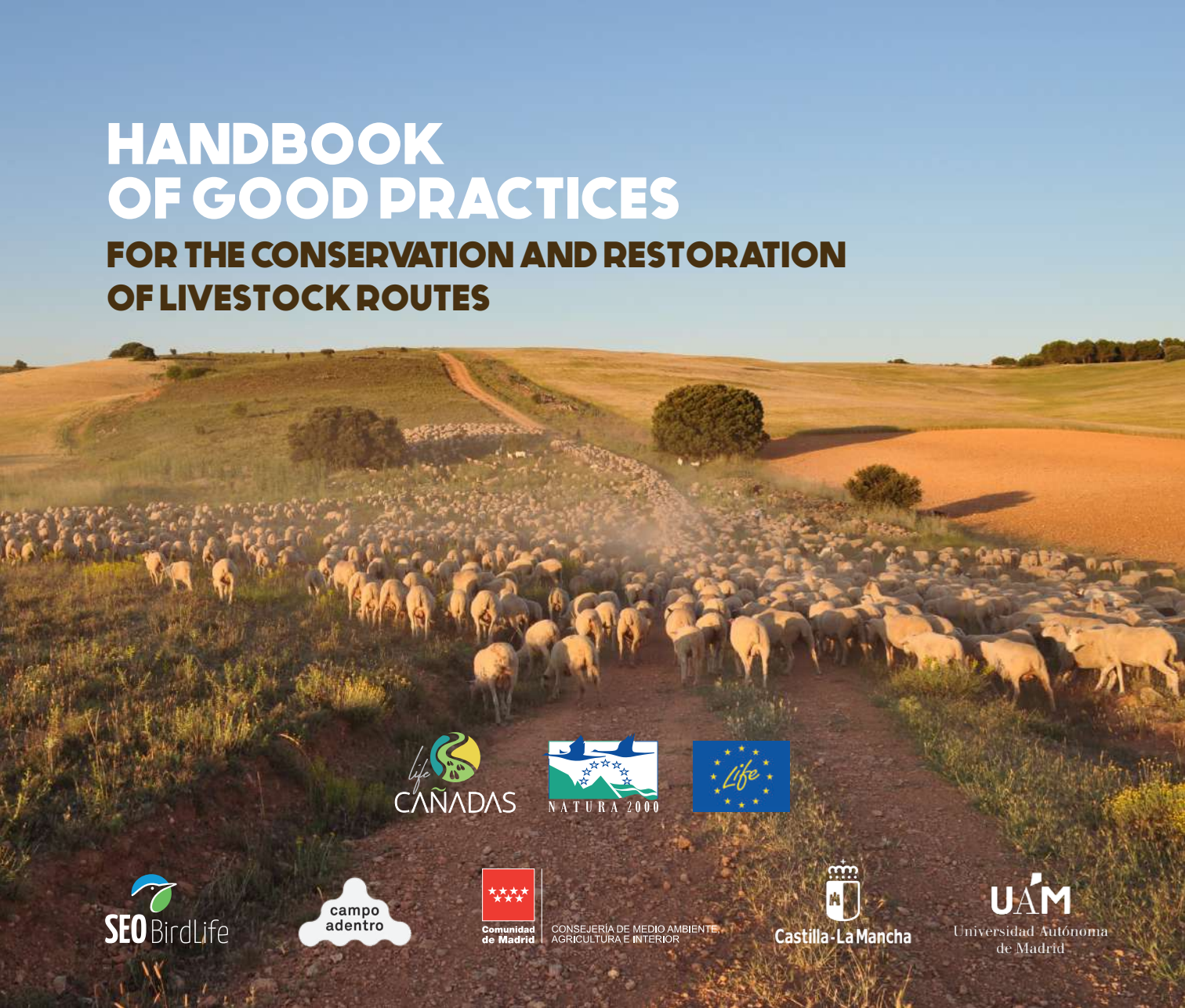
HANDBOOK OF GOOD PRACTICES

FOR THE CONSERVATION AND RESTORATION OF LIVESTOCK ROUTES



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FOR THE CONSERVATION AND RESTORATION OF LIVESTOCK ROUTES

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Cover Transhumant flock moving through the Cañada Real Conquense towards winter pastures. © José A. González

Back cover Vidal Martínez, a transhumant shepherd from Guadalaviar, contemplating from Casa Tejá (Vilches) the *dehesa* that his sheep used to occupy during winter. © José A. González

01

Introduction

The Handbook of Good Practices for the Conservation and Restoration of Livestock Routes is one of the most relevant products of the LIFE CAÑADAS project as it allows the knowledge acquired during its development to be transferred to a broader audience. Its goal is to provide clear and practical guidelines for the restoration of livestock routes (also known as drove roads), favoring their role as ecological corridors.

This technical handbook aims to be very useful for all authorities and decision makers at the national, regional and municipal level, as it provides them with a solid basis to develop their own strategies based on the guidelines of the National Strategy for Green Infrastructure and Ecological Connectivity and Restoration.

Transhumant sheep passing through the Cañada Real Conquense in the municipality of San Lorenzo de la Parrilla (Cuenca).
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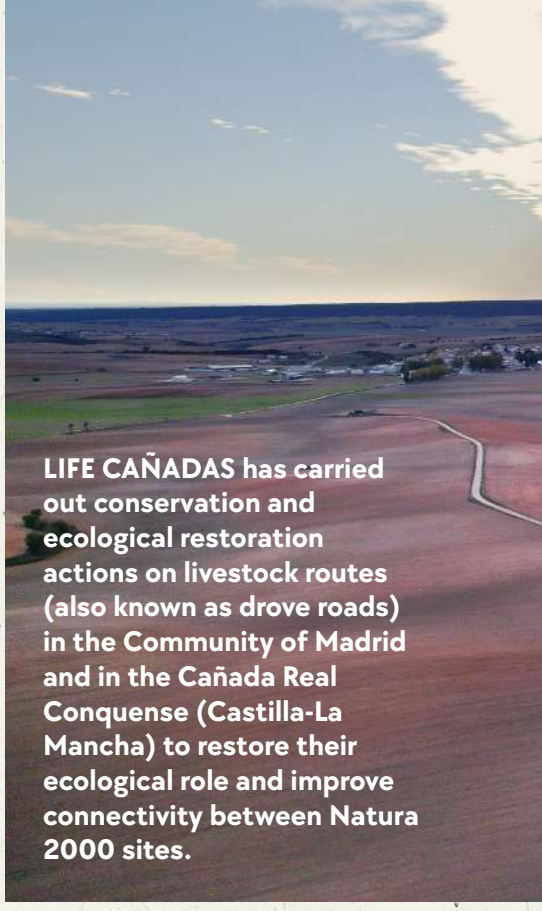
1.1
The LIFE CAÑADAS Project

The LIFE CAÑADAS project is co-financed by the European Commission and coordinated by the Autonomous University of Madrid. Partners include the General Directorate of Agriculture, Livestock, and Food of the Community of Madrid, the General Directorate of Forest Policy and Natural Areas of Castilla-La Mancha, SEO/BirdLife, and the Campo Adentro Association.

The LIFE CAÑADAS project has set the following specific objectives:

- Evaluate the conservation status of one of the largest livestock routes still in use by transhumant shepherds and the network of livestock routes in the Community of Madrid to identify priority areas for connectivity between Natura 2000 sites.



LIFE CAÑADAS has carried out conservation and ecological restoration actions on livestock routes (also known as drove roads) in the Community of Madrid and in the Cañada Real Conquense (Castilla-La Mancha) to restore their ecological role and improve connectivity between Natura 2000 sites.

