



INITIATIVE ON

Livestock and Climate



Opportunistic Grazing to Restore Soil Health

Ecosystem Function and Ecosystem Services
- MELIA Study -

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List of Acronyms

CRDA	Commissariat Régional Développement Agricole (Regional Commissariat for Agricultural Development)
DGF	Directorate General of Forests (Tunisia)
FAO	Food and Agriculture Organization
GDA	Agricultural Development Group
ICARDA	International Center for Agricultural Research in the Dry Areas
IGC	International Grassland Congress
IRC	International Rangeland Congress
MELIA	Monitoring, Evaluation, Learning and Impact Assessment
PRODEFIL	Inclusive Value Chain Development Project
PRODESUD	Agropastoral Development and Promotion of Local Initiatives in South-eastern Tunisia
IFAD	International Fund for Agricultural Development
IRA	Arid Regions Institute
TND	Tunisian Dinar
OEP	Office of Livestock and Pasture (Tunisia)

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Summary

Rangelands in Tunisia are crucial to local livelihoods, supporting pastoralists and significantly contributing to household incomes. However, climate change, rising livestock populations, complex land tenure systems and land fragmentation have degraded these vital landscapes. The decline has been further exacerbated by the collapse of the traditional Bedouin-led grazing system, *gdel* or *Hima*, which traditionally allowed rangelands to fallow and recover. In response, the Tunisian government has integrated *gdel* principles into a national rangeland restoration strategy. Still, the policy of mandatory three-year grazing exclusion has caused conflicts, especially when favourable rainfall results in unused biomass. To address this, the study focused on the application of opportunistic grazing, an approach that is more acceptable to pastoral communities. This method offers ecological and economic benefits, promoting long-term rangeland recovery while alleviating pressure on remaining grazing areas. The study aimed to assess the effectiveness of opportunistic grazing in restoring degraded arid rangelands by measuring productivity, biodiversity and soil health improvements while also analyzing socioeconomic benefits for livestock productivity and ecosystem services.

Additionally, the research examined the role of gender and community-led decision-making in adopting validated practices. A mixed methods approach was employed, combining qualitative and quantitative data from focus group interviews, rangeland monitoring reports and impact assessments from projects funded by the International Fund for Agricultural Development (IFAD), such as PRODEFIL and PRODESUD II.¹ Capacity-building efforts, including workshops and on-the-job training, were also carried out to offer stakeholders the necessary skills to assess grazing land capacity and determine optimal grazing timing and carrying capacity for sustainable management. The findings provide valuable insights for policymakers looking to strike a balance between livestock production and sustainable rangeland management.

1 PRODEFIL: Agropastoral Value Chains Project in the Governorate of Médenine; PRODESUD: Agropastoral Development and Local Initiatives Promotion Programme for the South-East.

Opportunistic grazing for restoring soil health, ecosystem function and ecosystem services: Findings

Opportunistic grazing has emerged as a transformative strategy for restoring degraded arid rangelands, enhancing biodiversity, and promoting sustainable livelihoods. The approach has achieved measurable success in balancing economic gains and ecological restoration by improving both livestock productivity and ecosystem health. Livestock fertility and prolificacy increased by 10%, with significant cost savings from reduced feeding expenses. These economic benefits were complemented by a sixfold increase in collective rangeland productivity, a 270% improvement in vegetation recovery and notable biodiversity gains, including the return of extinct species. These transformations have strengthened ecological resilience and supported sustainable pastoral economies.

The economic and ecological impact of resting grazing lands were substantial, with annual values ranging between 9.55 million and 12.48 million Tunisian dinars (TND). Environmental services comprised 70% of pastoral profits, underscoring their central role in sustainable land management. Improved forage availability produced four million feed units annually across 19,000 hectares, equivalent to 4,000 tons of barley. Simultaneously, wind erosion was mitigated and soil moisture retention improved.

Progress toward initiative outcome: Governance, management and restoration practices on 400,000 hectares with women's active participation

Opportunistic grazing interventions have significantly advanced the Livestock and Climate initiative's goal of enhancing governance, management and restoration practices on vast rangeland areas while actively engaging women in decision-making processes. The project has already positively impacted 180,000 hectares and reached 6,212 beneficiaries, creating a strong

foundation for sustainable rangeland governance and restoration.

Evidence of progress

Community engagement in rangeland governance and management was significantly strengthened through Groupements de Développement Agricole (GDAs), with membership in GDA Dhaher rising from 69 to nearly 600 over six years, showcasing strong community buy-in. Collective rangeland management was formalized across 11,200 hectares, transitioning from reliance on subsidies to autonomous practices. Restoration efforts positively impacted over 180,000 hectares of rangelands, including 7,000 hectares of private rangelands and 12,000 hectares of collective rangelands in Médenine; 27,000 hectares of private rangelands and 84,000 hectares of collective rangelands in Tataouine; and 50,000 hectares of collective rangelands in Kébili. Resting practices enhanced ecosystem health, with a 216.7% increase in vegetation cover, reduced wind erosion and improved biodiversity.

