



# Restoration Cases Flagship Collection

## Case #18

Using regenerative agriculture  
to restore the Spanish Altiplano  
landscape

ETH zürich | CROWTHER LAB



*The Altiplano Estepario landscape, AlVelAl territory. Photo credit: Robin Chazdon*

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**In brief**

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## Overview

The Altiplano Estepario in Southeastern Spain was once home to vast dry Mediterranean forests. Farmed for thousands of years, its thin soils became degraded with the introduction of modern farming techniques. Despite having the world's largest area of rainfed almonds and a culture of local food and farming, unemployment was high and many farmers migrated to the city. In this context, the non-profit Commonland initiated a pilot project in 2014 to show the potential of using regenerative agriculture to restore landscapes. They initially worked with 21 innovative farmers and other stakeholders to initiate a landscape restoration process, forming the ALVeAL Association in 2015. ALVeAL promoted reforestation and regenerative agricultural practices to enhance soil, water resources, and biodiversity, focusing on a critical 25,000 ha biodiversity corridor that would connect protected areas and allow iconic species such as the Iberian Lynx to travel across the landscape. By 2022, membership had expanded to more than 450 people, regenerative agriculture was practiced on 10,500 ha of land, and more than 400 ha of trees and forests had returned to farms and public lands through planting and natural regeneration.

## Exemplary practices

This initiative used a range of restorative activities in collaboration with farmers over a large spatial scale. Engaging an innovative, motivated group of farmers was key to starting the association, and early adopters demonstrated the positive impacts to other farmers. Commonland and ALVeAL created the economic case for regenerative farming, developing businesses to process and market regenerative goods and connecting farms with consumers willing to pay a premium. The restorative approach also focused on promoting landscape and watershed connectivity between the mountain ranges flanking the region rather than on "wall to wall" restoration., making the intervention feasible over a larger area and spreading benefits widely.

## Key lessons learned

- ▶ *Regenerative agriculture can fit well as part of integrated landscape restoration or Forest and Landscape Restoration.*
- ▶ *There is no “one size fits all” for regenerative agriculture.*
- ▶ *Farmers listen and learn from other farmers.*
- ▶ *Assisted natural regeneration (ANR) can be harder to fund than tree planting.*
- ▶ *Making the economic case and creating market demand for regenerative products is key.*
- ▶ *Regenerative, future-looking farming practices can elevate the cultural status of farmers and draw younger people back to rural areas.*





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# Restoration narrative

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### *Using regenerative agriculture to restore the Spanish Altiplano landscape*

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[Altiplano Spain](#)



## Geography and ecological setting

Distributed over one million ha, the Altiplano in Southeastern Spain is a mosaic of desert, scrublands, wetlands, crops, pasture, rainfed agriculture, and isolated forests where the steep slopes and rocky soil make farming untenable (Yue et al., 2019). The region — which spans both the Murcia and Andalucía autonomous communities — is home to the world's largest area of rainfed almonds, one of its major economic activities (Dudley et al., 2021; Figure 1). But youth out-migration, soil degradation, and erratic water supplies have threatened the region's soils, and its social and ecological fabric. In 2014, the organization Commonland helped bring together local farmers and other stakeholders to introduce regenerative agriculture to the region and showcase its potential to restore landscapes elsewhere. They created the farmers' association ALVeAL, which includes the plateau regions Granada, Los Veléz, Alto Almanzora, Guadix, and the Northeast of Murcia. Since then, ALVeAL has been working to transform production practices and increase connectivity and biodiversity, focusing on a 25,000-ha corridor connecting the mountains on either side of the region.

The ecosystems that comprise the Altiplano range from desert to dry forest to wetlands along rivers. Elevation ranges from 600 to 2,300 masl and annual precipitation from 300–500 mm, with heavy rains and prolonged dry periods including a pronounced summer dry season (Commonland, 2021; Cruz Pardo et al., 2010; De Leijster, 2016). Temperatures in the summer range from 20–28°C and 0–10°C in winter, when frosts and snow are common (Angelucci, 2018; Cruz Pardo et al., 2010). Surface water is scarce and soils retain water poorly (Angelucci, 2018).

Historically, much of the land was covered with native Mediterranean forests — shrubs and small trees adapted to dry conditions including juniper (*Juniperus thurifera*), holm oak (*Quercus ilex*), Portuguese oak (*Quercus faginea*), and aleppo pine (*Pinus halepensis*) (AlVelAl, 2021b; Nocentini, Travaglini and Muys, 2022; Gauquelin et al., 2018). These forests were converted to farmland in coastal Andalusia as early as 6850–5700 BP (Anaya-Romero et al., 2016; Valbuena-Carabaña et al., 2010), and continued to be used over millenia for wood, agriculture, and grazing animals. Repeated burning was common to prevent forest regrowth, which over time degraded soils and killed seeds and rootstock (Valbuena-Carabaña et al., 2010). In recent decades, “green revolution” technologies and practices (using heavy machinery to expose soil, chemical inputs, etc.) accelerated soil and ecosystem degradation.

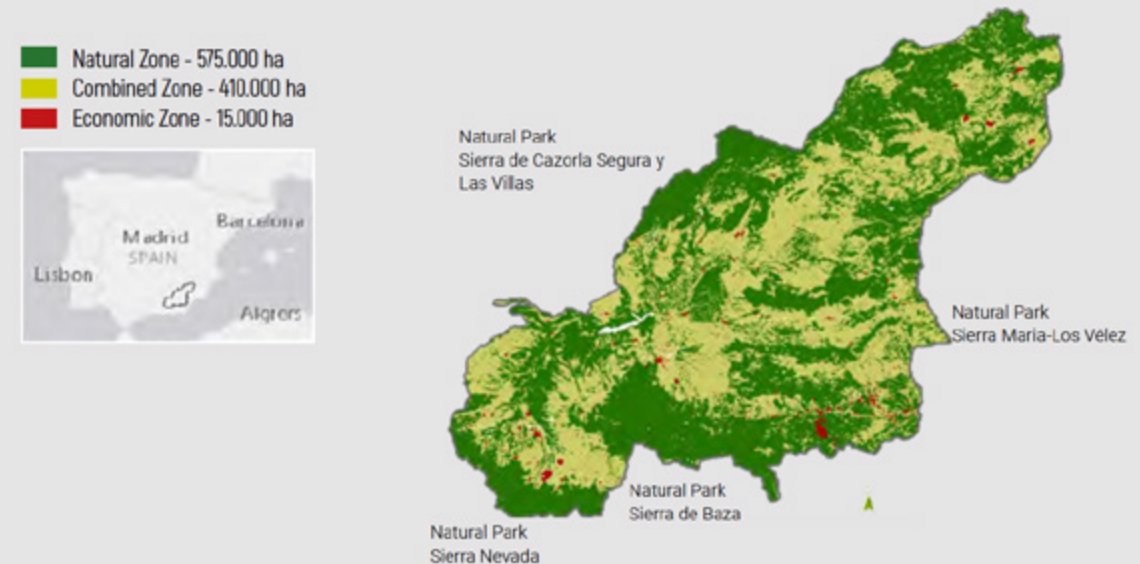
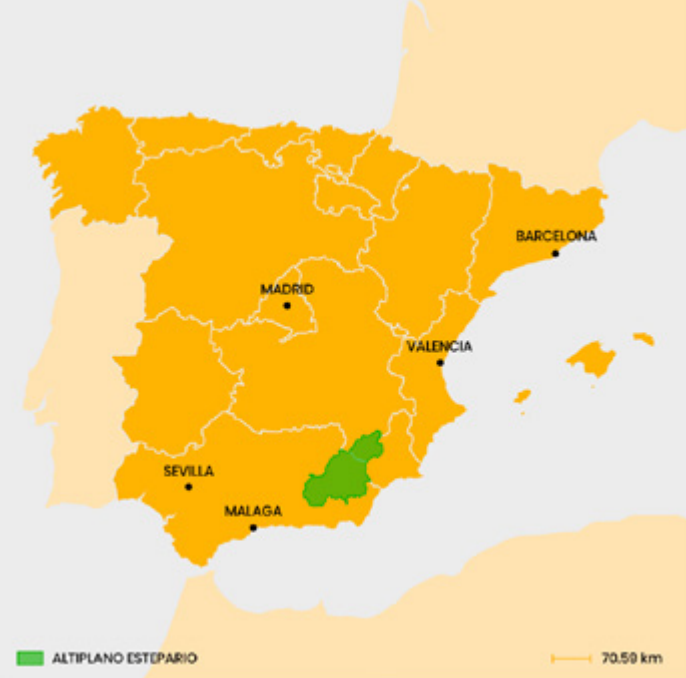


