ROUND TABLE: THE BEGINNINGS OF CONSERVATION PROJECTS

The fifth session of this Congress hosts, rather than a presentation on the latest scientific developments regarding the Iberian lynx and its conservation, a conversation—a round table featuring four key figures essential to understanding the recent history of the species.

Miguel Delibes, former director of the Doñana Biological Station (EBD) and a pioneer in the studies that sounded the alarm on the precarious status of the feline; Astrid Vargas, veterinarian in charge of the captive breeding program; and Christine and Urs Breitenmoser, co-chairs of the IUCN Cat Specialist Group, who have been involved in the project since its inception, discuss those uncertain and challenging years that set the stage for the development of a conservation project destined to become an international benchmark.

SESSION / 05

The Beginnings of Conservation Projects

ROUND TABLE /

- **MIGUEL DELIBES DE CASTRO**
  An international reference in Iberian lynx conservation. He was a pioneer in its study and in raising awareness of its critical status. Emeritus researcher at CSIC and Director of the Doñana Biological Station (EBD) for eight years, from where he worked intensively for the species.
- **ASTRID VARGAS**
  Veterinarian, she was for seven years the coordinator of the Iberian Lynx ex situ Conservation Project, which achieved, for the first time in history, the captive breeding of this feline. A worldwide authority on the captive breeding of threatened species.
- **CHRISTINE BREITENMOSER**
  Co-chair of the IUCN Cat Specialist Group and one of the world's leading experts on the European lynx, she has specialized in preventing conflicts between humans and wildlife, which is one of her main areas of work at the KORA Foundation.
- **URS BREITENMOSER**
  Professor at the University of Bern and President of the Swiss KORA Foundation, specialized in carnivore ecology and management, his role as co-chair of the IUCN Cat Specialist Group has allowed him to follow the Iberian lynx situation firsthand, minute by minute.

Miguel Delibes de Castro
(Former Director of EBD-CSIC and Iberian lynx expert)

Urs Breitenmoser
(Co-Chair IUCN SSC Cat Specialist Group)

Astrid Vargas
(Former National Coordinator of the Species' Captive Breeding Program)

Christine Breitenmoser
(Co-Chair IUCN SSC Cat Specialist Group)

SESSION / 06

GENETIC ASPECTS OF THE IBERIAN LYNX

The Iberian lynx is one of the most genetically studied threatened species and among the most severely affected by genetic erosion. This session will review what we have learned about the species' origin and evolution, present the genetic status of populations before and after the implementation of genetic management measures, and showcase the potential of recent advances in genomics for species conservation. The session will conclude with a round table discussion on the present and future of the species from a genetic perspective.

SESSION / 06

Genetic Aspects of the Iberian Lynx

The Iberian Lynx Genome: A Window into Its Evolutionary History

LORENA LORENZO FERNÁNDEZ /

Doñana Biological Station, CSIC

Comparative genomics of felids has allowed the reconstruction of the complex evolutionary history of the genus Lynx, which comprises the four lynx species—including the Iberian lynx—that diverged three million years ago after separating from other felids around seven million years ago.

Traditionally, the topology most supported by both morphological and molecular data placed the Iberian lynx (Lynx pardinus) and the Eurasian lynx (L. lynx) as sister species. However, recent genomic data support an early divergence of the Iberian lynx from the common ancestor of the Eurasian and Canadian lynxes (L. canadensis), followed by extensive introgression—genetic exchange between species—with the Eurasian lynx. This introgression may have acted as a form of "evolutionary rescue," introducing genetic variation and thereby bringing the two species closer genetically despite not sharing an immediate common ancestor.

Ongoing genomic analyses are allowing researchers to characterize this introgression, estimating its magnitude and directionality, and identifying the affected genomic regions, some of which show signs of positive selection (adaptive introgression). These are in addition to other species-specific adaptation signals, including a potential specialization of the immune system.