- Restore the connectivity and functionality of livestock routes to enhance their role as biodiversity reservoirs and ecological corridors between Natura 2000 areas.

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- Recover extensive traditional grazing activities, preferably through transhumance, in areas where herbivore management is critical to maintaining the diversity and functionality of livestock routes.
- Define priority management criteria to incorporate into a future Green Infrastructure Strategy in Spain, including the network of livestock routes and an appropriate institutional framework for their sustainable management.
- Raise awareness in society and improve the perception of local stakeholders about the importance of livestock routes in biodiversity conservation and landscape connectivity.

Andrés Belenchón, transhumant shepherd from Guadalaviar (Teruel).

1.2
Objective and Target Audience of the Handbook

This handbook is aimed at technicians, managers, farmers, citizen associations, and individuals interested in the management, conservation, and restoration of livestock routes.

It is a proposal from the LIFE CAÑADAS project where we have tried to synthesize the main conclusions and learnings gathered after almost 15 years of experience in livestock routes.

Throughout this project, we have had the opportunity to visit livestock routes in various states of conservation, we have witnessed the results of different types of interventions, and we have been able to engage in dialogue with representatives from various social sectors that interact daily with the livestock routes.

Our proposal adopts the **approach of ecological restoration,** which we consider the ideal method for managing these corridors.

This implies starting with rigorous ecological diagnostics and the establishment of appropriate references, implementing actions that respect the principle of minimal intervention, and prioritizing the reactivation of processes and the autonomous recovery of the system.

We are convinced that the good ecological condition of a livestock route should be understood from a **multifunctional perspective,** which is achieved as its primary role as a corridor for livestock movement is accompanied by an adequate capacity to provide ecosystem services, ecological connectivity, and the conservation of habitats and biodiversity; ultimately, a general state that is resilient and sustainable both ecologically and socially. These functions should not be seen as different options or alternatives but are clearly interdependent: **livestock routes with proper use for grazing are the most valuable from an ecological standpoint,** and the good conservation of the spaces and habitats specific to the livestock route is the best guarantee that herds have access to food, water, and the space needed for transhumance under optimal conditions. A network of livestock routes that is understood, valued, and properly used by society can be maintained sustainably over time, both ecologically and economically. In summary, it is about implementing a management model that prioritizes the multifunctionality of the network, recovering its integration into the territory and society.

We encourage you to explore this handbook, apply its proposals, and reflect on the shared responsibility of preserving our livestock routes as vital elements of our environmental and cultural heritage, and as essential structures for the proper functioning of our territory.

02

How to Use This Handbook?

This handbook has been designed to provide a clear and practical guide for the conservation and restoration of livestock routes. Below is a brief description of how to make the most of the information contained within.

Transhumant flock using one of the existing watering troughs on the Cañada Real Conquense.
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Transhumant shepherd with his herd, his mastiffs, and his shepherd dog.

Chapter 03

This chapter constitutes the **informative basis** of the handbook and delves into key aspects related to livestock routes. Specifically, it provides a clear and concise definition of livestock routes, highlighting their historical and ecological importance. It details how an ideal livestock route should be in a good ecological, structural, and functional state. Likewise, guidelines are included to attempt to preserve the integrity of these structures of high environmental, social, and cultural importance.

Chapter 04

Two main sections are described: **i) Planning interventions,** where the necessary steps to design effective interventions are detailed, ensuring the sustainable conservation and restoration of livestock routes; **ii) Some examples of actions are presented,** showing strategies to address the main issues in the conservation and restoration of livestock routes.

Chapter 05

This chapter describes some common interventions in livestock routes that are not appropriate to guarantee the success of conservation and restoration initiatives.

Chapter 06

It provides additional information and supporting material that **complements the handbook,** allowing users to delve into specific aspects according to their needs and interests.

The complete reading of the handbook is recommended to gain a comprehensive understanding of all guidelines and suggested practices.

03

Basic Information

Livestock routes (or Drove roads) are spatially well-defined corridors through which livestock transit has traditionally passed or still passes.

In Spain, there is a national law (Law 3/1995, of March 23, on Livestock Routes) that protects the network and regulates its use, delegating its management to the regional authorities (Autonomous Communities), many of which have their own specific laws for the management of livestock routes.

Flock of sheep using a livestock route to cross an agricultural landscape
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3.1
What are Livestock Routes?

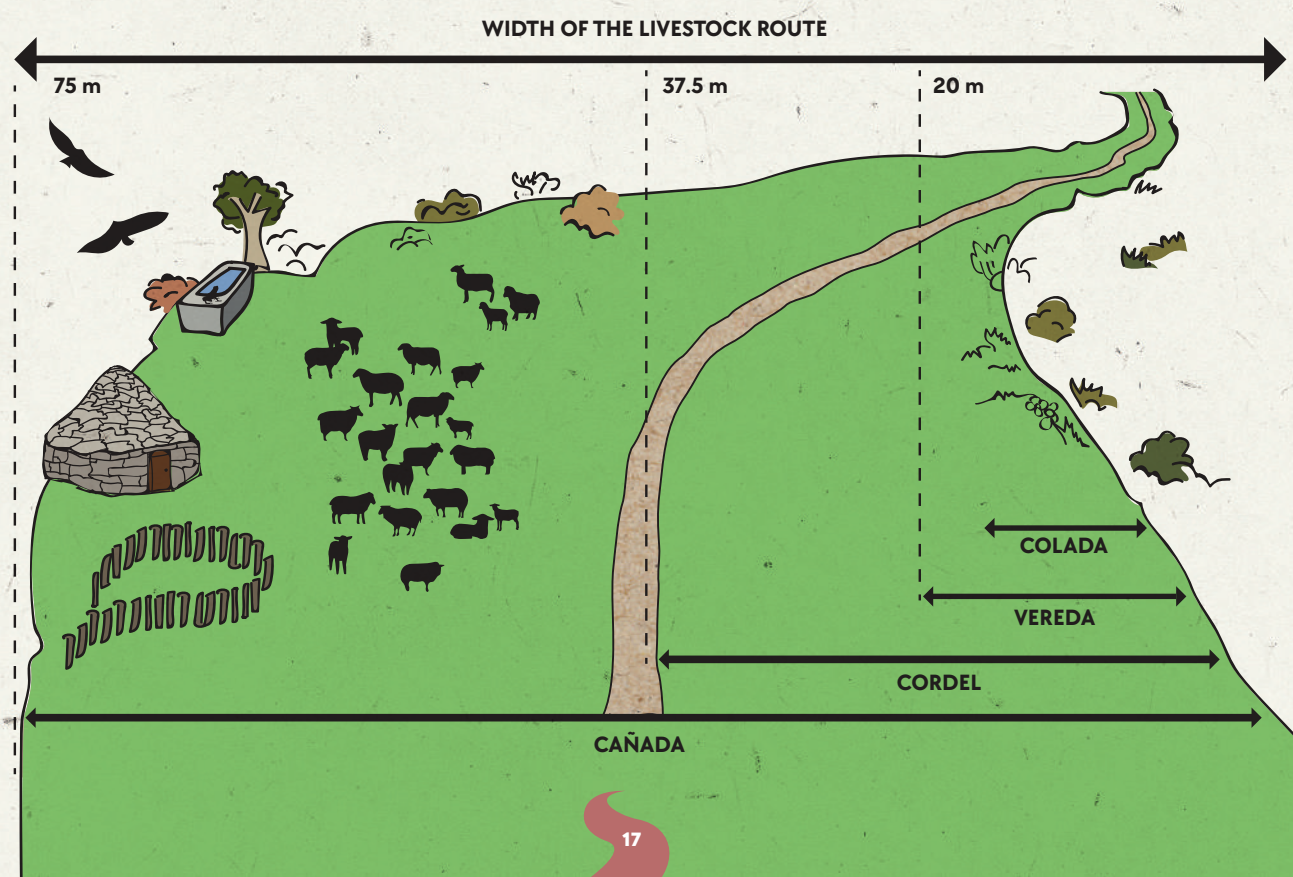
Livestock routes are the paths or itineraries where livestock transit traditionally occurs or has historically occurred. They are public domain assets of the Autonomous Communities and, consequently, are inalienable, imprescriptible, and unseizable. The most important routes that cross several Autonomous Communities are included in the so-called **National Network of Livestock Routes,** which, although also dependent on the Autonomous Communities, must be managed in a coordinated manner with the competent ministry.