Figure 1. (Top) Map of Spain and location of Altiplano Estepario in green. Source: Yue et al., 2019. (Bottom) Map of the Altiplano Estepario area including the three regions of intervention: the natural, combined, and economic zones. Source: Dudley et al., 2021.



Today, remnant forests are present mainly on slopes, marginal areas, and natural conservation areas. The majority of the Altiplano area is dedicated to agriculture—in 2003, 62% of the Altiplano area was agricultural land, a slight increase from 60% in 1956 (Cruz Pardo et al., 2010). During this time there was a significant transition from cereals to almond production, and forested areas decreased slightly (about 3%) (Cruz Pardo et al., 2010; Luján Soto et al., 2021). In some areas, pines were planted for timber production, but these were often poorly managed and overstocked, creating fire hazards. Even on abandoned farms, desertification and soil erosion often prevent vegetation from growing back (Dudley et al., 2021).

## Land use and livelihoods

Historically, most farms were low-input and small-scale, with mixed crops and sheep. In the 1950s the government introduced heavily subsidized green revolution technologies, including chemical inputs, mechanized farming, and intensified tilling. Agriculture began to change dramatically (Angelucci, 2018). Farmers mostly stopped using traditional water and soil conservation methods and began growing almonds and olives instead of cereal crops.

Sheep rearing declined dramatically. Some of the social structures that supported peasant farming eroded, including social networks and traditional knowledge sharing. Farmers began to rely more on government subsidies and had less control over their output and production methods (Luján Soto et al., 2021). Soil erosion, compaction, and pollution became widespread. Out-migration to Spanish cities increased, especially of young people (Dudley et al., 2021).

Agriculture is still a major livelihood activity for many of the region's 250,000 inhabitants. In addition to almond plantations (50% of which are certified organic), people grow cereals, pistachios, vegetables, olives, and aromatic herbs. The region specializes in producing delicious, healthy food, including organic rainfed almonds and lamb (Dudley et al., 2021). But it is also one of the poorest areas in Spain, with (prior to restoration) a 40% unemployment rate and high dependency on agricultural subsidies (Yue et al., 2019). Soil degradation and drought reduced agricultural productivity (Yue et al., 2019), and desertification threatens 75% of Spanish territory and 90% of Murcia province.

## The turning point

By the early 2010s, it was clear that widespread degradation threatened the future of agriculture. In a region that already faced many natural challenges—an arid climate, soils with low organic matter—“farmers could see the degradation of the soil,” says AlVelAl’s Director, Elvira Marín Irigaray. “There were only 10 farmers talking about this at the beginning, but these soon became 20. They were talking about real problems on the farm that affect production and of course, economic returns. ‘Okay, I can also see that pollinators have disappeared from my farm’” (Elvira Marín Irigaray, 2022, personal communication).

Green revolution technologies were not working to solve the problems they had created, and amidst high unemployment rates, the region was experiencing a “geriatrification” of agriculture as young people left to pursue better opportunities in cities (Elvira Marín Irigaray, 2022, personal communication; Dudley et al., 2021).

Still, many families strongly identified with farming and the region. Amid tough conditions, a small group of innovative farmers began looking for support to change their farming practices.

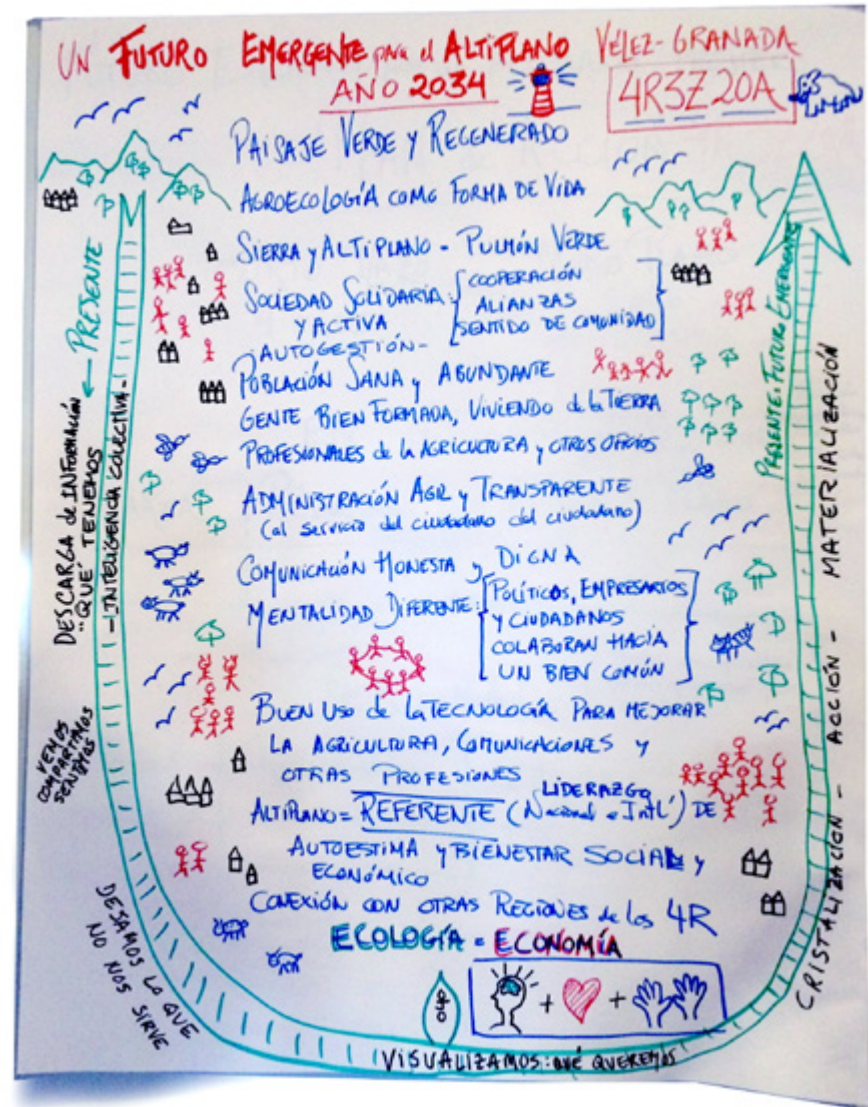


Figure 2. Landscape vision 2034 through the first Theory U workshop in the Altiplano, November 2014. “The emerging future of the Altiplano: A green and regenerating landscape, agriculture as a way of life, a mountain and plain greenbelt, a united and active society with a feeling of community . . .” Source: AlVelAl.