Understanding the position of the Iberian lynx within the genus Lynx is not only an exercise in reconstructing its past but also a key to understanding how this history shapes its present and to guiding actions that ensure its future.

SESSION / 06

Genetic Aspects of the Iberian Lynx

The Contribution of Genetic Management to the Recovery of the Iberian Lynx

JOSÉ ANTONIO GODOY /

Doñana Biological Station, CSIC

The low genetic diversity and high levels of inbreeding in the remnant populations posed an additional threat to the species' survival by limiting adaptive capacity and negatively affecting survival and reproduction. However, the mixing of the two genetically differentiated remnant populations and the implementation of a comprehensive genetic management program have improved the genetic status of both remnant, captive, and reintroduced populations. On one hand, the translocation of individuals to Doñana has enhanced its genetic status and driven population growth after decades of stagnation. On the other hand, the ex situ conservation program has successfully captured the remaining genetic variation, prevented further losses, and is producing juveniles of high genetic quality for release in reintroduction areas. Finally, selecting individuals minimally related to those already present, based on data from non-invasive genetic monitoring, has minimized genetic diversity losses and prevented high levels of individual inbreeding.

Accumulated evidence suggests that genetic factors once contributed to the species' decline and hindered early conservation efforts for the Iberian lynx, and that their management is now contributing to its remarkable recovery. Long-term genetic viability of the species, however, requires effective metapopulation sizes substantially larger than current ones, and the still limited overall genetic diversity necessitates additional measures to increase it.

SESSION / 06

Genetic Aspects of the Iberian Lynx

Genomics-informed conservation: shaping the future of biodiversity restoration

COCK VAN OOSTERHOUT /

School of Environmental Sciences, University of East Anglia, Norwich, UK

Scientific and technological advances, from genomics and bioinformatics to AI and genome editing, offer transformative tools for biodiversity restoration. Yet the IUCN Red List still does not incorporate genomic data, despite mounting evidence that “genomic erosion” (the loss of genetic diversity and accumulation of deleterious mutations) continues even after demographic recovery. Using the pink pigeon (Nesoenas mayeri) as a model, we demonstrate that population recovery can conceal ongoing loss of heterozygosity and increased genetic load, producing a “drift debt” that threatens long-term viability. Genomics-informed breeding programmes, such as those implemented in zoo populations, can mitigate inbreeding depression and identify optimal mate pairings, while novel approaches such as the “sonification” of genomic data help communicate these findings to wider audiences.

Looking ahead, AI can help predict extinction risk by learning from simulated digital- twin populations and integrating genomic, demographic, and environmental features. Early results show that supervised machine-learning models can predict population extinction with >85% accuracy from genomic data alone. These insights underscore that while technologies like AI and genome engineering are valuable tools, they are not panaceas. Sustainable biodiversity restoration requires combining genomic insights with ecological, behavioural, and policy actions to address the ultimate drivers of extinction.

SESSION / 07

EVOLUTION AND DEVELOPMENT OF THE LYNXCONNECT PROJECT IN THE DIFFERENT AREAS OF ACTION

SESSION / 07

Evolution and Development of the LynxConnect Project Across the Different Areas of Action

Analysis of the Results in the Management of the Selected Stepping Stones in Andalusia

ANDALUSIA /

One of the objectives of the LIFE LYNXCONNECT project has been to reduce the overall loss of genetic diversity in populations by promoting the establishment of breeding pairs in "Stepping Stones" located in intermediate areas between existing population nuclei. The settlement of breeding individuals in these Stepping Stones would improve the likelihood of gene flow among members of neighboring populations. To this end, a protocol was defined for selecting such Stepping Stones, and if the evaluation was positive, individuals could be released to establish themselves in the area as breeders. During the implementation of this process, different scenarios have occurred:

- *Cases in which an individual has arrived in an area evaluated as a Stepping Stone, and following the arrival of this/these individual(s), additional conspecifics were released.*

- *Cases in which evaluated areas passed the assessment, and individuals were subsequently released.*

- *Cases in which lynx individuals arrived on their own in unevaluated areas, and after detecting their presence, the area was assessed and, depending on the results, lynx individuals were released.*

Although the sample size is still relatively small, based on observations during the implementation of LIFE LYNXCONNECT, it can be concluded that in the patches evaluated and selected as potential Stepping Stones, but where the species is absent, no individuals have yet established themselves, nor have there been reproduction events or migrations of offspring to enhance gene flow among neighboring population nuclei.