On the other hand, both the National Law and the regional laws grant a certain role to municipalities for some procedures, and it is quite common for municipal administrations to promote interventions in livestock routes, which in any case must always receive authorization from the regional administration.

Spain is probably the country in the world where livestock routes have the greatest historical significance (documented intense use since at least the 12th century) and territorial importance (125,000 km in length and 421,000 ha in surface area, which represents almost 1% of the country's surface area, *Mangas-Navas 1992, Cuadernos de la Trashumancia).*

Depending on their rank and width, four basic types of livestock routes are distinguished in Spain: **cañadas, cordeles, veredas, and coladas.**

In addition, there are other spaces and places belonging to the network, such as **watering places, resting places, sheepfolds,** etc., whose surface area is variable and dependent on what is determined in the classification process.



Livestock use, especially the transit of herds, is the primary function of livestock routes, although legislation considers other compatible and complementary uses that should not interfere with livestock use and must respect the environment, landscape, and natural and cultural heritage.

Among the compatible uses of livestock routes, those traditional uses related to agricultural activities are considered, as long as they can be carried out in harmony with livestock transit and do not involve encroachments on the routes. As complementary uses, walking, hiking, horseback riding, and other forms of non-motorized recreational travel are considered, provided they respect the priority of livestock transit.

Legal framework of livestock routes

The Spanish network of livestock routes is one of the elements specifically considered in the National Strategy for Green Infrastructure and Ecological Connectivity and Restoration (Order PCM/735/2021, of July 9th), given the role they play in the landscape as ecological corridors. The aforementioned ministerial order implements what is established in Law 33/2015, of September 21st, which indicated that livestock routes should be included as part of the Strategy. Two decades earlier, Law 3/1995, of March 23rd, on Livestock Routes, already considered them as "ecological corridors, essential for the migration, geographic distribution, and genetic exchange of wild species," in a manner compatible and to a large extent dependent on their priority use for livestock.

Livestock routes are also included in the Strategic Plan for Natural Heritage and Biodiversity 2011-2017 (RD 1274/2011, September 16th; under revision), as part of the priority ecological corridors that administrations must establish and protect.

This strategy, in turn, complies with the provisions of Law 42/2007, of December 13th, on Natural Heritage and Biodiversity, which indicated that livestock routes should be incorporated into environmental planning and natural resource management plans as a priority, once again mentioning their role as ecological corridors.

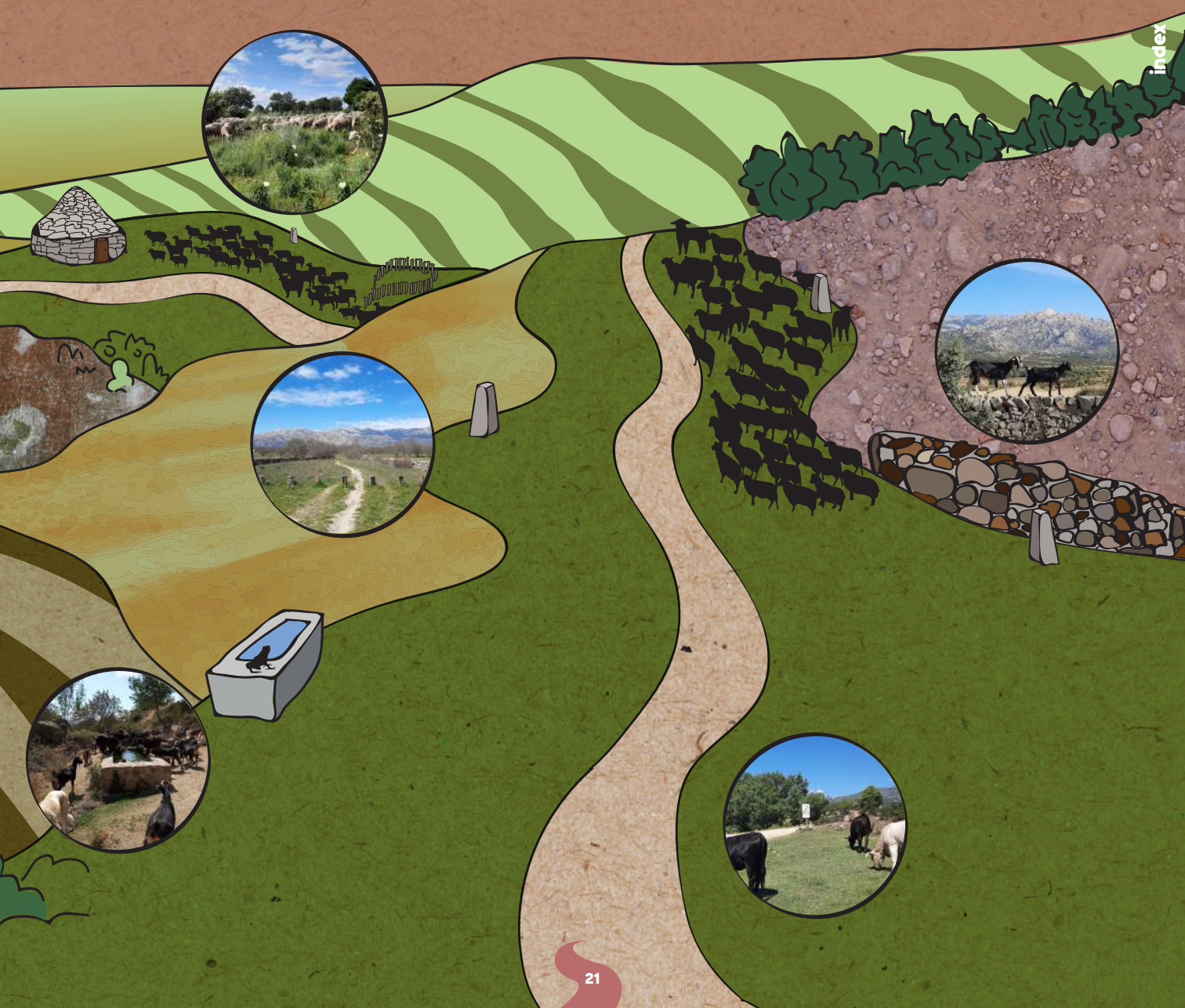
The conservation of livestock routes is also addressed in action line 11.2 of the National Plan for Adaptation to Climate Change 2021-2030 of the Ministry for Ecological Transition and Demographic Challenge (MITECO), given the strategic interest of conserving pastoralism as part of climate adaptation.

All of this, combined with the vast extent of the network, makes it a priority to develop scientific knowledge about its ecological functioning, and this knowledge should be taken into account in decision-making regarding the management of the network, for an effective protection of the biodiversity hosted by livestock routes and the territories they connect or influence.