At the same time, Commonland, a non-profit organization that helps communities restore landscapes, identified the region as a good candidate for a regenerative agriculture pilot they were hoping to launch in Spain. Commonland wanted a large, heavily-degraded area where people would participate in and benefit from a landscape restoration program to show investors and farmers that regenerative agriculture could be ecologically beneficial and financially viable (Yue et al., 2019). Thus, as ALVeAl's Laura Nuñez put it, "*El hambre con las ganas de comer*" (hunger came together with the desire to eat).

But transitioning from green revolution technologies to regenerative practices still involved a major shift for many farmers, as much cultural as technical. Most families had been using green revolution technologies for two generations, and farmers had been taught to farm this way from a young age. Plowing almond groves to bare soil and keeping farms free from weeds were important cultural markers of being a "good farmer." Regenerative practices were considered foreign and financially risky by many (Yue et al., 2019).

"The farmers here...are not poor, but they don't have very high incomes either. So, when you come and talk about...the return of financial capital and pay a premium price for goods, more and more farmers engage.

The money is a big motivation for performance," says Elvira (2022, personal communication).

The major challenge to engage farmers was to show "that sustainable and regenerative practices were not just beneficial for the environment and society in Andalusia, but made good business sense as well" (Yue et al., 2019, p. 13). Providing economically viable alternatives would help farmers adopt new practices to combat the worsening environmental conditions in the region while attracting new interest and investment in the region (Yue et al., 2019).

The initiative started by engaging those farmers and other stakeholders who were interested in the approach, willing to experiment and pilot it, and who were influential in the community. This small but crucial group of farmers participated in a 60-person visioning workshop series along with other stakeholders — entrepreneurs, researchers, local government and local businesses — in 2015 to "create the dream for 2035 for this territory" (Elvira Marín Irigaray, 2022, personal communication; Figure 2).

"I think the success of this workshop was really the energy that moved things forward," says Elvira. "There was a lot of energy in the people who saw that there is another

way — that it's possible the territory could have prosperity and economy, and that young people could stay because there are opportunities for employment. There was a lot of excitement because...it was the first time that this happened in the territory” (Elvira Marín Irigaray, 2022, personal communication). Farmers decided to form an association, ALVeAl, to practice regenerative agriculture, which started with 50 farmers and other stakeholders. Once the first farms could show results, peer-to-peer learning helped spread the word. Having farmers see first-hand results and learn from the initial adopters was critical to having the technique spread throughout the region. Today, there are 450 members, and membership is limited by the support available rather than by lack of interest.

## Actors and arrangements

The ALVeAl association (formed in 2015) brought together farmers, conservation organizations, businesses, researchers, and other stakeholders to restore the Altiplano using regenerative agriculture as the core intervention. Developing the business case for restoration, providing inspiration, and uniting and working with different cultures within the Altiplano are key features of their approach. ALVeAl is supported by the Commonland Foundation, regional governments, local businesses, and research institutions (Luján Soto et al., 2021)

ALVeAl was initiated by Commonland, an organization dedicated to holistically restoring landscapes through sustainable business cases, community engagement and policy alignment using their “4>Returns” approach (Commonland, n.d.; Box 1). Commonland identified the Altiplano as a priority landscape based on its extensive degradation, high unemployment, and high potential for restoration to have a positive impact. They support the ALVeAl network with capacity building and training in business, restoration techniques, regenerative agricultural techniques, and connections to markets.

La Almendrehesa is ALVelAl's flagship business, the first of several. Farmer-driven and diverse, the company processes and markets a range of regenerative products with the goal of making regenerative agriculture profitable and accessible to consumers.

At the beginning, several key individuals also played a role in starting the network. A German immigrant, Dietmar Roth, was influential in generating regional interest in regenerative agriculture early on. Astrid Vargas, a conservation biologist with experience developing and leading conservation programs, was also instrumental as a founding member of ALVelAl and created the link with Commonland.

ALVelAl is part of the Regenerative Education Alliance ([Alianza Educación Regenerativa](#)), formed by eight entities involved in education, ecosystem restoration, and social revitalization. They promote "learning landscapes" in regenerative farms, where people learn through observing, caring for, and helping to restore nature (Figure 3). They also connect different people and sectors through their work.



Figure 3. "Regenerating Butterflies" is an art and restoration activity, developed within the framework of the Regenerative Education Alliance, engaging children between 3 and 12 years old in 2023 (both photos, above). Photo credit: Elvira Marin Irigaray

## Planning and engagement

***“We believe that one farmer can inspire other farmers. If I cannot invite a farmer and an association cannot, another farmer can often inspire other farmers to start regenerative practices.”***

– *Elvira Marín Irigaray*

Engagement is an ongoing and essential component of AlVelAl's work. At AlVelAl's initial three-day educational workshop, 60 stakeholders came together to create a 20-year plan for restoring the region within general goals, a critical engagement opportunity for people from different sectors (Figure 2; Dudley et al., 2021). Inspiration is critical to scale up regenerative agriculture, and creates a sense of place and belonging among members (Gutierrez et al., 2023). AlVelAl's philosophy is that farmers are best situated to inspire other farmers. To this end, they developed several activities where farmers can share experiences and learn from others.

## Box 1: Goals for the project under Commonland's 4>Returns Framework

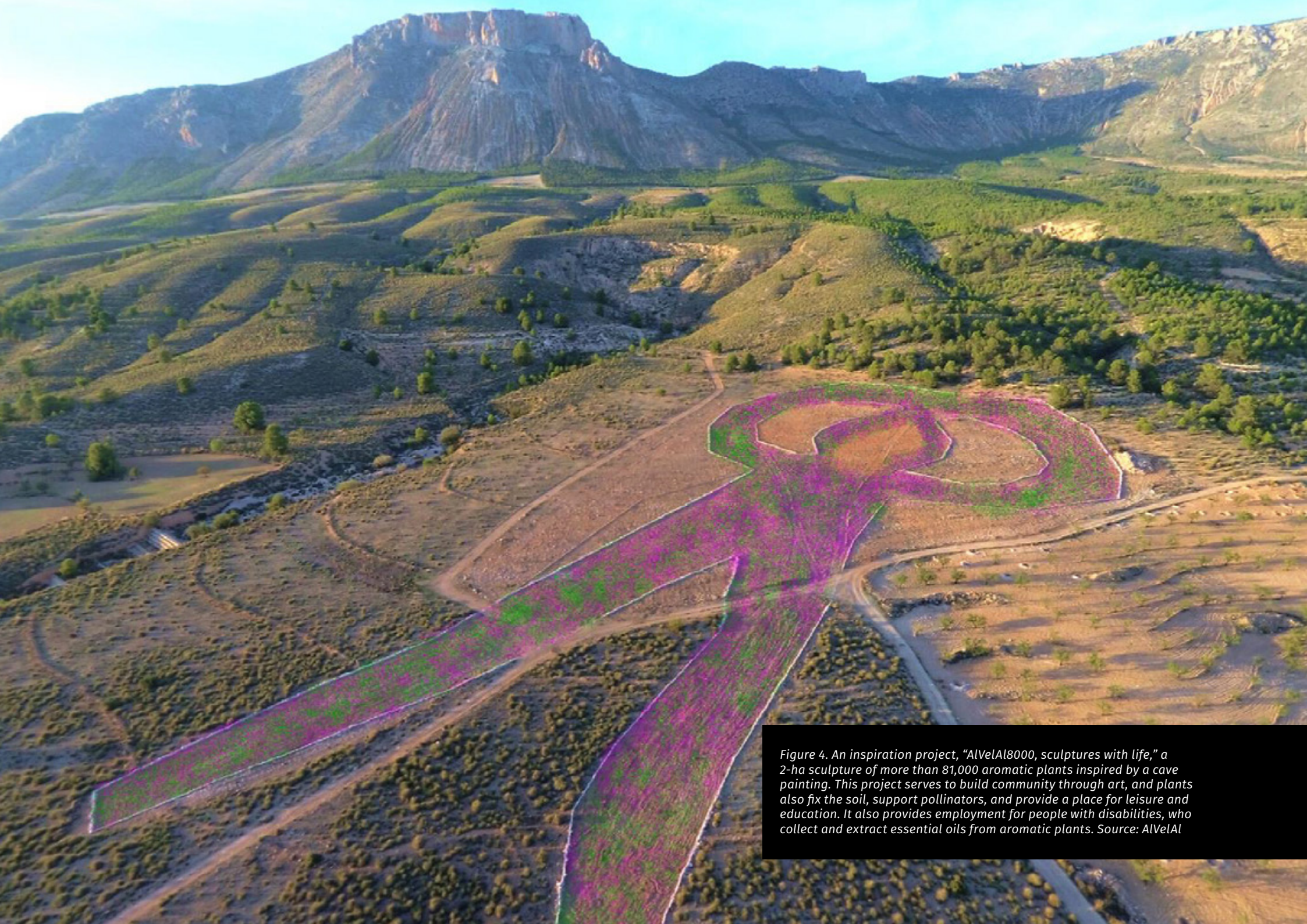
(adapted from Dudley et al., 2021)