Women's participation in decision-making reached 34% in capacity-building workshops, surpassing the 30% target. Additionally, 14 women in Médenine gained income opportunities through essential oil extraction and marketing tied to rangeland restoration. Capacity-building efforts trained 263 individuals, including 75 women, in sustainable grazing, rangeland assessment and ecosystem restoration, fostering local expertise. Economic and social empowerment emerged as a key outcome, with rangeland productivity improvements contributing annual values of 9.55 to 12.48 million TND, 70% of which stemmed from environmental services. Women and youth also engaged in grazing-related enterprises and value-added activities such as wool valorization, creating sustainable livelihoods and driving local innovation.

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Background

Rangelands in Tunisia cover about 33% (5.5 million ha) of the country's total territory; 87% are in the south and described as arid and desert areas (45% and 42%, respectively).

Rangelands and forests play a vital role in the livelihoods of nearby communities, providing around 38% of household incomes and supporting an estimated 35,000 permanent jobs that benefit approximately 100,000 rural households. Rangelands alone contribute about 1,062 million Tunisian dinar (TND) annually (approximately USD 340 million), three times the economic output of Tunisia's forests and representing 1.5% of the national GDP.

In Tataouine, approximately 41,850 hectares (around 25% of the region's private rangelands) have undergone natural restoration, benefiting around 1,078 residents. Rangelands fulfil 20–60% of livestock feed needs and are essential for soil protection, particularly against wind erosion and biodiversity conservation. Sheep are the dominant livestock species, with an average population of 6.5 million, followed by 1.2 million goats (ONAGRI, 2017). Beyond their economic benefits, rangelands offer essential ecosystem services, including water retention, protection against desertification, carbon sequestration and biodiversity preservation. In certain areas, the strategy has seen some success. In Tataouine, for example, around 41,850 hectares—roughly 25% of the region's private rangelands—have undergone natural restoration, benefiting an estimated 1,078 people (Louhaichi et al., 2019).

Climate change, increased livestock population, complex land tenure systems and land fragmentation are key factors contributing to the decline of rangelands. The dismantling of Tunisia's traditional Bedouin-led grazing system (*gdel*), has further exacerbated the problem. *Gdel* is a millennia-old approach that allows designated rangeland areas to lie fallow while forbidding animal grazing until vegetation recovers.

Recognizing its benefits, the Government of Tunisia has recommended *gdel* principles, also called a resting technique, as part of a national strategy for rangeland improvement since the beginning of the 1990s. The agency responsible for implementing the strategy is the Office of Livestock and Pasture (OEP). They developed a fixed contractual agreement with livestock owners and pastoralists, stipulating that rangelands must remain fallow for three years before being reopened for grazing. When rangelands are off-limits, pastoralists are compensated with subsidized animal feeds of barley or concentrates.

Unfortunately, banning livestock grazing for three consecutive years has created conflict between administrations implementing the strategy and pastoral communities, especially when local rainfall conditions produce a considerable quantity of green biomass, which is not valorized through livestock grazing.

The decision on how long livestock grazing exclusion would last should not be made upfront as it depends on the climatic and site-specific conditions. To improve the current policy and procedures and to allow more flexibility in grazing practices when certain conditions are met, under the CGIAR Research Initiative on Livestock and Climate. Opportunistic grazing exclusion and management was rolled out as part of A proven methodology for rangeland management. With adequate rainfall and distribution, opportunistic grazing exclusion offers a cost-effective technical option to ensure the sustainable restoration of arid rangeland (Louhaichi et al. 2021, Louhiachi and Gamoun, 2024).

Considered to be more acceptable by the pastoral communities, this opportunistic grazing management approach also had social and economic benefits through building trust and cooperation and saving on animal feeds. Longer resting periods could have detrimental effects on arid rangeland vegetation and put more pressure on the remaining rangeland areas subject to free grazing. This approach includes controlled rapid grazing to support the long-term recovery and resilience of Tunisia's rangelands. Using this method, livestock hooves break up hard-crusts soils typical of arid zones, improving rainwater infiltration and encouraging seed germination. Additionally, controlled grazing removes oxidized plant material from perennial grasses, which otherwise hampers photosynthesis and can lead to plant die-off.

This concept evolved through structured steps. The International Center for Agricultural Research in the Dry Areas (ICARDA) and national partners initially validated the innovation with scientific evidence.

Subsequently, they engaged stakeholders, including policymakers, to build consensus on an opportunistic grazing model that allows pastoralists to graze rested areas under certain conditions, such as high precipitation and good biomass production. Capacity-building sessions were held to give stakeholders skills for accurately measuring and assessing rangeland productivity and carrying capacity. This was to help develop well-informed decision-making by all actors that aligned with rangeland sustainability goals.