3.2
The Good Ecological Condition of a Livestock Route

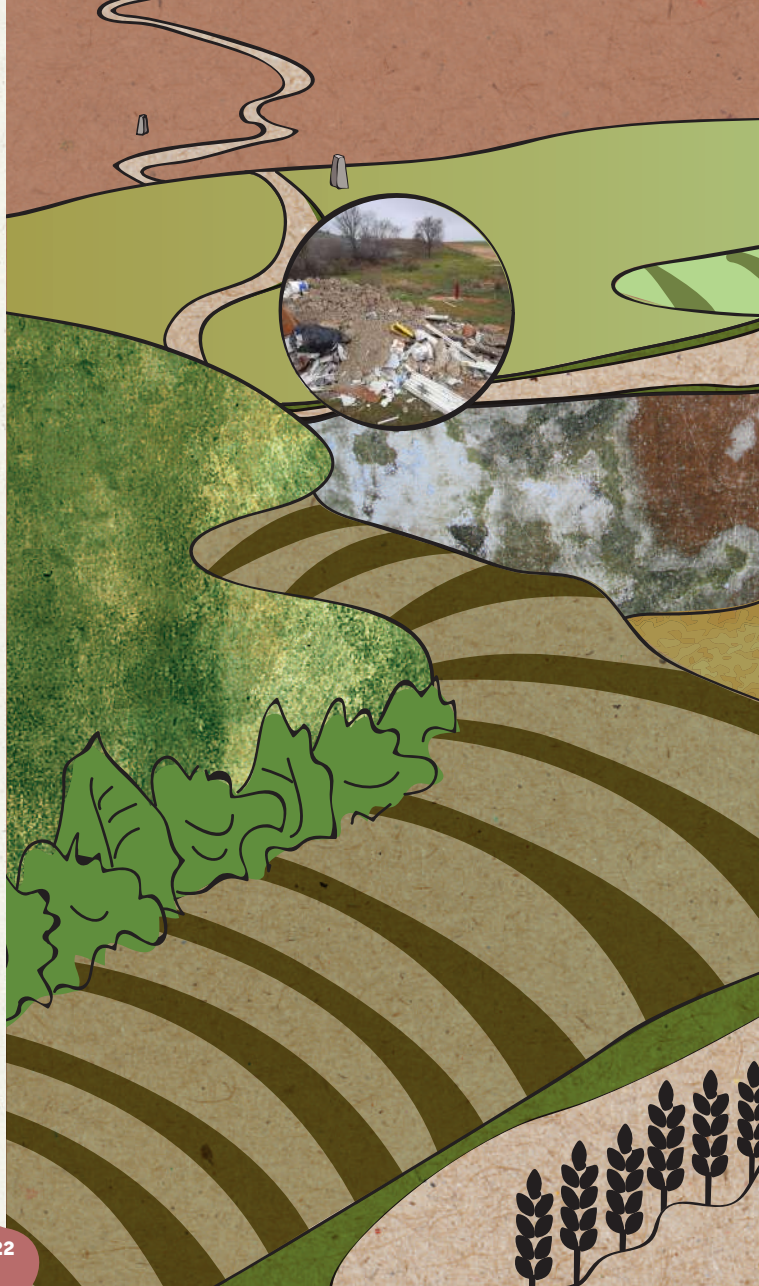
How a livestock route should be?

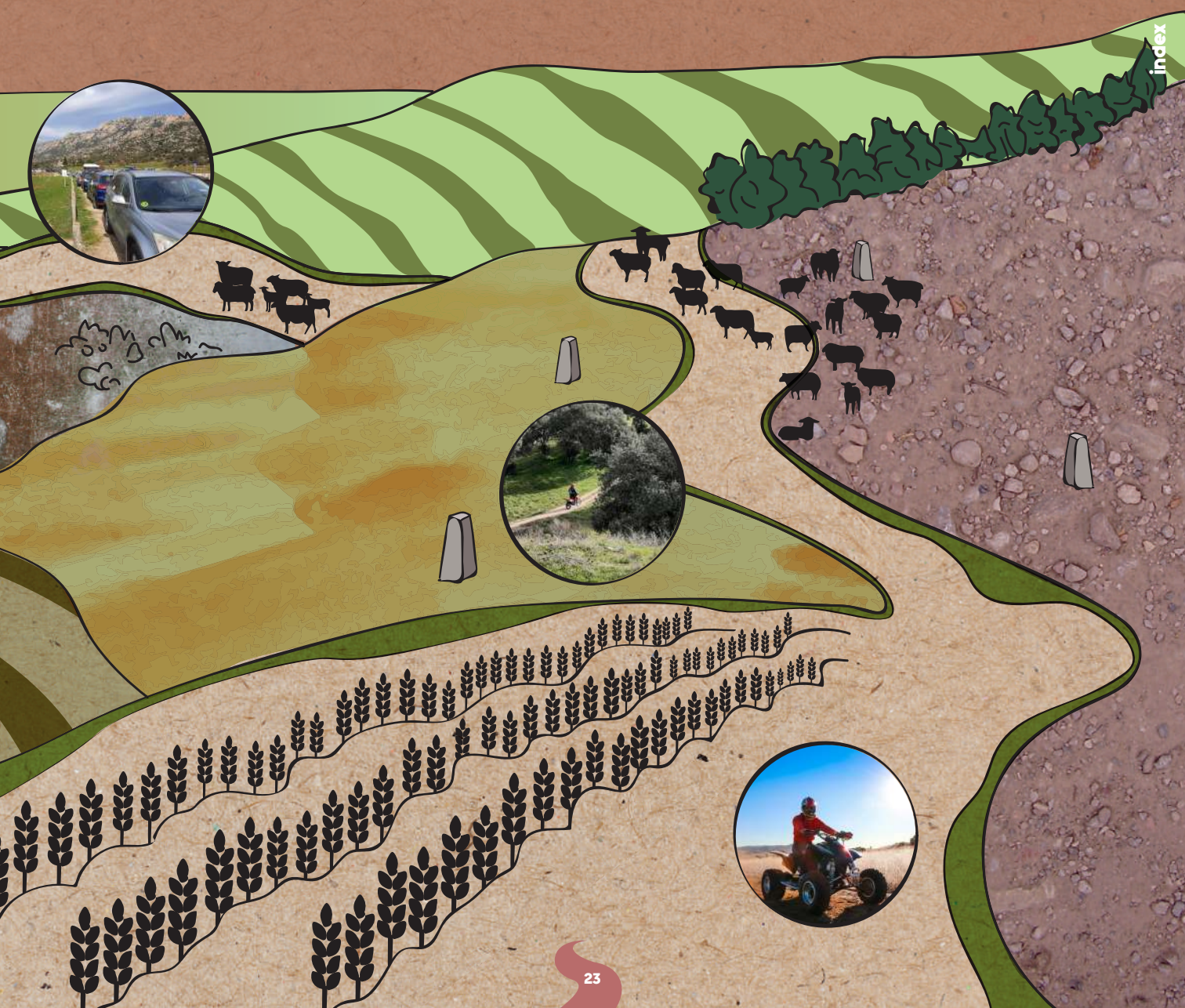
A livestock route in good condition is one that maintains its **territorial integrity** and is capable of adequately performing its **livestock functions** (grazing and animal mo vement), while also providing other **ecological and social services, functions, and benefits.** Based on this general definition, in each territory, with its climatic, geological, biogeographic, social, etc., peculiarities, we must identify which models are suitable for a good condition, and therefore, in what situation the livestock routes on which we can intervene are found.



How a livestock route should not be?

The problems of livestock routes comprise a very wide range of situations and are highly dependent on local and regional conditions. Among the most common degradation factors, we can mention the **usurpation of space by crops** and other uses (including urban and industrial at times), **degradation of vegetation and soil** due to off-road vehicle transit, proliferation of **debris and garbage dumping, deterioration of water points** and other livestock infrastructure, or excessive **accumulation of plant biomass** due to loss of grazing, leading to the **loss of ecological and livestock value** of grasslands.