***Return of inspiration:*** Reverse desertification and rural abandonment to improve living conditions, beautify the landscape and create a clear perspective for the future.

***Social returns:*** Create employment opportunities, increase the capacity of local stakeholders through workshops and courses, and develop a network of professional contacts, to slow migration out of the region and strengthen the area's cultural and historical heritage.

***Return of nature:*** Reduce erosion, increase soil fertility, and restore the water cycle, to increase biodiversity, ecosystem function, and connect natural areas.

***Financial returns:*** Revitalize the region by increasing and making the income of both the producers and business people more sustainable.



*Figure 4. An inspiration project, "AlVeAl8000, sculptures with life," a 2-ha sculpture of more than 81,000 aromatic plants inspired by a cave painting. This project serves to build community through art, and plants also fix the soil, support pollinators, and provide a place for leisure and education. It also provides employment for people with disabilities, who collect and extract essential oils from aromatic plants. Source: AlVeAl*

Inspiration is also promoted through celebrations, festivals, art collaborations, and fostering intergenerational engagement (for example, by including young people in organizing events) (Figures 3 and 4). In October 2021, AlVelAl launched a bank of shared regenerative machinery with the aim of generating a community around the machinery to share, exchange, and inspire each other.

Celebrating cultural heritage and traditions is also used to inspire and promote restoration (Table 1; Figure 4). For example, in April 2019 a “Day of Rural Pride” celebration showcased how important rural people are to society at large. They also host regular AlVelAl colloquia, where participants share knowledge about the regional geography, natural resources, culture, and ways of working towards a regenerative future (as of 2022, four meetings had been held). They organize walking tours — called *Ruta del Estraperlo* — from village to village to share the region’s history and traditions with visitors and locals alike (AlVelAl, n.d.b).

AlVelAl is governed using a “sociocracy” model which creates safe, inclusive decision-making environments. “Information flow is bidirectional. For example, members of the board join team meetings and team members join board meetings. This allows integrating multiple perspectives more effectively,

preventing potential conflict or solving conflict through questioning and dialogue prior to decision-making and implementation” (Gutierrez et al., 2023, p. 5). Decision-making is based on consent, and there is a high degree of communication between folks in the field, the technical teams, and the board of directors. But still conflicts and differences in opinions arise from their diverse membership. A “circle of wise people” serves as a conflict-resolution mechanism when needed, and sometimes professional facilitators help with this process as well (Gutierrez et al., 2023).



## Costs, funding, and other support

The Commonland Foundation supports ALVeIAl financially and strategically, including a principal sum to support annual operating costs. ALVeIAl also receives donations and grants from public and private, national and international entities (ALVeIAl, 2021a). Some donations are general, others bookmarked for particular activities. Grants are directed towards specific projects, such as the Ministry of Agriculture's support of the CULTIVA 2021 program which welcomes and trains young farmers on the farms of pre-existing ALVeIAl members (ALVeIAl, 2021a). Costs for ALVeIAl are broken down into nine main areas: natural areas; regenerative agriculture; entrepreneurship and business cases; inspiration, education, culture and tourism; coordination; research; communication; training; and monitoring and evaluation (Figure 5). Volunteers also support ALVeIAl's work in the territory.

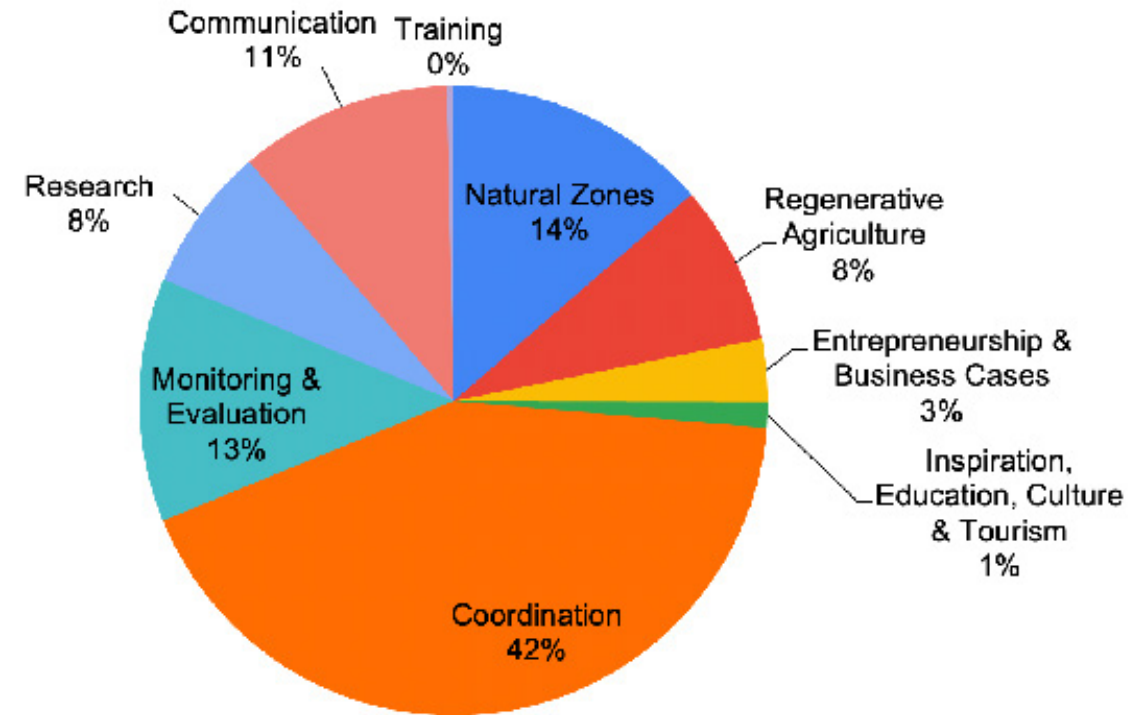


Figure 5. ALVeIAl's annual expenditures by category for 2021. Source data: ALVeIAl, 2021a

## Implementation

Much of ALVeIAl's on-the-ground activities focus on improving soils and water resources, enhancing biodiversity, and reducing erosion in almond groves. Specific activities are conducted in each of the natural, combined, and economic zones (Figure 6). In natural zones, practitioners restore ecosystems and create landscape connectivity. In the combined zone, practitioners implement regenerative techniques, including restoring terraces, making swales, planting green cover and trees, and creating windbreaks to retain soil and water and enhance biodiversity. In the economic zone, activities include supporting co-ops and businesses to process and sell regenerative goods at a higher premium and connecting producers to markets.