The Livestock and Climate Initiative conducted an assessment jointly with all involved stakeholders, including the community-based organizations, to assess the effect of short-duration, high-stocking-rate opportunistic grazing on the arid rangelands of southern Tunisia. The findings of this assessment are important in documenting the progress towards end-of-initiative outcomes, particularly under Work Package 3. The findings may be useful to policymakers who make recommendations to national and international development agencies to enhance livestock production while conserving the natural resource base.

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Objectives

This study focused on assessing the uptake of tools and technologies to improve land-use planning, governance and restoration of degraded arid rangelands. The study evaluated how these validated practices contributed to sustainable livestock production, improved ecosystem management and enhanced governance frameworks in these regions.

Specifically:

- ▶ to **assess the effectiveness** of promoting opportunistic grazing in restoring degraded arid rangelands by quantifying improvements in range land productivity, biodiversity and soil health
- ▶ to **analyze the socioeconomic benefits and sustainability** of using opportunistic grazing applied by pastoral communities for improving livestock productivity and supporting ecosystem services of arid rangelands; and
- ▶ to **examine the role of gender-inclusive and community-led decision-making** in land management and its impact on the adoption of validated technologies and practices.





▲
Dead plant due to absence of grazing (long term resting). Photo credits: ©Mounir Louhaichi.

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Methodology for opportunistic grazing approach in restoring degraded arid rangelands

Institutionalization of opportunistic grazing

Article 9 regulating the exploitation of resting rangelands (GDA CRDA Convention for resting rangelands) stipulates that based on the results that will be obtained thanks to the resting technique, particularly at the level of vegetation and managing their exploitation in such a way as to ensure the preservation of the environmental balance and the continuity of the diversity of their plant cover and by relying on recognized traditions of exploitation of the pastoral space, all contracting parties have agreed on a set of management rules to organize the exploitation and grazing process in the medium and long term. Here are the main points of the recommended operating process:

- ▶ It was agreed that the exploitation process is subject to planning which mainly considers climatic factors (the amount and distribution of annual precipitation), as follows:
 - ▶ **Rainy year:** exploitation takes place during the summer (from the beginning of June to the beginning of September)
 - ▶ **Dry year (less than the annual average):** Do not open rangelands for exploitation.
- ▶ The open pastures covered by the agreement may be made accessible each year if the initial conditions are fulfilled.
- ▶ The operating principle is approved and authorized and the grazing capacity of open pastures is determined by the CRDA of Médenine after consultation with the GDA.
- ▶ A fee is required to access the improved rangeland and water facilities. The fee is defined through local arbitration in accordance with regional regulations. The fee is paid to the GDA bank account, which is used to provide services to GDA members.
- ▶ The GDA will determine beneficiaries wishing to graze open pastures through local arbitration.

- ▶ Any beneficiary must sign a commitment to which he adheres to all applicable provisions and procedures and bears all the consequences in the event of failure to comply with them.
- ▶ Discourage anyone who grazes on rangelands outside authorized operating periods, anyone who enters rangelands without commitment and permit, or anyone who violates their obligation during any process of opening to exploitation in accordance with the laws in force.

Methodology

This study used a mixed methods approach to measure the effects. Qualitative and quantitative data from three primary sources were used: (i) semi-structured focus group interviews, (ii) rangeland monitoring reports and (iii) impact assessments from IFAD-funded projects, specifically PRODEFIL and PRODESUD II.

Focus group interviews

Semi-structured interviews were conducted with members of pastoral communities following a guided questionnaire (Appendix 1). These interviews provided insights into local perceptions, challenges and benefits associated with the innovation, offering valuable qualitative data on its social and economic impact.

Rangeland monitoring reports

Annual assessments of rangeland conditions for three to five years, systematically comparing rested sites with control areas under unrestricted grazing. Key indicators measured were plant cover rate, species diversity, biomass production and forage productivity (expressed in feed units). These indicators proved instrumental in making data-driven decisions regarding the timing and conditions for opening rested sites for grazing, determining the appropriate carrying capacity and setting grazing duration in line with the “take half, leave half” principle to promote sustainable use.

Impact assessment reports of IFAD’s PRODEFIL and PRODESUD II

On quantitative effectiveness and outcomes of the project’s interventions on rangeland, including improvements in vegetation cover and sustainable resource management practices.

Rangeland monitoring methodology

Drawing on its research and a thorough literature review, ICARDA developed a set of indicators collaboratively with stakeholders to guide planning and determine when opportunistic grazing can be applied. Assessments of rangeland productivity, including vegetation growth rates, were conducted based on scientific measurements. The selected methodology for monitoring rangelands employs a structured approach to assess changes in:

- ▶ **Vegetation over time**, focusing on density, species composition, plant cover, pastoral values and overall rangeland productivity. Plant cover was measured using the quadrat point method, which systematically quantifies vegetation attributes across various plots. (Goodall 1953; Daget and Poissonnet 1971). This protocol requires a minimum of three transects per plot, two inside the resting area and one reference transect outside. At each transect, we lay three 100-metre lines. We measure plant density by considering one metre of width along every 100 linear metres or 100 m² for perennial species and choose 10 quadrats of 1 m² for annual species. This method enabled us to record the following indicators: plant density, vegetation cover and species composition.