04

Good Practices
in Conservation and Restoration of Livestock Routes

The Handbook of Good Practices for the Conservation and Restoration of Livestock Routes aims to be a useful resource to help ensure the integrity and functionality of these traditional routes. This section develops some basic concepts on how to approach the planning of interventions that will improve the conservation status of livestock routes.

When the pastures in the wintering areas of Sierra Morena dry up, the transhumant herds begin their journey back to the summer pastures in the Sierra de Albarracín.
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4.1
Planning Interventions

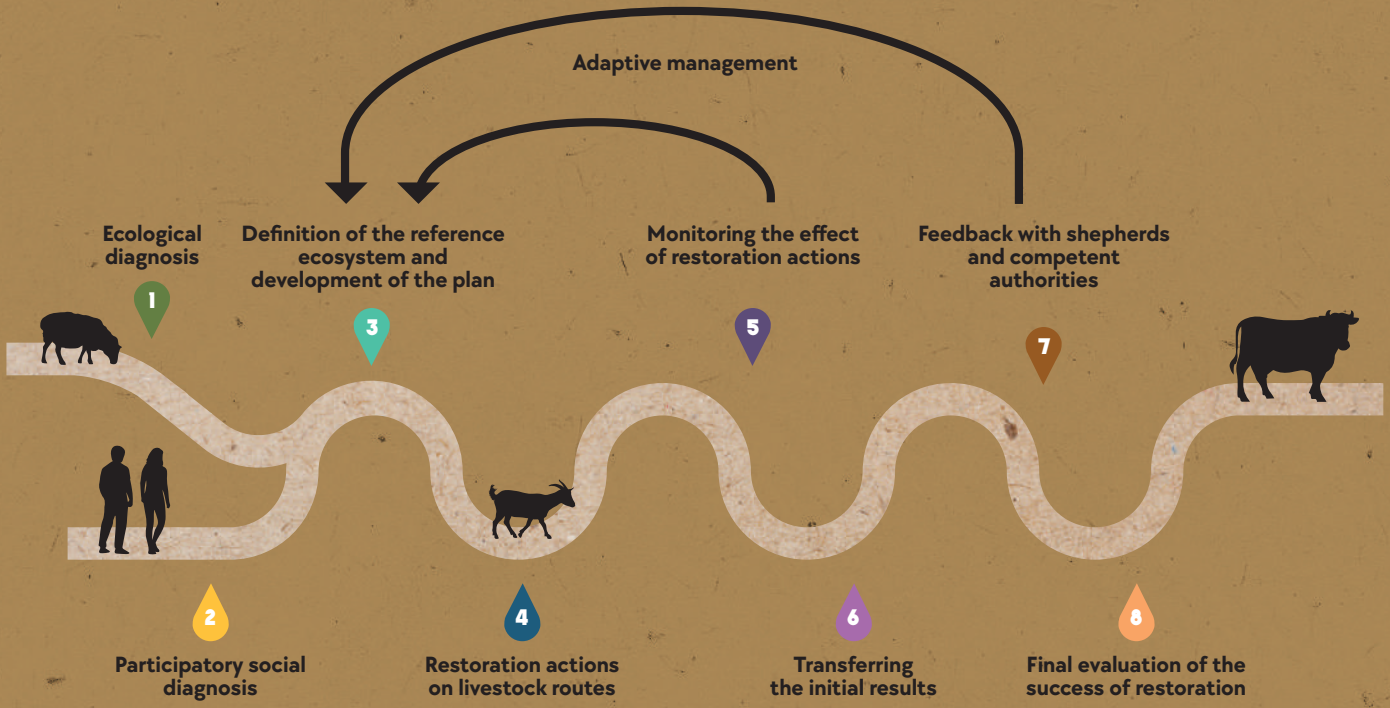
The decision to intervene should be based on a prior ecological diagnosis, which thoroughly explains the problems affecting the livestock route and identifies the causes of degradation.

The diagnosis should be conducted taking into account the ecological (landscape, region) and social contexts of the livestock route. Following this, actions strictly necessary to bring the livestock route closer to the reference ecosystem can be designed.

It should be noted that the reality of Spanish livestock routes not only includes sections affected by conservation problems but also includes functional and well-maintained drove roads. In these cases, management should be more focused on protecting and conserving the current use of the corridor rather than carrying out interventions that may be counterproductive; *see section "Undesirable Actions".*

Interventions should be planned with consideration for users and the nearby social environment. Therefore, in parallel with the diagnosis, it is advisable to include participatory processes with livestock farmers and other sectors related to the livestock route. Their inclusion will not only provide valuable information to define multifunctional benchmarks but also help the population understand the benefits of a well-preserved network of livestock routes and allow for the forging of partnerships with citizens, thereby facilitating the proper use and conservation of the network.

As a result of the ecological diagnosis and the participatory process, a restoration project should be developed, which should include not only the interventions to be carried out and their detailed design but also the justification for them (diagnosis and benchmark for restoration), a monitoring system for the interventions, and an adaptive management plan that allows for addressing possible deviations from the intended objectives.



4.2
Some Examples of Actions

Recovery and protection of the official width

The first measure that must be taken to protect or restore a livestock route is to properly delineate and protect its **official boundaries** with adjoining lands. This involves a series of administrative acts, executed by the Autonomous Communities, which first lead to the correct **classification,** then to the **demarcation,** and finally to the **marking** of the livestock route. However, despite the years that have passed since the approval of Law 3/1995, many sections of livestock routes have not yet completed the process and are not adequately delineated, so the Autonomous Communities must be urged to expedite this task. Unfortunately, even in cases where the livestock route is correctly demarcated and marked, invasions and other encroachments from adjoining lands can occur. This is especially common in agricultural landscapes, and in general, in livestock routes that lack dry stone walls or other elements that clearly mark the boundary.

Thus, one way to deter these encroachments is to increase the presence of **boundary and protective elements** that hinder the expansion of neighboring properties.

Previous page:
Nesting site for wild bees made with bamboo canes of various diameters inserted into a dry stone wall.

Dry stone walls and cairns have proven to be especially valuable structures for reptiles and invertebrates, providing shelters and nesting sites in their crevices. They also create microclimatic modifications (shaded areas, sunnier areas, soil moisture conservation) that can help diversify microhabitats.

In any case, it is essential that the administrations intensify monitoring and administrative actions aimed at preserving the legal width of the livestock routes.

This role can be fulfilled by various types of anthropogenic structures that require little maintenance and are durable, and that can provide additional benefits for the functioning of the livestock route, including benefits for biodiversity.

Examples of such structures include bird perches, dry stone walls, cairns, wild bee nesting sites, etc. Another option is to plant or sow trees along the boundary, although in this case, it is important to carefully select species and techniques so that the intervention is sustainable and does not require investments in water and resources that are difficult to maintain over time; *see section "Undesirable Actions."*

Another option is the incorporation of hedges, composed of shrubs or a combination of trees and shrubs suitable for the local conditions and capable of self-maintenance; *see section "Recovery of Woody Habitats."*

Delimiting and marking should be a priority for livestock route managers in the autonomous communities, and once marked, forest rangers and SEPRONA should carry out their monitoring duties, acting promptly when invasions or occupations are detected.

Traffic on livestock routes and the advisability of a suitable track

Motorized traffic on livestock routes is restricted to duly authorized vehicles, as stipulated by Law 3/1995. The lack of awareness of this regulation among much of the public makes it advisable for the autonomous communities and municipalities to make an effort to signpost this rule. In cases where the indiscriminate entry of vehicles is particularly problematic (disturbance to herds or hikers, proliferation of dumping), **it may be necessary to install barriers** that can only be crossed by authorized users.