In addition to zone-specific activities, cross-cutting initiatives help to improve and promote the work generally (Table 1). These include research on region-specific methods, engagement and education, and creating eco and cultural tourism opportunities.

In the natural zone practitioners conserve and restore natural ecosystems in strategic locations to increase native biodiversity, provide key services for farming, and restore connectivity. "The aim is not to plant trees, but to improve the ecosystem," says ALVeIAl's Fernando Bautista, natural area leader.



Figure 6. The three zones of ALVeIAl's activities.  
Source: Ferwerda and Gutierrez, 2021.

The goal is to create a biological corridor of habitat islands (rather than continuous forest) between the north and south mountain ranges that border the area (Figure 7). Implementers work on both public and private lands (ALVeAl, n.d.a), and regenerative agriculture farms often also set aside land for conservation and restoration. ALVeAl was the first organization to receive the Forest Ecosystem Restoration Standard from Preferred by Nature based on these practices (Preferred by Nature, 2021).

Activities in the natural zone include creating natural water retention structures, planting endemic and native trees and shrubs, and creating natural areas on farms (Dudley et al., 2021). Tree planting focuses on native species that used to be more abundant (e.g., *Quercus ilex*, *Q. rotundifolia*, *Juniperus spp.*, and *Pinus halapensis*). Interventions work with existing remnant vegetation and assist natural regeneration processes (Figure 8; Figure 9). Tree seedlings are grown in a local nursery (not owned by ALVeAl) that uses only local seeds. After planting, seedlings are monitored during the first few years and planted in a regular grid so they can be located easily and checked for survival. The planted area is georeferenced when tree planting is complete, and a representative transect is selected within this area for monitoring. Trees that have not survived are recorded, and at least 10% of the total area is sampled.

This process is carried out four or five times: before and after the first summer, after the second summer, and five years after planting.

## Natural zone restoration: 20 years

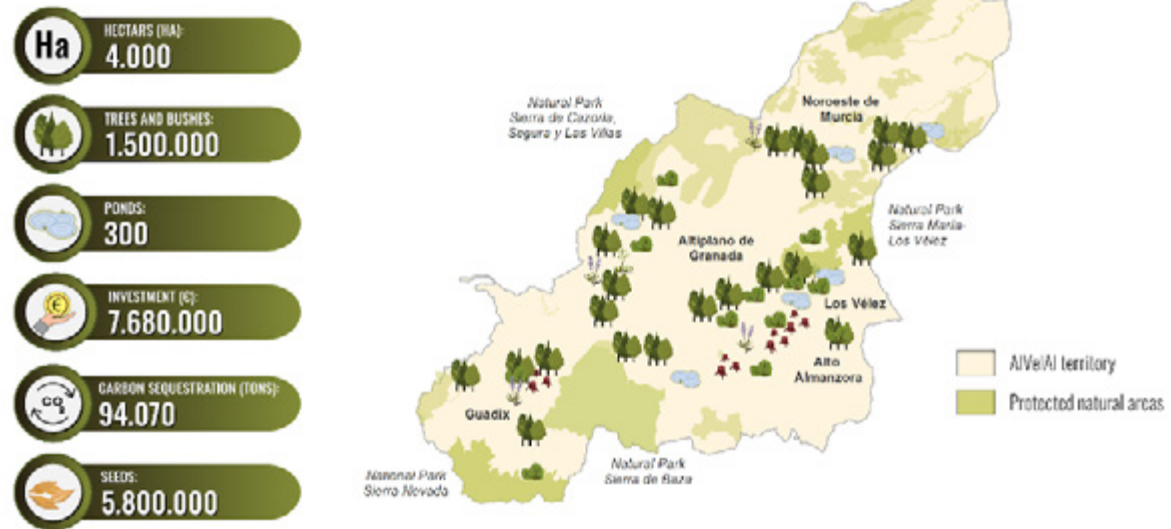


Figure 7. ALVeAl's plan to connect the mountain ranges around the Altiplano by creating green corridors and stepping-stones for flora and fauna in the agricultural landscape. By 2050, they aim to create 25,000 ha of ecological corridors and work with regional and municipal authorities to maintain and restore existing natural areas. Source: ALVeAl, 2021c



*Figure 8. A planted juniper seedling (left) and remnant vegetation in Sierra María-Los Vélez Natural Park in the Altiplano (right). Photo credit: Robin Chazdon*

*Figure 9. Overgrazed slopes in Parque Natural Sierra María Los Vélez. Photo credit: Robin Chazdon*



Implementers are also working to eradicate a prolific invasive tree species, *Ailanthus* (from Asia, also invasive in Northeastern USA) by injecting a poison in small holes drilled into the stem, and are developing a method to inject into the root system. *Ailanthus* is also problematic for honey production as its pollen gives honey a bad taste. Restricting grazing is another important activity, especially on public lands in Natural Parks.

The combined zone covers ~400,000 ha intended for regenerative agriculture, which aims to make farming not only sustainable, but restorative. Activities focus on improving and conserving soil and water resources and promoting biodiversity. Farmers do all the work and do not receive financial support but are provided with seeds for *abono verde* (green plant cover; a mixture of legumes and grasses) and shrubs for planting. ALVelAL offers technical support (workshops, consultations), provides small grants for innovative or experimental techniques, and encourages innovation and risk taking. This zone has approximately 100,000 ha of almonds, 120,000 ha of cereals, and 150,000 ha of other agricultural activities including crops and livestock (Dudley et al., 2021).

A soil diagnostic is often the first step to help farmers plan and prioritize other interventions in the combined zone.

Planting trees (including new almond trees) along elevational contours, using *abono verde* (green cover crops) to reduce soil erosion and increase soil organic matter, and planting aromatic shrubs along the edges of the groves are common activities (Figure 10). Shrubs support native pollinators and provide farmers with an alternative crop should tree crops freeze, which has happened in recent years.

Keeping the soil covered with green cover crops, perennial plants, and/or compost is a critical intervention to reduce erosion, improve soil fertility, and enhance water retention (Figure 10 and Figure 11). Some farmers also re-integrate livestock into plant farming systems, a traditional practice largely abandoned in recent decades. At low levels, grazing stores carbon, reduces soil erosion, aerates and remineralizes soils, restores beneficial soil microorganisms, protects groundwater and minimizes damage from pesticides and harmful fertilizers (ALVelAL, n.d.a).

“We also promote water management,” says Elvira Marín. “We create ditches in swales to capture rainwater, stop erosion, and allow water to infiltrate into soils and ponds” (Elvira Marín Irigaray, 2022, personal communication). Ponds and ditches also create thriving aquatic ecosystems for amphibians, pollinators, and insects (Box 2; Figure 12).