- ▶ **Pastoral value:** A synthetic index derived from vegetation surveys that summarizes the forage yield, quality and palatability for livestock (Daget and Poissonet, 1969). It is calculated based on the following key indicators:
 - ▶ **Overall plant cover** is proportional to the surface of the ground covered by the vertical projection of the aerial organs of plant species. This is the ratio, expressed as a percentage, between the number of points where the species are present and the total number of sampling points.
 - ▶ **Coverage by species**, or centesimal frequency, reflects the specific recovery and is expressed as the ratio between the number of points where the designated species is present and the total number of reading points.
 - ▶ **The species contribution to cover (CSP)** or the percentage ratio between the species.
 - ▶ **Cover assigned to each species** and the sum of the cover of all species.
 - ▶ **Pastoral value (VP)** is determined by the formula:

$$VP = 0.2 \sum (CSP_i \times ISI_i) \times C / 100$$

Where VP is the pastoral value; CSP_i is the specific contribution of the presence of the species (i); ISI is the species-specific palatability index (i) (Le Houérou and Ionesco 1973); and C is the overall vegetation cover.
- ▶ **Determination of carrying capacity:** Rangeland productivity serves as a key indicator for estimating changes in carrying capacity based on forage units. Typically, 50% of the vegetation is reserved for grazing in designated resting areas, while the other 50% is left undisturbed to foster regeneration. During years of low precipitation and limited biomass, grazing in these areas is restricted to prevent overuse and degradation. However, in favourable years with sufficient rainfall and robust biomass growth, opportunistic grazing may be allowed on lands in their second or third year of rest to support ecological restoration while maintaining rangeland sustainability.

Capacity development

As part of the comprehensive capacity development efforts to enhance rangeland and silvopastoral system management, a series of training workshops and on-the-job training sessions were conducted. These sessions were designed to impart the knowledge and tools staff will need to evaluate the capacity of grazing lands and define the best timing and carrying capacity for grazing to ensure long-term rangeland sustainability.



$$P = 7.5 \times 2VP$$



▲
Vegetation sampling and monitoring. Photo credits: ©Mounir Louhaichi.

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Results

The results highlight substantial benefits across multiple dimensions. To ensure a comprehensive analysis, the results are categorized into five themes detailing how opportunistic grazing contributes to the sustainable development of arid lands and the livelihoods of communities dependent on them.

- ▶ **Livestock performance** examines improvements in livestock productivity, health and resilience to climatic variations;
- ▶ **Ecosystem restoration** shows = the ecological impacts, including vegetation recovery, soil health and biodiversity enhancement;
- ▶ **Economic sustainability** assesses the economic variability and benefits for pastoral communities, including income generation and cost-effectiveness;
- ▶ **Gender and empowerment** explores the role of opportunistic grazing in promoting gender equity and empowering women within pastoral systems; and
- ▶ **Social and community well-being** highlight changes in social dynamics, community cohesion and collective resource management practices.

Livestock performance

Results indicate that opportunistic grazing land significantly enhanced livestock productivity. Focus group discussions revealed a 10% increase in sheep and goat fertility and prolificacy. The provision of supplemental feed—concentrate feed for maintenance by the OEP and barley for collective rangelands—was noted to have a significant effect. While the resulting increase in herd size posed some management challenges, breeders eventually saw it as a positive outcome. This highlights the effectiveness of these interventions in promoting herd growth and overall livestock production.

These findings are consistent with the *PRODEFIL project's impact study*, which reported a 33% increase in overall livestock productivity and a 20% reduction in sheep and goat mortality rates. The consistency of these results shows the potential of opportunistic grazing and complementary interventions to enhance livestock performance sustainably.

Reduced feeding expenses

Beneficiaries highlighted the significant benefits of resting grazing land, as evidenced by testimonies from the Médenine focus group discussion. Participants estimated that the effect of resting equates to three months of supplemental feeding for an average herd.

For an average herd size of 400 animals, the required supplementation—calculated in terms of barley grain—would amount to 1,012,500 kg (500 animals × 45 herds × 90 days × 0.5 kg/day). At the official barley price of 1,159.32 TND per ton, this results in a value of 1,173,811 TND for an area of 12,000 hectares.

This translates to a gain of 98 TND per hectare per year, compared to an investment of 25 TND/ha/year provided by the government as compensation for resting.