At the same time, it is important that the livestock routes with authorized vehicle traffic have a **high-quality, stable track** that facilitates the movement of vehicles for livestock farmers and other users. If the livestock route has a suitable track that concentrates traffic, it will prevent the traffic from spreading in an unregulated manner, creating duplicate paths, ruts in the pasture, and the resulting problems of loss of vegetation cover and widespread erosion that are observed all too often.

The conditioning of the main track should therefore be seen as an appropriate measure for the conservation of the natural habitats of the livestock route. While the asphalt paving of these tracks is expressly prohibited by law, it may be advisable to use compacted gravel and/or stabilizers to obtain a durable platform, which will increase

The misuse by motor vehicles is one of the causes of deterioration of livestock routes, especially when there is no well-conditioned main track and traffic occurs in an unregulated manner.

its longevity. A high-quality construction will be more cost-effective in the long run and reduce the frequency of repairs, thereby minimizing the impacts caused by the constant visits of heavy machinery.

Deficiencies in water drainage are the main cause of road deterioration, so it is advisable to **construct properly crowned platforms,** with efficient and gradual drainage towards the sides, accompanied by cross drains, small bridges, or reinforced sections at crossings with ravines or streams. The lack of crown inevitably leads to ponding and rutting, resulting in vehicles having to veer off the paths to overcome these difficulties. **Ditches should be gentle with a smooth transition to vegetation.** Narrow, deep ditches with vertical walls are more unstable, have poorer infiltration, and produce more erosive flows, in addition to creating a greater visual impact. In general, a design prioritizing the infiltrability of the system and reducing runoff should be preferred, minimizing long-flow and high-flow rates, as these will accumulate more erosive power.

The surface area occupied by the track competes directly with that of the natural habitats of the livestock route, and therefore its size should not be excessive; ***see section "Undesirable Actions".***

In a livestock route, heavy traffic should not be common, nor should heavy-duty vehicles be habitual, so in most cases, **tracks should be 3 meters wide or, at most, 4 meters wide.**

Fork in dirt track, recently decompacted to begin its recovery as habitat for the livestock route.

Wide tracks are also more unstable and costly to maintain, given the direct relationship between bare soil surface area and surface runoff. If a certain amount of tractor or truck traffic is expected (and justified),

it is preferable to have gentle ditches that can be occasionally stepped on in the event of vehicle crossing, or establish wider points at regular intervals, rather than building a high-capacity track.

Achieving a higher-quality track, albeit narrower than the existing one, should be considered in many cases as one of the intervention objectives.

The road conditioning works can cause serious impacts on the livestock route if they are too frequent and inadequately planned. It is important to minimize the impact on natural habitats by avoiding substrate extraction, reducing the placement points of stockpiles, and ensuring that the remains of the work are properly collected. If necessary, restoration actions can be scheduled for the affected areas.

Some sections of the livestock routes present a serious problem of waste accumulation, which must be urgently addressed by the competent authorities.

Elimination of spills, constructions, and other intrusions

The neglect in the monitoring of livestock routes, the non-compliance with access restrictions, the lack of awareness of legislation, and the unscrupulousness of some people have led to the proliferation of waste dumps, illegal constructions, and various intrusions unrelated to the nature of these corridors. The elimination of these aggressions presents a very variable difficulty. The dumping of debris and garbage can be removed by the authorities, provided there is the will to do so, and a budget is allocated. **It is important that cleaning operations are carried out as promptly as possible once waste is identified,** as otherwise there is a risk of a **contagion effect,** making the problem more challenging to tackle.

When it comes to constructions, the action will likely require a more complex legal procedure, which can be initiated by the authorities themselves, associations, or individuals, and the dismantling will require more specific techniques.

After the elimination of the intrusion, the disturbed space may require further actions, aimed, for example, at restoring the soil and vegetation, or installing some useful anthropic element for the livestock route that can help consolidate the recovery of the space.

Recovery of soils

A significant portion of the surface of Spanish livestock routes presents severe soil degradation problems.

This deterioration may be caused by the impacts of various types of intrusions and occupations, or, more commonly, by the proliferation of tracks and ruts within the livestock routes, outside the main path. Among the causes of this serious phenomenon is **the inappropriate use of livestock routes by unauthorized motor vehicles** (quads, motorcycles, 4x4s, etc.), as well as the practice of sports activities (such as mountain biking).

Raising public awareness and monitoring the public use of livestock routes are part of the solution to this serious problem and can help prevent it. In cases where deterioration has already occurred (or is occurring), intervention should start by preventing cars, motorcycles, or bicycles from leaving the main path. It is advisable to first adapt this path to adequately serve authorized vehicles, which in many cases may be sufficient to address the problem.

If closures are necessary, physical barriers such as rows

of stones, soil cords, or wooden fences can be used, depending on the nature of the vehicles (two or four wheels) causing the problem.

Once it is ensured that no further invasions occur, it should be evaluated whether the soil deterioration is mild and can regenerate on its own, autonomously recovering the vegetation cover and soil processes, or if any intervention is needed. If the soils are very compacted, it may be advisable to perform tillage to restore porosity and infiltration capacity. Before doing so, it is important to assess the risk of erosion and perhaps reconstruct the landform so that water flows are managed in the most optimal way possible. Machinery or manual tools can be used for this, depending on the magnitude of the problem, always preferring the least aggressive and most artisanal technique possible.

Once the physical properties of the soil are restored, actions can be taken to recover fertility and vegetation cover through manuring by night penning of sheep (*majadeo*), sowing, or other actions, as explained in the following sections.

The increase in the surface area used for vehicle passage results in the disappearance of natural habitats, soil compaction, loss of infiltration capacity, increased runoff, and increased erosion, among other impacts. Eroded livestock routes lose many of their ecological functions and can even act as channels of disturbance whose undesirable effects operate at the landscape scale.

Recovery of open habitats and grasslands

An open vegetation structure, with good coverage of grasslands, facilitates the passage of herds and allows them to have sufficient food when using the livestock routes. Open habitats are, in turn, a consequence of the traditional livestock use of these corridors, and therefore it is necessary to be vigilant to prevent and avoid possible scenarios of abandonment of grazing in the livestock routes that are currently in use.

The best way to counteract overgrowth or shrub encroachment is through the reintroduction of herbivory, which involves strengthening the livestock use of the affected livestock routes. At times, shock treatments may be necessary, with an appropriate combination of browsers (such

The loss of grazing leads to changes in vegetation, resulting in overgrown grasslands of low nutritional value, or even dense shrublands that hinder the passage of animals .

as goats) and grazers (cows), as well as larger herbivores (horses, donkeys) or smaller ones (sheep), depending on the characteristics of the vegetation to be managed.

Over time, the pressure of herbivory can be moderated, eventually leading to a grassland system that is in line with the site's characteristics. This system should be maintained with a regime of seasonal herbivory appropriate to the peaks of productivity and phenology conditioned by the environmental factors of the area.

Brush clearing should be carefully planned, avoiding excessive actions; ***see section "Undesirable Actions".*** There are other techniques for biomass removal that better simulate natural dynamics, such as prescribed burns, which are being successfully used in the management of some forests. While similar experiences are not

The extent of overgrowth can be such that the use of livestock may not be sufficient to open the livestock route. In such cases, it may be advisable to carry out mechanical brush clearing prior to the introduction of herbivores.

The introduction of herbivores should be carefully planned and secured once the structure is opened, as otherwise, the shrubbery will regrow, often with even greater vigor than before.