However, in cases where lynx individuals arrived on their own, the characteristics of the area met the requirements of the Stepping Stone selection protocol, and additional lynx were released, it has been observed in most of these cases that the released individuals established territoriality, with subsequent confirmation of reproduction events and even migrations to neighboring population nuclei.

The aim of this presentation is to show the results observed in the different scenarios and to evaluate the best management options for the Stepping Stones.

SESSION / 07

Evolution and Development of the LynxConnect Project Across the Different Areas of Action

Current Status of Lynxes in Extremadura, November 2025

EXTREMADURA /

AUTHORS /

María Jesús Palacios *(Dirección General de sostenibilidad. Junta de Extremadura) /* ***Matías Taborda*** *(Dirección General de Mundo Rural, Caza, Pesca Y Tauromaquia. Junta de Extremadura) /* ***Michel López*** *(Área del Medio Natural GPEX. Junta de Extremadura) /* ***Benigno Cienfuegos*** *(FOTEX)*

According to data from the official 2024 national census, the Autonomous Community of Extremadura has **five breeding nuclei**, with a total of 254 individuals recorded that year. **As of November 2025, 295 individuals have been identified and monitored, of which 70 are breeding females**, which have produced **100 cubs** this year.

Among the five breeding nuclei, the following stand out:

In the **Matachel** River Valley (Badajoz), which hosts the Source Population, 151 individuals were recorded, of which 114 were adults or subadults. Among these, there were 69 females, 37 of which were breeding females.

The **Ortiga** nucleus (Badajoz) hosted 41 individuals, 25 of which were adults, including 15 adult and subadult females.

In the **Valdecigüeñas–El Sotillo** area (Badajoz), 16 individuals were recorded, of which 5 were adult and subadult females, 3 of them breeding.

In the province of Cáceres, the **Valdecañas and Ibores** nuclei totaled 40 individuals, 30 of which were adults, including 12 breeding females.

In **Monfragüe National Park**, there is one surplus male from the Ex Situ Program, Pintxo, released in 2019, as well as an adult female from the Ex Situ Program, Flora, released in Valdecañas in 2024, along with her four adopted cubs, rescued from the wild after their mothers were run over in the Valdecañas and Matachel areas.

From 2014 to 2025, 130 lynx deaths have been recorded in Extremadura, including 37 in 2025 (23 roadkill). The main cause of mortality is roadkill, accounting for 70% of detected mortality causes and 56% of corrected mortality causes.

Lessons learned, as highlighted in a study conducted with researcher Dr. José Jimenez, Integrated Population Model Based on Iberian Lynx Monitoring Data in Extremadura (95% Bayesian Credibility Interval), include the following conclusions:

- *The population size in Extremadura before the breeding season is estimated at 88 (69–105) females, of which 29 (24–36) are breeding females, and 75 (62–89) males.*
- *There is demonstrated dependence of subadult female survival on density, combined with failed dispersal processes and road mortality, reaching 40% annual mortality in subadult females and a consistent 30% annual mortality in subadult males during the study period.*
- *The model predicts that the lynx population in Extremadura would not change significantly under simulated management scenarios aimed at reducing roadkill mortality.*

BIBLIOGRAPHY /

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SESSION / 07

Evolution and Development of the LynxConnect Project Across the Different Areas of Action

- Recovery of the Iberian Lynx Lynx pardinus in Castilla-La Mancha

CASTILLA LA MANCHA /

Since the beginning of the 21st century, the regional administration, in collaboration with other authorities and multiple social stakeholders, has promoted numerous efforts to reverse this situation. A key element has been the financial support from the European Union LIFE programs, through which four projects focused on the species' recovery have been implemented.