These findings align with the **PRODEFIL project report**, which used a different approach to estimate the impact of resting on reducing feeding expenses by monitoring the “rangeland productivity” indicator, expressed in fodder units. Data collected from five plots over four consecutive years (2018–2022) across 9,000 hectares revealed average productivity of 184 fodder units per hectare for rested plots compared to 73.3 for grazed (control) plots. This represents a 270% improvement or a yearly gain of 110.7 fodder units per hectare.

This gain translates to 110.7 kg of barley per hectare per year, valued at 128 TND/ha/year, based on a barley price of 1,159.32 TND per ton. While this estimate slightly exceeds the figures provided by the focus group (128 TND versus 98 TND per hectare per year), it remains within a comparable range.

Considering that 12,000 hectares have been put under rest in Dhaher (Médenine) and 85,500 hectares in the governorates of Tataouine and Kébili (Douz)—a total of 97,500 hectares—the total gain would range from 9.55 million TND per year (using the focus group estimate of 98 TND/ha/year) to 12.48 million TND per year (using the rangeland productivity estimate of 128 TND/ha/year). This corresponds to approximately USD 3.18 million to USD 4.16 million per year, assuming an exchange rate of 1 TND = 0.3333 USD.

Enhanced rangeland ecosystem services

Enhanced vegetation cover and increased productivity

Opportunistic grazing led to remarkable improvements in vegetation cover and rangeland productivity. In Tataouine, biodiversity and productivity of annual and perennial plants increased significantly, with collective rangelands showing up to sixfold productivity. In the Medenine Region, rested rangelands saw productivity improvements of 270%, underscoring the approach’s alignment with national efforts for sustainable rangeland management. Additionally, opportunistic grazing on 19,000 hectares produced approximately 4 million feed units annually, equivalent to 4,000 tons of barley. The productivity of rangelands has at least doubled, as has the biodiversity of annuals and perennials.

In Tataouine, the improvements in plant cover, biodiversity and productivity of rangelands under opportunistic grazing are spectacular. The productivity of private rangelands has practically doubled, and that of collective rangelands has almost been multiplied by six. This improvement concerns both annual herbaceous and perennial plants and the return of extinct species, such as the annual sulla (*Hedysarum spinosissimum*) is registered.

According to the **IFAD impact study report** for the Medenine Region:

- ▶ Rangeland productivity measurements carried out at the level of resting entities indicate a very positive effect on rangeland productivity (number of forage units per ha per year). This improvement is estimated, on average, at 270%.
- ▶ The actions to apply opportunistic grazing on more than 19,000 ha of collective and private rangelands are consistent with national strategies for the conservation and sustainable management of natural resources,

the preservation of fragile ecosystems, including rangelands in arid zones, combating desertification and adaptation to climate change. The relevance of this action is confirmed by the results of the ecological monitoring of the sites put in rest within the framework of the PRODEFIL project. This made it possible to note a very clear improvement in plant cover, floristic richness and pastoral productivity.

- ▶ Adopting opportunistic grazing (versus resting) permitted us to produce nearly four million feed units in a favourable year, equivalent to 4,000 tons of barley grain.

- ▶ The improvement rate in the rangelands plant diversity index reached 177%.

Monitoring measurements of the state of the rangelands (plant cover, floristic richness and rangeland productivity) carried out in five rangeland sites of the Dhafer Béni Khedache in Médénine showed that the plant cover rate improved by 216.7% and the rangeland productivity 270% (expressed in forage units). It is undeniable that such an improvement in plant cover contributes to a reduction in wind erosion, and the accumulation of a wind veil is favourable to improving biodiversity (Table 1).

Table 1. Average of four years of monitoring five rangeland sites, Dhafer Médénine rangelands

	Plant cover rate (%)	Rangeland productivity (Feed unit/ha)
Control	23.7	73.3
Opportunistic grazing	42.4	184.0
Improvement (%)	216.7	270.1

Source: Author’s creation.

Table 2 presents data on plant cover rates and rangeland productivity measured in forage units per hectare across five plots of the Dhafer Béni Khédache rangelands in Médénine, monitored from 2018 to 2022. The plots were managed under control (open grazing) and resting (opportunistic grazing). The percentage improvements reflect the impact of the resting approach compared to the control.

In all plots, the resting approach consistently resulted in higher plant cover rates than in the control plots. For example, in the Mthinine plot, resting resulted in an average plant cover rate of 34.5%, which is 285.8% higher than the control average of 10.5%. This trend was observed across all other plots, emphasizing the effectiveness of resting for promoting vegetation growth.

Rangeland productivity, measured in FU/ha, also increased significantly under the resting management approach.

In the Mthinine plot, resting produced an average productivity of 149.8 FU/ha, a 210.8% increase over the control. This improvement underscores the value of resting and enhancing forage availability across the monitored rangelands.