Night penning (*majadeo* or *redileo*) is a very powerful tool for the recovery of highly degraded livestock routes, as they provide fertility and seeds to the soil, thus facilitating the recovery of vegetation cover.

known in livestock routes, it is an option worth exploring. On the other hand, misuse of livestock routes has led to serious soil erosion problems, resulting in the disappearance of grasslands, among other types of vegetation.

Once the previous actions aimed at the recovery of geomorphology and substrate decompaction *(see previous section)* have been completed, night penning becomes an ideal tool to initiate the recovery of grasslands.

Night penning involves keeping a herd overnight or for several nights on a defined surface, so that they contribute substantial amounts of droppings. If done at the right time, the droppings will not only incorporate nutrients but also provide seeds of grassland species, many of which are effectively dispersed by animals after passing through their digestive system (endozoochory).

Night penning should gradually be replaced by gentler grazing, until an ordinary grazing regime is restored, as the floristic composition of the grasslands is recovered.

Recovery of habitats with woody species

While grasslands are the primary habitat type of livestock routes, it is desirable some heterogeneity in structures and types of vegetation. This allows for a more complete range of food resources for livestock and improves the function of biodiversity reservoir. Therefore, restoration measures may include the recovery of woody formations in very homogeneous livestock routes, fully dominated by herbaceous communities.

If this is the case, the first step is to identify which spaces are suitable for incorporating woody vegetation and what type of formations we want to regenerate. Not all spaces within a livestock route are suitable for transformation into woody habitats, nor is it desirable to transform large areas of grassland. Therefore, actions such as large-scale plantations should be avoided, especially when carried out on soils most suitable for the development of grasslands; *see section "Undesirable Actions".*

Hedgerows of low woody plants obtained by sowing seeds along dry stone walls and stone blocks.

In general, **it is preferable to use sloped surfaces or areas with more skeletal soils to regenerate patches of woody vegetation**, which can consist of communities of shrubs composed of native and hardy species. For example, in Mediterranean environments, stands can be designed with species from genera such as *Thymus, Lavandula, Halimium, Salvia, Genista,* etc., which, in addition to their resilience, contribute to extending the flowering period beyond that of herbaceous plants, thus promoting greater diversity of wild bees and other benefited groups. **Another option is to include hedgerows that help to delineate the livestock route** *(see previous section),* composed of shrubs or a combination of shrubs and trees that, depending on the characteristics of the area, may include species more or less demanding in terms of moisture and soil quality.

The lack of woody vegetation may have been caused by excessive grazing within the livestock route, in which case reducing or excluding livestock from the areas to be transformed may be sufficient. However, in many cases, the underlying problem is related to the **lack of source populations producing seeds,** so whether or not there is herbivory, there is no possibility of natural colonization.

I**n these cases, it is advisable to carry out seeding in the spaces to be restored,** which may be accompanied by a superficial soil tillage, always taking care to avoid causing an increase in erosion.

It is recommended to use seed mixtures of various native species to ensure that at least some are compatible with the microhabitat conditions and therefore can germinate and grow without the need for care.

Seeding is preferable to plantations, which always involve risks and maintenance care for some time, and often fail or result in a "linear park" approach that is not consistent with the nature of livestock routes and the ecological restoration approach outlined in this document.

Livestock facilities

The use of livestock routes for transhumant movements requires that they have a minimal infrastructure, such as shelters and pens, that allow shepherds and herds to rest overnight under suitable conditions. However, a large portion of these facilities has been abandoned and requires repairs or reconstruction. These actions should be considered within the plans for the restoration of livestock routes. It should not be forgotten that the maintenance of livestock use, especially transhumance, is the best way to protect the integrity of livestock routes and their ecological functions.

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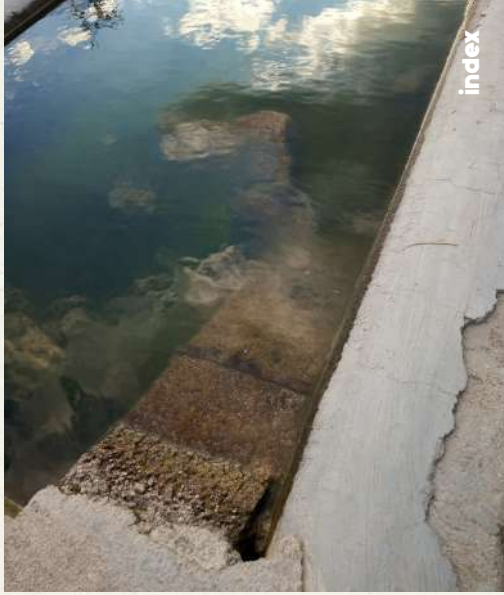
Repairs to shelters and pens should be planned in collaboration with the shepherds, as they have the most accurate information about the characteristics that these facilities should have. On the other hand, measures should be taken to protect against possible acts of vandalism, such as gates that can only be opened by shepherds and authorized users, and regular checks by forest rangers or other personnel from the public administration.

Water points

Water points play a crucial role in livestock routes, not only as critical infrastructures for livestock but also as biodiversity reservoirs. However, many livestock troughs present problems due to lack of maintenance, and in many cases, the catchment has been lost, completely losing its functionality. The restoration of livestock troughs should also be carried out in collaboration with shepherds. Key aspects such as their size or height are highly dependent on the type of herds that typically use the livestock route, and therefore, having that information is important. Livestock troughs should be equipped with **ramps for amphibians' entry and exit,** and it is advisable to check for the possible presence of invasive exotic species and remove them if necessary.

Habitats with presence of water in livestock routes can be used for the creation or recovery of temporary ponds, although the suitability of the location should be carefully assessed from geomorphological and lithological perspectives. Ideally, minimal interventions should always be performed, making locations with concave geomorphologies and poorly permeable substrates more suitable. Sometimes, the excess water from livestock troughs can be directed to these ponds.

Depending on the context, excavations can be made to increase the size or depth of the pond, and layers of clayey substrates can be incorporated to improve the waterproofing of the bottom. Geotextiles and other artificial elements that hinder the rooting of aquatic plants and deteriorate over time should be



avoided. It is also important that the depth profile and the shape of the pond are irregular so that a greater number of microhabitats are available. Incorporating rocks that promote greater heterogeneity is also advisable. Depending on the livestock use of the area, it may be advisable to incorporate fencing to prevent excessive disturbances to the pond by animals. In any case, actions on the pond should not compromise the availability of water for the animals or hinder their passage.

05

Undesirable Actions

The conservation problems of livestock routes may not only stem from the abandonment of their management but, in some cases, also result from ill-advised interventions.

The eagerness to "act for the sake of acting" or the need to spend funds without allowing sufficient time for proper planning can lead to mistakes and the misallocation of resources and labor into counterproductive actions.

Aerial view of the "Cañada Real Conquese" as it passes through an area of intensive agriculture in La Mancha region.
© Into the Wild Productions

These interventions may result from the incorrect application of techniques, lack of planning, or the adoption of references unrelated to the grazed spaces, but they almost always share the common denominator of the absence of a good ecological diagnosis. It is not uncommon to hear that there is "nothing" on a livestock route when there are spaces occupied by herbaceous or small woody communities. These open spaces are the essence of grazed environments and, therefore, constitute the primary ecosystem that, with its multiple climatic and edaphic variations, should cover most of the surface area of Spanish livestock routes. A good diagnosis should identify and understand the value of these pastures, and therefore should be sufficient to prevent some of the inadequate interventions that, as an example and considering that the cases can be very diverse, we describe below.

The absence of diagnoses is the basis of the first and most widespread error, which is blindness towards grasslands and their ecological value.