The reintroduction of the first individuals took place in 2014 under the LIFE Iberlince Project. The selected areas were the Montes de Toledo and Sierra Morena, historical strongholds of the species where the last Iberian lynxes in the region had been documented.

Subsequently, the LIFE LynxConnect Project provided a decisive boost toward achieving a favorable conservation status. By 2024, Castilla-La Mancha had three consolidated populations and several areas with stable presence, totaling 942 individuals, of which 175 were breeding females.

Looking ahead, the main conservation challenges focus on:

- *Consolidating reintroductions initiated in the provinces of Albacete and Cuenca.*
- *Reducing mortality, particularly through corrective measures on road infrastructures.*
- *Strengthening health monitoring, with special attention to viral diseases affecting the species.*
- *Maintaining population monitoring and genetic management.*
- *Promoting actions that enhance connectivity between population nuclei.*

SESSION / 07

Evolution and Development of the LynxConnect Project Across the Different Areas of Action

Ten years of Iberian lynx reintroduction in Portugal: demographic recovery, multidisciplinarity, and technological innovation applied to conservation

PORTUGAL /

Over the past two decades, Iberian lynx (Lynx pardinus) populations have undergone a remarkable demographic recovery, supported by integrated programs of active conservation and reintroduction carried out in Portugal and Spain. In Portuguese territory, the LIFE Lynxconnect project (LIFE19 NAT/ES/001055), successor to LIFE Iberlince (LIFE10 NAT/ES/000570), has implemented several types of actions in the Guadiana Valley — between Serpa and Castro Marim — with the aim of re-establishing a viable population of the species. Between 2015 and 2024, 61 lynx (32 males and 29 females) were released, and approximately 570 births in the wild were recorded.

At present, the Portuguese population stands at 354 individuals, distributed across roughly 1,000 km², demonstrating the success of the reintroduction program. The use of emerging technologies — such as artificial intelligence tools applied to camera-trapping and GSM systems (initially) and LoRaWAN (from 2023 onwards) for radiotelemetry, together with interaction via the WAZE app — has improved the precision and efficiency of monitoring and has served as a measure for preventing road collisions.

Between 2015 and 2024, 55 mortality events were documented, with road collisions identified as the main cause (70% of cases, n = 39). Even so, this figure likely represents an underestimation, given the difficulty of detecting deaths associated with disease, poaching, or intraspecific predation.

The future of Iberian lynx conservation in Portugal depends on the continued genetic and demographic monitoring of the population, the strengthening of connectivity between population nuclei, and the collaboration of local stakeholders and partner organizations. Administrative, financial, and logistical stability is essential for the implementation of medium- and long-term actions. The Portuguese experience highlights the value of integrating multiple disciplines — such as social sciences, molecular genetics, and veterinary science. An approach that bridges science, technology, and adaptive management may serve as a reference model for the recovery of critically endangered species.

SESSION / 07

Evolution and Development of the LynxConnect Project Across the Different Areas of Action

Reintroduction of the Iberian lynx in the High Lands of Lorca, Region of Murcia: Initial Actions and Results

MURCIA /

AUTHORS /

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The Region of Murcia began working on the return of the Iberian lynx (Lynx pardinus) in 2011, participating as a partner in the LIFE IBERLINCE project. In spring 2023, the first individuals were released under the LIFE LYNXCONNECT project, resulting from collaborative work with the other partners, the hunting and agricultural sectors, non-governmental organizations, and the general public, following a rigorous process of evaluation and selection of suitable areas for the species. This process culminated in 2022 with the designation of 22,500 hectares in the Lorca Highlands as a reintroduction area.