The results demonstrate that resting (opportunistic grazing) can significantly improve plant cover and rangeland productivity across various plots. These gains highlight the benefits of reducing grazing pressure, which allows for natural vegetation regeneration and fosters increased resilience in arid landscapes. Enhanced plant cover stabilizes the soil, mitigates erosion and improves moisture retention, supporting a healthier and more sustainable ecosystem. The increase in productivity under resting management suggests that forage availability can be boosted and livestock can be supported without compromising ecological integrity.

Differences in the percentage improvements across plots may stem from variations in soil quality, baseline degradation or local climate, indicating that some areas may respond more positively to resting practices. These results emphasize the importance of localized management strategies tailored to specific environmental contexts.

The findings suggest that adopting a resting approach is an effective strategy for rangeland recovery, particularly in degraded, arid areas. Opportunistic grazing addresses productivity and environmental sustainability goals by improving forage availability and supporting sustainable livestock production without depleting resources.

The success of opportunistic grazing in enhancing productivity may encourage policymakers and

local communities to integrate this approach into sustainable land management frameworks. Combining opportunistic grazing with traditional grazing practices could support rangeland restoration and bolster long-term ecosystem health. Given the observed improvements, opportunistic grazing could be scaled out to other regions with similar arid conditions. However, careful attention to local conditions remains crucial for optimizing results and ensuring sustainable outcomes.

These findings affirm that opportunistic grazing offers a balanced approach to conserving degraded rangelands, improving vegetation cover and supporting livestock production. Integrating such practices into land management policies could play a pivotal role in combating land degradation while sustaining pastoral livelihoods.

Table 2: Results of rangelands' monitoring measurements on five plots of the Dhafer Béni Khédache rangelands in Médenine from 2018 to 2022

Rangelands monitored	Plant cover rate (%)					Rangeland productivity (FU/ha)				
	2018	2019	2021	2022	Average	2018	2019	2021	2022	Average
Mthinine (3,000 ha)										
Control (open for grazing)	8.17	13	16.33	8	10.5	50	83	87	80	75
Resting (Opportunistic grazing)	28.33	43	22.83	26	34.5	158	231	129	81	149.8
Improvement (%)	347	331	140	325	285.8	316	278	148	101	210.8
Lajef Oun (2,100 ha)										
Control (open for grazing)	30	27	10	10	19.25	59	70	46	26.6	50.4
Resting (Opportunistic grazing)	56	61	34	18	42.25	208	447	157	64.7	219.2
Improvement (%)	187	226	340	180	233.3	353	639	341	243	394
Zredib (800 ha)										
Control (open for grazing)	27	48	10	10	23.75	68	88	46	26.6	57.2
Resting (Opportunistic grazing)	48	74	25	28	43.75	235	260	131	56.7	170.7
Improvement (%)	178	154	250	280	215.5	346	295	285	213	284.8

Rangelands monitored	Plant cover rate (%)					Rangeland productivity (FU/ha)				
	2018	2019	2021	2022	Average	2018	2019	2021	2022	Average
El Bhira (3,100 ha)										
Control (open for grazing)	42	50	15.667	12	34.7	49	208	64	60.7	95.4
Resting (Opportunistic grazing)	81	80	35	18	53.5	176	319	174	75.6	186.2
Improvement (%)	193	160	223	150	181.5	359	153	272	124	227
Chwamekh (3,000 ha)										
Control (open for grazing)	34.67	38	34.67	23	30.5	71	126	71	86.7	88.675
Resting (Opportunistic grazing)	63.5	52.83	63.5	38	38	212	192	212	160.8	194.2
Improvement (%)	183	139	183	165	167.5	299	152	299	185	233.8

Source: Author's creation.

Higher biodiversity

Biodiversity flourished in rested rangelands, with a floristic richness improvement of 219% in Dhaher Beni Khedache. Higher plant diversity provided essential ecosystem benefits, such as wind erosion reduction and habitat stability for native species. Monitoring rangelands under rest and, in particular, the measurement of floristic richness indicator for the effect of opportunistic grazing on biodiversity. By definition, the floristic richness is the total number of species present in the study site; it consists of recording the presence or absence of species in the target site.

Monitoring data from Dhaher Béni Khedache in Médenine illustrated that plant cover improved by 216.7%, enhancing ecosystem resilience and supporting a sustainable pastoral economy. Flora richness improved by 219% after applying the opportunistic grazing technique (Table 3).

Table 3: Effect of applying opportunistic grazing technique on biodiversity assessed by floristic richness (total number of perennial and annual species recorded) in four rested sites of Dhaher Beni Khedache

Rangeland plots	Opportunistic grazing (under rest)	Control (open for grazing)
Mthinine (3,000 ha)	40	16
Lajef Oun (2,100 ha)	25	17
El Bhira (3,100 ha)	28	12
Chwamekh (3,000 ha)	65	27
Average	39.5	18
Improvement of floristic richness, %	219	

Source: Author's creation.