5.1
Construction of Excessively Wide Tracks

Excessively wide tracks pose a serious impact on the integrity of the habitats along the livestock route. However, it is increasingly common to find that maintenance tasks on roads or tracks take advantage to progressively widen the road, sometimes resulting in the extreme case of it completely occupying the width of the livestock route ("from wall to wall" or "from crop to crop"). These actions seem to stem from a clear confusion between a livestock route and a forest track or an agricultural or neighborhood road, as well as from a misconception about the role played by width in the functionality of these roads. The most obvious consequence

of widening the roads is that it directly competes with the space available for the natural habitats of the livestock route, thus harming its ecological and livestock value. Furthermore, managing the roads of livestock routes as if they were high-capacity highways encourages unauthorized vehicles to enter

Increasing the surface area of the roadway is not a suitable strategy for its sustainability and long-term maintenance. More pavement means more compacted surface, little or no infiltration, and therefore, an increase in runoff and reduced water regulation.

and travel at high speeds, facilitates the passage of heavy vehicles that can deposit debris or other waste, and ultimately sends a very misleading message about the nature of the livestock route.

Large-sized roadways are more likely to develop water accumulation and erosion problems, requiring more robust ditches and drainage systems, and ultimately being more problematic in the long run. Please *see section 4.2* for further details.

Additionally, a portion of the excessive water flows generated by these roadways will eventually surpass the capacity of the ditches and transfer to adjacent lands, accelerating the erosion and degradation of the livestock route.

5.2
Use of Livestock Routes for Forest Plantations

The idea that a greater number of trees necessarily equates to a better ecological state is widespread among the population, despite being based on a flawed conceptualization of the functionality and diversity of terrestrial ecosystems.

Perhaps due to their public nature and their role as ecological corridors, livestock routes have been and continue to be preferred sites for numerous tree plantations, which, unfortunately, are often carried out without planning, diagnosis, or rigorous analysis of ecological references.

These actions are one of the consequences of the previously mentioned error of "not seeing the pastures", and they are almost always carried out **ignoring the framework of ecological restoration.** As a result, valuable habitats are often transformed into artificial woodlands that are disconnected from the traditional physiognomy of livestock routes and have limited functionality.

Many of these plantations, on the other hand, result

in significant failures, leaving behind a heavily altered landscape with numerous tree wells and persistent mounds of soil, as well as large quantities of plastic protectors, stakes, and other scattered artificial elements throughout the livestock route.

However, there may be cases where, after a proper diagnosis, it could be appropriate to carry out some planting. For example, it may be interesting to use trees to reinforce the perimeters of livestock routes, provide shade in resting areas, or contribute to the regeneration of highly degraded soils on steep slopes or other areas where regeneration through grazing may not be advisable, at least as an initial step. Landscape-level analyses should always guide these actions, so that in landscapes already wooded, it is preferable to keep the livestock route as open as possible (strengthening its role as a generator of habitat heterogeneity and diversity), while in landscapes with few trees, it may make more sense to plant trees in some of the situations described above, always avoiding continuous or homogeneous formations that displace the habitats typical of the livestock route, reduce its nutritional value, or hinder the movement of livestock.

5.3
Transformation of Livestock Routes into Gardens or Linear Parks

Another aspect of the trend towards afforesting livestock routes involves the integration of irrigation and care practices aimed at reducing the typically high mortality rates of seedlings, which often ends up transforming the corridor into a linear garden or park, whose justification usually does not go much further than the use of native plants. These types of actions often identify livestock use as a problem, and it is common for them to require exclusions or cumbersome protectors to prevent browsing.

This approach differs significantly from the principles of ecological restoration, which aim to restore processes so that the system evolves after interventions focused on minimizing maintenance tasks.

It should be emphasized that livestock routes must be resilient and sustainable structures, and therefore **interventions should be designed to restore ecological states in which grazing and livestock movement are necessary and sufficient to keep the system functional,** without the need to allocate additional economic resources to maintain the living components of the system.

Therefore, landscaping is not typical of livestock routes, except in very specific cases where they have been absorbed by urban areas, and the concept of a linear park is the most suitable approach to reconcile public use with the potential for livestock use, which is less likely in urban environments.

5.4
Inappropriate or Indiscriminate Clearing

Clearing through mechanical tools may be appropriate, in certain cases, to counteract the lack of herbivores, reduce the risk of fires, or facilitate the passage of herds in heavily overgrown sections of livestock routes *(see section 4.2)*, but they should always be applied carefully and well planned, avoiding massive and indiscriminate actions. If the objectives of clearing can be achieved through the use of herds, this should always be the preferred option.

It should be noted that erosion and soil loss are among the most pressing issues in many livestock routes, and therefore, extensive clearing on steep slopes or easily erodible substrates should be very limited. **Indiscriminate clearing can seriously damage hedge cover and the composition of other shrub communities of interest,** so supervision by expert personnel capable of properly identifying plant communities is recommended.

It is not uncommon that excessive clearing ends up promoting the simplification of vegetation in livestock routes, ultimately favoring the expansion of species particularly resistant to this type of disturbance (such

as blackberries or rockroses), which are often more flammable than pre-existing formations. It is essential to plan the timing of clearing, avoiding negative impacts on the availability of floral resources and other elements essential for wild bees and other organisms that depend on vegetation in livestock routes.

Ideally, clearing should be part of a grazing recovery plan, so that after the initial opening of the livestock route, grazing and herd movement can maintain a heterogeneous and naturalized structure, with a balanced distribution of grasses and woody plants in accordance with the characteristics of the livestock route. If grazing restoration is not planned after clearing, scrub is likely to reappear very quickly, often with greater vigor.

In cases where there is no local or transhumant grazing, we encourage public administrations to explore the option of hiring livestock for managing livestock routes as a more economically, socially, and ecologically viable alternative to machinery-based treatments.

5.5
Transformation of Livestock Routes into Conventional Firebreaks

Although well-maintained livestock routes play an important role in fire prevention, it should be noted that this is just one of the multiple functions they perform, and they perform it better and more sustainably when they have herbaceous vegetation and are attractive for grazing.

Therefore, we advise against reducing the management of livestock routes to the implementation of systematic plowing, clearing, and other machinery-based actions aimed solely at the complete removal of their vegetation, thus causing a significant impact on their ecological and livestock values.

Systematic plowing, heavy machinery operations, and, in general, actions aimed at the complete removal of vegetation should be avoided in the management of livestock routes, given their significant impact on soils, vegetation, and the livestock value of these corridors.

Proper livestock management is the best option for regulating the biomass in livestock routes, thereby ensuring they fulfill their function of reducing the risk of fires without compromising their other functions.

06

Recommended Readings and Support Material


CAÑADA
REAL

Mola, I., Sopeña, A. y de Torre, R. (editors). 2018. *Guía Práctica de Restauración Ecológica.* Fundación Biodiversidad del Ministerio para la Transición Ecológica. Madrid. 77 pp (available in *https://ieeb.fundacion-biodiversidad.es/sites/default/files/guia_practica_re_impresion_baja_0.pdf*).

Libro Blanco de la Trashumancia en España. Available in: *https://www.custodia-territorio.es/sites/default/files/recursos/libro_blanco_de_la_trashumancia.pdf*

Ley 3/1995, de 23 de marzo, de Vías Pecuarias. Available in: *https://www.boe.es/buscar/act.php?id=BOE-A-1995-7241*

Ministerio para la Transición Ecológica y el Reto Demográfico. Cuadernos de la Trashumancia. Available in: *https://www.miteco.gob.es/es/biodiversidad/temas/politica-forestal/vias-pecuarias/rvp_cuadernos_trashumancia.html*

Dedicated to the memory of Jesús Garzón, pioneer of the conservation of livestock routes in Spain, and a great advocate of transhumance.