In 2024, several stable territories with resident individuals were established, and in 2025, the first two litters born in the wild were recorded, confirming the successful progress of the process and initiating the consolidation of the nascent population. These births also reinforce the natural role of the Region of Murcia as a connectivity area between southern populations and the regions of southern La Mancha and the Levante. This function is evidenced both by the arrival of dispersing individuals from Andalusia and by movements of lynxes from Lorca to Almería and Sierra Morena, as well as by exchanges with the new reintroduction area in Albacete, which receives sporadic individuals and to which lynxes from Lorca also move.

The regional government of the Autonomous Community of Murcia continues to work on the release of lynxes into the wild, protecting their habitat, promoting public awareness, and generating opportunities around this emblematic species, fostering sustainable development linked to biodiversity, demonstrating that conservation is possible when it becomes a shared objective.

CONCLUSIONS/

CONCLUSIONS / 01

From the knowledge and experiences presented throughout this International Congress on the Iberian lynx, we can highlight the following aspects as fundamental for understanding not only the scope, level, and diversity of the research lines applied to the species, but also the future plans for a feline saved from the brink of extinction that still requires ongoing actions to secure its future.

- At a general level, the LIFE LynxConnect Project was launched with **the goal of creating a viable and functional metapopulation from the existing Iberian lynx subpopulations** (as well as establishing **two new population nuclei** in Tierras de Lorca-Murcia and Sierra Arana-Granada) to reduce the risk of inbreeding in a species with already depressed genetic diversity. The more than ten **"stepping stones"** created have become key and effective corridors for connecting subpopulations. Combined with measures applied on roads to reduce unnatural mortality, agreements with landowners and hunting associations, and active education and communication initiatives, the project has achieved a major milestone: surpassing 2,400 individuals on the Iberian Peninsula and lowering the species' threat status to **"Vulnerable"** according to the IUCN.

- In the current context of climate change, understanding the Iberian lynx's evolutionary past is essential **to evaluate its resilience** and identify viable strategies to maintain the species over time. Notable discoveries, such as the Iberian lynx from the Quibas site in Murcia, dated to one million years ago, provide evidence not only of the species' historical presence in the region but **also insights into its habitat (arid), size (larger than today), and diet (less specialized on rabbits)**. Even older fossils, approximately 1.6 million years old, have been found in **Taurida Cave, Crimea (Ukraine)**, indicating that the species once had a much wider distribution than at present. Such fossil evidence has yielded critical information about **habitat requirements and reproductive strategies**. Historical records further reveal **two significant population declines**: the first during the Late Middle Ages, linked to the **commercial demand** for lynx pelts, and the second at the end of the 20th and beginning of the 21st century, due to the combined effects of **myxomatosis and viral hemorrhagic pneumonia**, which decimated rabbit populations—the lynx's main prey—reducing lynx populations to unsustainable levels.

- Knowledge of the species' **spatial patterns**, enabled by advances in technology, has become a crucial conservation tool for **selecting** optimal **reintroduction sites** and **stepping stones** with the lowest risk of unnatural mortality, ensuring successful connections between subpopulations. GPS telemetry tracking of 124 Iberian lynxes revealed a preference for **mosaics of natural vegetation—including tree cover, shrubland, and grassland—with low densities of roads and human infrastructure** when selecting territories. During excursions, lynxes actively avoid roads, though this avoidance is less pronounced during dispersal. **Connectivity** between subpopulations has improved between 2004 and 2024, thanks to population growth and the development of stepping stones acting as corridors. Finally, studies on movement patterns of wild-born and captive-bred individuals released in reintroduction programs have shown **successful settlement of captive-bred lynxes**, the efficiency of wild individuals in population reinforcements, and the importance of an acclimatization period of around 45 days to increase settlement success in the target area.