The economic variability and benefits for pastoral communities, including income generation and cost-effectiveness

Results from the focus group discussion and reviewed reports highlight the significant economic benefit of opportunistic grazing practices for pastoralists and Agricultural Development Groups (GDAs).

Initially, the Dhaher Béni Khédache GDA had only 96 members and a working capital of 271 TND. After four years of implementing opportunistic grazing, membership grew to 600 and the working capital increased to 450,000 TND. The compensation received for resting grazing land allowed the GDA to establish a forage storage center, where it purchases large quantities of forage and sells it to members at a reduced price. The GDA also acquired tents and plastic water containers, which they rent out to shepherds. These improvements have helped the GDA build trust with breeders, shepherds and donors. This highlights how opportunistic grazing fosters organizational sustainability, enabling GDAs to establish critical infrastructure, such as forage storage centres, which lower input costs for members while enhancing the timely availability of resources.

Resting rangelands during favourable years led to the production and sale of high-value products such as aromatic and medicinal plants, desert truffles (*terfez* or sand truffles) and “pink garlic” (*Allium roseum* or *yazoul*). Aromatic and medicinal plants are sold in their natural form or used for distilling essential oils. Truffles are harvested and sold locally or exported to Gulf countries at relatively high prices. *Allium roseum* is gathered by families for local use as a condiment. This diversification of income sources helps mitigate economic risks for pastoralists, especially in arid regions while promoting the sustainable use of natural resources.

Results also show that beyond these immediate economic gains, the PRODEFIL project report highlighted other significant benefits stemming from the improved rangeland management practices.

For the GDA Chwamekh (Médenine), the compensation provided supported the creation of 60 jobs for skilled or farm labourers and investment in oil and flour mills. Indirectly, young people have benefited from the process through job creation, including roles as herders or in services such as maintaining solar photovoltaic panels. However, the panels are often left unguarded and damaged without consistent supervision. These developments have contributed to stabilizing local populations and reducing out-migration. In Tataouine, it was estimated that from January to June 2022, approximately 20,000 young individuals migrated to Europe due to the lack of job opportunities. These initiatives have helped retain rural populations, engage younger generations in livestock-related enterprises, and strengthen community resilience by creating employment prospects.

Opportunistic grazing at Chwamekh increased the availability of raw materials for small enterprises (aromatic and medicinal plants), encouraging 14 women to begin distilling and marketing essential oils and valorizing wool. Women have also benefited through GDA projects that focus on their involvement in value-added activities, which enhances household incomes and strengthens their socioeconomic roles in pastoral communities.

In terms of the value of environmental services, the **World Bank (2015)** highlighted that rangelands contribute significantly to pastoral profits, with 30% derived from forage provision and 70% from environmental and cultural services. Estimates indicate a value of 128 TND, representing 30% of total costs in environmental benefits, noting the broader ecosystem contribution of improving grazing practices.

This means that the value of environmental services is approximately 298 TND ($128 \times 0.7 / 0.3$). Similarly, using the focus group's estimate of 98 TND for forage provision, the environmental services would be valued at 229 TND ($98 \times 0.7 / 0.3$). These findings highlight the dual economic and ecological value of opportunistic grazing as a sustainable rangeland management approach.

Gender and empowerment and community social well-being

Empowering local pastoral communities such as GDA Dhaher and Chwamekh in Medenine

Opportunistic grazing fostered behavioural and perceptual changes among local communities, particularly with increased membership in associations like the GDAs Dhahar and Chwamek in Medenine. These groups were able to take responsibility for sharing authority over rangelands and took initiatives in grazing implementation, creating business plans and improving living conditions. For instance, rangeland resting, managed by multiple councils, saw compensation allocated directly to GDAs, enhancing local governance and community buy-in.

Sharing authority over rangelands management was an opportunity to provide the GDAs (relatively new organizations made up of young people) with more authority over rangelands, mainly through the mechanism of compensation and its administration). Previously, rigid management councils were strongly and exclusively held by the older generation, who were wary of any intervention programme for fear of losing authority.

Subsidies allocated for resting are used differently for collective and private rangelands. For private rangelands, subsidies are allocated in the form of feeds, the effects of which are short-lived and can cause an unreasonable increase in the size of herds. The subsidies allocated against the resting technique of collective rangelands are invested in creating infrastructure of

common interest, which guarantees a certain sustainability. These infrastructures are built by the administration and managed by the GDAs. Agreements signed for 11,200 hectares reflect a commitment to the long-term resilience process, evolving from initial profit-driven participation to a genuine conviction in rangeland restoration.