*Figure 10. Aromatic shrubs planted along the edges of an almond grove with planted "green" cover crops. Photo credit: Robin Chazdon*

*Figure 11. Old almond trees in a 'living mulch' system of grasses and leguminous herbs. Photo credit: Robin Chazdon*





In 2022, 127 ponds “were created (ALVeAl, 2021). Other interventions include restoring terraces, making swales, and planting windbreaks to retain soil and water and enhance biodiversity.

In 2022, ALVeAl piloted a regenerative agricultural machine bank. Farmers share nine machines (for producing compost and other functions) that would be too costly to obtain alone but feasible as a group. The hope is that sharing them will also build community. “They can use their machinery but also exchange work and information,” says Elvira.

The economic zone spans 15,000 ha and includes urban areas and spaces for processing and marketing goods via local businesses and co-ops. ALVeAl created three sustainable businesses—La Almendrehesa, Habitat, and ALVeAl Foods—that process and market goods from regenerative agriculture. Farmers receive a premium price for regenerative goods, which helps reward and motivate the shift from conventional or organic farming to regenerative practices. Customers receive easier access to environmentally positive foods.

ALVeAl’s flagship company La Almendrehesa processes and sells almonds, wine, honey, olives, and lamb from regenerative farms.

## Box 2: Restoring water for farming and biodiversity

Capturing water on farms has obvious benefits for agriculture and can also promote natural biodiversity. Near the town of Chirivel, two farms (both owned by professors who live elsewhere but visit often) intentionally created ‘natural’ water areas. One used a natural mountain spring to create a series of ponds. These ponds store water and hold thriving aquatic ecosystems of insects, frogs, and plants (Figure 12, left photo) and attract waterfowl such as herons, and beneficial insects like dragonflies. The ponds and canals increase soil moisture which helps both crops and planted trees. The other farm restored a severely eroded abandoned clay quarry (Figure 12, right photo). The owner used to swim there as a child and wanted to restore its previously clear water. They dug out the quarry to create a small reservoir to conserve water, improve almond production, and create a biodiverse wetland area. Efforts have successfully controlled erosion and Phragmites now grow there, along with lots of other aquatic life.



*Figure 12. Ponds and water areas constructed on farms. (Left) A natural spring from the mountains was used to create a series of ponds. (Right) A restored clay quarry. Photo credit: Robin Chazdon*

La Almendrehesa was founded in 2016 as a farmer-driven trading company, beginning with almond products. La Almendrehesa connects farmers to consumers in Spain, Germany, the UK, and other European countries willing to pay more for a superior, environmentally positive product (Yue et al., 2019).

The local cooperative Habitat processes and sells high-quality olive oil grown using regenerative techniques. Founded in 2019, Habitat operates in a similar way to La Almendrehesa. A wide range of regenerative products is also available via ALVelAl Foods, a website that allows consumers to buy goods directly from regenerative businesses.

Cross-cutting activities were implemented across all three zones. Existing regenerative practices had to be adapted to the dry, degraded Altiplano landscape, which required research and testing. An experimental regenerative almond tree farm was set up as a research and demonstration site, where researchers tested approaches to improve soils, promote carbon sequestration, improve biodiversity, and optimize chemical inputs. They also piloted ways to promote the technique from a socioeconomic perspective, including increasing agricultural diversification, promoting innovation, fostering cooperation, and sharing information.

They also research antifungals, almond quality, and water use efficiency of almond trees under different treatments/ground covers. A two-year initiative—the Operative Group 4 Returns—promotes synergies between producers and researchers to improve crop production (especially of almonds) while meeting the other environmental goals of the initiative. Other cross-cutting activities are listed in Table 1.

Activity category	Specific interventions
<b>Restoring natural zones</b>	Planting trees, protecting lands for natural regeneration, promoting landscape connectivity (Figure 13). Private and public land.
<b>Research</b>	Developing techniques for the local ecology and social conditions of the region, including managing almond groves and water saving interventions.
<b>Creating businesses</b>	Building businesses that are economically viable and sustainable based on the 4 Returns Framework. Initiatives include La Almendrehesa (almonds + other goods), Habitat (olive oil), and the online AlVeAl Foods.
<b>Sensitization (education and awareness building)</b>	Training and educating local populations through workshops and awareness-building initiatives, to counter the challenge of rural depopulation and mobilize people to act on environmental and social challenges. Workshops on technical elements (growing traditional crops, soil saving techniques, etc.) and cultural elements (cooking with local ingredients and other activities).
<b>Return of inspiration</b>	Experiential activities that bring people together to celebrate the landscape. Activities include collective artwork and celebrations (soundscapes, murals, etc.).
<b>Diffusion of heritage and traditions</b>	Promoting intergenerational work, local food traditions and history. Walking tours from village to village showcasing local history and agriculture.
<b>Agritourism</b>	Showcasing the rich cultural and gastronomic heritage of the region + their innovative use of regenerative practices. AlVeAl connects producers with nearby tourist resorts, promotes local products in local restaurants, and organizes and participates in gastronomic festivals and tastings.

Table 1. AlVeAl conducts projects in seven main areas of focus (AlVeAl, n.d.c)

## Box 3: Timeline of key milestones and events

**2013-2014:** Commonland searches for a location in Spain, finds and settles on Altiplano Estepario area

**2014:** Project launched by Commonland, initial engagement workshop held with ~60 stakeholders

**2015:** AlVeAl — a landscape partnership association — is created

**2016:** AlVeAl launches its first business, La Almendrehesa, to process and market regenerative produce from local farmers. La Almendrehesa pays its farmers higher margins for their crops, which allows them to invest in their farms and to transition fully to regenerative agriculture.

**2017:** AlVeAl designs a plan to restore the territory's ecosystems which includes public lands and private properties and aims to create biodiversity hotspots on farms

**2018:** AlVeAl and its partners inspired more than 1,000 people and 85 proud farmers to become part of AlVeAl

**2020:** The cooperative Habitat is formed, using a similar model to La Almendrehesa but for olive products.

**2020:** 140,000 trees planted and 200,000 seeds sown by drone by AlVeAl since beginning restoration activities

**2022:** The online AlVeAl Foods is launched to sell a range of goods including almonds, pistachios, walnuts, wine, honey, aromatic herbs, and olive oils, produced through regenerative farming.

**2022:** The regenerative machinery bank pilot project is launched, where farmers share costly machinery for regenerative practices.

**2023:** The Aland Foundation begins taking AlVeAl's 7 years of experience to influence policy at the national level by promoting a network of restoration initiatives working under the 4R model to make the Iberian Peninsula (Portugal and Spain) a resilient territory in the face of climate change and an example for the rest of Europe.



Figure 13. Restoring La Muela in the natural park Sierra María Los Vélez. This area suffers from deforestation and subsequent soil erosion. It receives more than 3m of snow in the winter, and vegetation is mostly low shrubs and drought-tolerant species. The steep slopes have been grazed for 5,000 years or more, leaving sparse remnant vegetation. Vegetation was not returning to the site naturally, so implementers created small “albarradas” (walls) to capture rainwater for planted trees. In 2017, they planted an initial 50,000 native oaks (*Quercus ilex*, *Q. rotundifolia*), junipers (*Juniperus* spp.), and Aleppo pine (*Pinus halapensis*) to increase native biodiversity and ecosystem function. There was enough water to support trees, but despite the park’s designation to restrict grazing sheep and cattle, grazing animals killed many seedlings and pose an ongoing challenge to forest recovery. Photo credit: Robin Chazdon

## Outcomes and impacts

**“The Altiplano becomes a regenerative landscape where agroecology and regenerative farming is a form of life, connecting economy and ecology. And just as important: confidence and wellbeing, both socially and economically.”**

*(Dudley et al., 2021, p. 28)*

After less than a decade, both environmental and social impacts were evident across the territory. Participating farms are found throughout, with a concentration in areas key for connectivity (Figure 14), many with both regenerative agriculture and restored natural areas (Dudley et al., 2021). New businesses have created economic opportunities to practice regenerative farming, and young people and families are returning to the landscape (Elvira Marín Irigaray, 2022, personal communication).