CONCLUSIONES / 02

- En cuanto a las **Técnicas de seguimiento** empleadas con el lince ibérico, herramientas que hacen uso de **Inteligencia Artificial** como Wildlife Insights (que automatiza el reconocimiento de especies) y LynxWildbook (para la identificación individual de ejemplares) muestran un potencial rotundo para la especie. Más allá de esto, el **Proyecto MOMAT** ha evaluado diversas metodologías para monitorizar todas las especies de mamíferos ibéricos, poniendo en valor herramientas como el ADN ambiental o protocolos estandarizados de fototrampeo. Líneas como las del proyecto **LIFE Iberconejo** se han centrado en el estudio de la presa clave del lince a través de numerosas metodologías como las bolsas de caza, el uso de modelos estadísticos o el Distance Sampling aportando información muy útil para el seguimiento de esta **especie angular**. Centrándonos en la actualidad del lince ibérico, el **fototrampeo** sigue siendo la herramienta más importante en el monitoreo aunque con cambios a lo largo del tiempo: hoy, debido al incremento demográfico de la especie, se hace imposible un seguimiento tan exhaustivo, palmo a palmo, como el que se hacía durante los primeros años de trabajo. Esto reduce el número de ejemplares detectados y hace necesario el uso de **estimas poblacionales**, difíciles de estandarizar debido a la diversidad en los equipos de seguimiento, territorios, etc. por lo que necesitarán ser adaptadas a las particularidades de cada zona para alcanzar estimaciones globales realistas.

- El **componente humano**, el trabajo comprometido de numerosísimos actores sociales desde el comienzo del Proyecto, el respaldo internacional y la apuesta por una toma de decisiones difícil pero imprescindible, además de la implicación social (a todos los niveles) con la especie, se pusieron en valor como claves del éxito de este programa.

- La **pobreza genética** ha sido, desde el comienzo, uno de los grandes talones de Aquiles para el lince ibérico debido a su menguada población de partida (apenas un centenar de ejemplares a principios de siglo). Por ello, se trata de un aspecto estudiado y analizado en detalle. Así, sabemos que el lince ibérico divergió del resto de especies del género *Lynx* hace unos 3 millones de años y que ha sido frecuente su **reproducción interespecífica con ejemplares de lince boreal**, lo que ha supuesto, evolutivamente, un **"rescate genético"** que ha incrementado su diversidad y que plantea interesantes cuestiones a futuro para la recuperación genética de nuestro felino ibérico. Hoy, la reducida diversidad supone **una limitación de la capacidad adaptativa**, lo que se convierte en una amenaza para su supervivencia a largo plazo. Así, la **gestión genética** (incluyendo traslocaciones de individuos) llevada a cabo desde el comienzo del Proyecto con la especie ha sido crucial para mejorar su situación, evitar una mayor pérdida genética y problemas de consanguinidad. El futuro de la especie pasa por incrementar sustancialmente su metapoblación y, además, apostar por **medidas adicionales para incrementar la diversidad genética** para evitar que la pobreza de esta se convierta en un lastre determinante para la especie. Esas "medidas adicionales" como la **edición genética** (apoyada en la IA) se plantean como opciones de futuro para recuperar una heterocigosidad que puede decaer incluso en poblaciones crecientes como la de nuestra especie objeto.

- Las **cinco zonas de trabajo con la especie** dentro de este LIFE LynxConnect muestran exitosos resultados que muestran el impacto positivo y necesario de este Proyecto. Desde las primeras citas de cría en la región de Murcia tras la reintroducción de ejemplares en 2023, al uso contrastado e imprescindible de los Stepping Stones en Andalucía, pasando por el incremento poblacional de Extremadura, Portugal o Castilla La Mancha, las diferentes regiones son ejemplo de un trabajo social integral, coordinado y preciso, **ejemplo de una conservación que trasciende las fronteras**.

ABSTRACTS OF PRESENTATIONS

Seville, 25–27 November 2025

Expo Building (Cartuja Island)

INTERNATIONAL CONFERENCE ON THE
IBERIAN LYNX

Shared vision, cordinated action:
Conservation of the iberian lynx in the Iberian Peninsula.

lynxconnect

In collaboration with:

Junta de Andalucía

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