Figure 14. The AIVelAI territory in 2021, with participating farms and processing centers indicated. Source: Irigaray, 2022

**Adopting regenerative practices:** Farmers across the region have adopted regenerative practices. The initiative spread quickly; both the number of farmers participating and the area of land under regenerative practices doubled in only three years from 2018 to 2021 (Dudley et al., 2021; Yue et al., 2019; Figure 15). By 2022, 200+ farmers had adopted regenerative practices on at least part of their farm, which combined represent 10,500 ha under improved regenerative management (Dudley et al., 2021; Appendix C). Of these, 130 farmers implemented strategies to capture water and 12 converted their whole farm to regenerative practices. The project has the potential to transition over 85,000 more ha of almond monocultures into regenerative agroforestry systems, for a total of 100,000 ha (Ferwerda and Gutierrez, 2021). By 2022, membership in ALVeAL grew from 50 in 2015 to 450, including people from public, private and academic sectors (approximately 50% are farmers).

**Improving soils and crops:** ALVeAL's research showed that soil conditions and biodiversity both improved on farms with regenerative practices. Water infiltration capacity and soil organic matter both increased on regenerative agriculture plots as compared to conventional farming (by an average of 55% and 15%, respectively) (Appendix D).

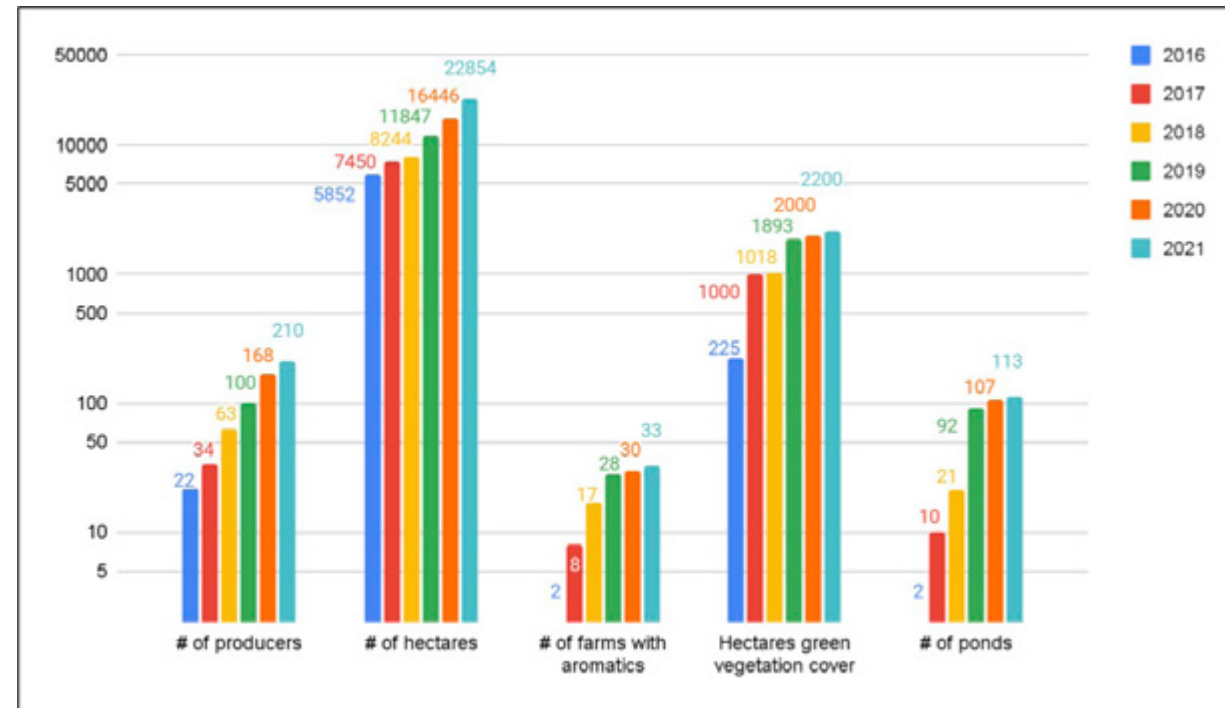


Figure 15. The spread of regenerative practices in the Altiplano, 2016-2021. Note the log scale. Source data from ALVeAL, 2021a (Appendix B).

Soil microbes also increased (there was, on average, 32% more fungi biomass on regenerative farms) (Appendix D), which is important for nutrient cycling. The quality of almonds and on-farm biodiversity both also increased compared to conventional methods (ALVeAL, 2021a).

**Restoring forests and natural ecosystems:**

As of 2022, more than 200 farmers were participating in landscape restoration. 400 ha of forests were returning on farms and public lands in the critical 25,000 ha corridor through both planting and natural regeneration, and 292,000 native seedlings had been planted on private and public lands and an additional 735,000 native seeds dispersed (largely by drones) (Appendix C; Elvira Marín Irigaray, 2022, personal communication). As of 2022, 31,350 ha have been positively influenced as part of the ALVeAL initiative (Appendix C). In planted areas, survival rates typically ranged from 33–63% (Elvira Marín Irigaray, 2022, personal communication). Monitoring is an integral part of ALVeAL's approach, and is used to learn and adapt interventions to the specific conditions in the Altiplano (Dudley et al., 2021).

**Creating businesses and market connections:**

Regenerative production increased. In 2017, the region produced 54 MT of regenerative certified organic almonds (Figure 16), in 2018,

86 MT, and by 2020 95 MT — an increase of over 80% (Yue et al., 2019). The three businesses — La Almendrehesa, Habitat, and ALVeAL Foods — have helped farmers find a market for regenerative goods. As of 2019, La Almendrehesa had 29 partnering and shareholder farmers cultivating 1600 ha of almond orchards (Yue et al., 2019). In 2021, they sold 83 tons of regenerative almonds as well as walnuts, pistachios, and various aromatic herbs (ALVeAL, 2021a) and were connected with regenerative agriculture markets across Europe.

**Rural engagement:** Young people are beginning to see a future for themselves in the region, with notable impacts on local towns and communities. “[In a small town in the region] the school was closed, but five families with eight children moved to that village and now the school is open again,” says Elvira. She illustrated the cultural shift in perceptions of farming and the opportunities it provides: “My family is from this territory. My grandparents were farmers, and they always told my parents ‘go to the city, go to the university. Farming is not a good employment for young people because you have to be there every day, you have no holidays. So go and don’t come back.’ So my parents went to the city and went into vocations with no relation to farming.”





Figure 16. Almond trees in bloom with green cover in place. Source: Ifund, n.d.

And now I'm living in the village where my grandma used to live. They [my grandparents] are very happy that my daughters can live here near nature and the almond trees" (Elvira Marín Irigaray, 2022, personal communication).

The COVID-19 pandemic also presented opportunities to work remotely, which helped some families transition to life in the region. "Young families that used to live in big cities [such] as Madrid or Barcelona are now living here because they can work at home," says Elvira Marín.

***Culture change and community building:*** As of 2022, 3500 people have been engaged through various events and initiatives, and the suite of activities and campaigns to inspire action and celebrate the land and local culture paid off (Appendix C). "The role of art and culture is all-pervasive in this LR

[landscape restoration] project. Collaborative creations function as a "glue" for social cohesion, create a collective memory and promote natural capital" (Gutierrez et al., 2023, p. 5). People of all ages participated in the project's activities, which helped to create community cohesion. "The inclusion of children and youth in the organization of events (e.g., re-generation festival) builds bridges across intergenerational approaches to LR" (Gutierrez et al., 2023, p. 5). Cultural walking routes helped reconnect isolated villages through shared history and traditions while serving as tourist attractions.

## Key challenges

Proof that a technique will pay off is crucial for farmers to adopt it, but at the project onset there were limited data and few examples on the effectiveness of regenerative agriculture in arid regions. Arid conditions mean results take longer to appear (soils are slower to develop), which has made some farmers hesitant to invest. ALVelAl's research is helping to fill this gap with additional data and case examples (Lee et al., 2019).

Finding funding for natural regeneration has been difficult. ALVelAl has developed

avenues to fund regenerative agriculture and planting trees, but donors are less willing to fund natural regeneration-based approaches. To overcome this challenge, ALVelAl is developing the business case for restoration rather than relying on donor funds. Funding to lay the social groundwork for agricultural transformation is also difficult. “Social interventions that drive transformation are rarely financed. [But] funders and governments guaranteeing these costs would significantly increase the chances of large-scale landscape restoration success” (Ferwerda and Gutierrez, 2021, p. 31).

Large agribusiness companies are increasingly buying or renting land from farmers to grow irrigated vegetables (lettuce, broccoli, etc.), extracting water from the aquifers and limiting the land available for restoration. “It is incredible,” says Elvira Marín. “Now you can drive and see big extensions of green, and each day there is a new one and a new one. But we are in an area that does not have a lot of water, and these farms are using enormous amounts of water.” Other large companies are starting industrial pig farms, which pollute groundwater supplies. Industrial farming creates employment and job security, but practices are not sustainable. In response, ALVelAl is educating people about the long-term benefits of regenerative agriculture, including in schools. “We have created an alliance with

other entities trying to promote this knowledge in the schools with small children. Because if not, we cannot fight or against the big companies” (Elvira Marín Irigarary, 2022, personal communication).

Some policies and subsidies are at odds with regenerative systems. Most EU agricultural subsidies are oriented towards monocultures and industrial farming, not alternative nature-based systems, and larger farms receive larger subsidies, a problem for smaller farms. Spain generally does not support eco-friendly agriculture through subsidies or other support, which puts regenerative agriculture at a distinct competitive disadvantage (Keenleyside et al., 2014; Ferwerda and Gutierrez, 2021). “As soon as you start mixing almond monocultures with other crops it becomes more difficult to get subsidies... we need policies that allow ecology and economy to go hand in hand” (ALVelAl, 2020).

## Enabling factors and innovations

People had the awareness that conditions were bad and the desire to fix them. Out-migration, soil erosion and depletion, and water management issues were apparent to farmers, who could see that current practices were not working as they should.

A shared cultural heritage of food and farming meant that people had common roots to build on.

Starting with a group of innovators was a critical first step. “We believe that one farmer can inspire other farmers,” says Elvira Marín. “I cannot invite a farmer or an association cannot, but another farmer can inspire other farmers to start using regenerative practices. We also develop a workshop together with farmers...we sit on the farm and the owner explains everything, the challenges, the opportunities, everything to the farmers, and...this works to engage other people in this model” (Elvira Marín Irigaray, 2022, personal communication).

Reaching and creating markets for regenerative goods was an important innovation to add value to environmentally produced goods. “ ‘It is a good moment for our almonds,’ said Frank Ohlenschlaeger, CEO of La Almendrehesa” (Yue et al., 2019, p. 8). “ ‘I see there is an increasing demand and some new potential customers like a cosmetic company that look for regenerative products. This is incredible because maybe five years ago people did not know about regenerative farming. Now people are looking for that. I have to find the customers that want to pay for our project and our story’ ” (Yue et al., 2019, p. 8).

The intervention intentionally built social inspiration and capital into the design of the project (DeAngelis et al., 2020). AlVeAl employed a governance strategy designed to build trust and facilitate communication. The project also created a conflict resolution strategy for conflicts arising within the organization (Gutierrez et al., 2023). The 4 Returns framework served as a helpful tool to communicate to communities and governments at all levels what the program is about and the benefits it can bring (Ferwerda and Gutierrez, 2021). Involving youth and children — through organizing and participating in events, for example — helped to build community and trust. Intergenerational exchange was also important for elevating the cultural status of farming and helping to ensure its continuity.

## Parting shot

***“I was Mr. Plower Number One. All this green cover business, I didn’t buy it. But now I am convinced, and able to convince anyone. I can demonstrate it any day.”***

—Francisco Martínez López (AlVelAl farmer)



Figure 17. Almond trees grown without green cover, leading to soil erosion. Photo credit: Commonland



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# Key lessons learned

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- ▶ **Regenerative agriculture can contribute to Forest and Landscape Restoration.** *Regenerative agriculture combines ecological, economic, and social components to restore soils and water resources. In the Altiplano, this integrative approach fit well with other techniques to restore natural ecosystems as it provided an economic backbone for the work while sharing the same ethos of restoring and rejuvenating the landscape.*
- ▶ **There is no “one size fits all” for regenerative agriculture.** *Implementers found that they had to develop many strategies for regenerative agriculture to fit arid conditions and the specific ecology of the region. They are now developing regenerative certification tailored to specific ecological and social conditions.*
- ▶ **Farmers listen to and learn from other farmers.** *This initiative started with a small group of farmers who were seeking something new. These early adopters who piloted and invested in the approach were crucial for bringing others on board.*
- ▶ **Making the economic case and creating market demand for regenerative products is key for farmers to adopt at larger scales.** *Although some farmers in the region were willing to take financial risks to improve practices, many needed proof that changes would pay off before participating. Specialty markets can be a good mechanism to achieve this.*
- ▶ **Assisted natural regeneration (ANR) can be harder to fund than tree planting.** *In this case, donors were interested in restoration that involved tree planting but not so interested in non-tree planting based approaches, despite the potential for ANR in this region.*
- ▶ **Regenerative, future-looking farming practices can elevate the cultural status of farmers and farming and draw younger people back to rural areas and farming.** *The potential of regenerative agriculture and the collective vision behind the movement inspired a community to form around this work, revitalizing communities and creating shared purpose. Young families began to return to work alongside older farmers.*



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Learn  
more

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## Further information and resources

Video: “ALVelAL, una historia real”

Video: “Farmland Restoration Stories: Spain”

Video: “ALVelAL”

Video: “El Sueño de ALVelAL”

Video: “The Forest Vegetation”

Video: “Why Regenerative Agriculture?”

Video: “Agricultura Regenerativa. Retorno del capital financiero”

Video: “Green Cover Workshop in Ferreira”

Interactive story showing ALVelAL farmers:

<https://local-heroes-alvelal.webflow.io/>

La Almendrehesa Website: <https://english.almendrehesa.es/>

Reversing desertification with regenerative

practices [https://commonland.com/landscapes/](https://commonland.com/landscapes/reversing-desertification-with-regenerative-practices/)

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