Constraints linked to the completion of development projects, particularly the sustainability of opportunistic grazing activities without subsidies, require a strong policy will. However, some positive signals need to be mentioned in the case of the Dhaher and Chwamekh rangelands. The GDAs, in agreement with the beneficiaries, continued resting rangeland areas without subsidies, provided that the administration paid the salaries of guardians of rangelands and water points. Agreements were signed to this effect by the two GDAs and the CRDA of Médenine. After the first resting operations were carried out according to the current rules of PRODEFIL (with subsidies), two agreements were signed for resting 8,200 ha of collective rangelands in Dhahar Béni Khedache and 3,000 ha in Chwamekh, both without subsidies. This reflects a gradual transition from acceptance, initially out of complacency or desire for profit, to a conviction and a demand for this process to improve the rangelands and their resilience.

The GDA Dhaher, previously perceived by breeders as a marginal organization, is increasingly perceived as an economic and commercial operator improving services provided to breeders and shepherds and satisfying their highest priority needs. Its membership increased from 69 to nearly 600 after six years.

The two GDAs of El Marai and Al Mostakbel in Douz actively participated in the negotiations. The first has 1,200 members and some 60,000 head of sheep, while the second has 900 members and 30,000 head of sheep. Both agree that in-kind subsidies and compensation should be avoided for the region's private rangelands that remain negligible.



▲
Panelists Capacity Development of local partners. *Photo credit: Azaiez O. Belgacem.*

GDAs' management of rangelands under opportunistic grazing in a post-revolution context is characterized by the weakening of institutions, including the "rigid" institutions of the state. This constitutes a challenge with regard to the "intrinsic" fragility of these voluntary GDA structures and the "sensitivities" of the social groups all having the right to the use of the collective rangelands of Dhaher. In addition to guarding and preserving these resting entities, GDA management (i.e. opening to grazing using selection criteria, arbitration and restriction of animal numbers) has never been tried in the previous development projects, even in more "comfortable" contexts.

Encouraging youth participation in business ventures within the arid agropastoral system

Focus group discussion findings.

Young people and women have indirectly benefited from opportunistic grazing of rangelands. Young people are increasingly attracted to the livestock sector, with job opportunities emerging as guards or in service activities such as maintenance of photovoltaic panels.

However, the absence of adequate guarding has resulted in some panels being abandoned and damaged, highlighting a need for improvement. Women have also benefited through GDA-supported projects that promote wool valorization, offering them opportunities for economic empowerment.

The PROFIFIL project reported that opportunistic grazing practices implemented in the Chwamekh community led to a marked increase in the availability of aromatic and medicinal plants. This improvement enabled 14 women to engage in distilling and marketing these plants, creating new entrepreneurial opportunities and sources of income.

Improved living conditions for guardians, breeders and shepherds in pastoral areas have significantly contributed to the sustainability of pastoral activities and extensive livestock breeding. These enhancements make these professions more attractive to young people by providing competitive remuneration and working conditions that align with modern standards, ensuring the continuity of these traditional roles (Table 4).

Study population

Table 4. Activity, indicator and number of participants involved in rangeland resting activities

Activity	Indicator	Number
Dissemination of improved grazing practices	Number of ha in relation to land tenure and beneficiaries	Médénine: 7,000 ha private rangelands, 2010 female small ruminants, 189 beneficiaries 12,000 ha collective rangelands, 31,000 female small ruminants, 1,500 beneficiaries Tataouine: 27,000 ha private rangelands, 560 beneficiaries 84,000 ha collective rangelands, 1,600 beneficiaries Kébili: 50,000 ha collective rangelands, 2,100 beneficiaries, 90,000 female small ruminants
Valuation of the ecosystem	Number of women extracting and marketing essential oils	14 women in Beni Khedache, Medenine
Capacity development	Number of people trained	263, including 75 women
Accompanying measures		
Total		(189+1,500+560+1,600+2,100+263) = 6,212 beneficiaries

Source: Author's creation.

Capacity building

A series of targeted training workshops and on-the-job sessions were implemented as part of a comprehensive capacity development initiative to enhance rangeland and silvopastoral management. These sessions were designed to impart the knowledge, skills and practical tools people would need to assess rangeland conditions, determine grazing land capacity and establish optimal grazing timing and carrying capacity to ensure long-term rangeland sustainability. The training covered essential topics related to sustainable land management, ecosystem restoration and the delivery of ecosystem services, with a strong focus on practical skills such as vegetation cover surveying

and analysis, rangeland productivity assessment, carrying capacity estimation and plant species identification and classification. These skills are necessary to implement sustainable grazing management programmes that balance productivity and ecological health.

A dual approach combining train-the-trainer and on-the-job training methods was adopted to ensure the effective application of knowledge gained in workshops. This approach provided participants with theory and practical experience. On-the-job training, in particular, was invaluable in giving staff hands-on experience in the field, enabling them to apply theoretical knowledge to real-world rangeland conditions.

Trainees actively participated in activities such as assessing vegetation cover, calculating carrying capacity and evaluating land productivity across various rangeland environments.

These interactive sessions emphasized a learning-by-doing methodology, allowing participants to gain confidence and develop essential problem-solving skills. This approach enhanced their practical expertise and empowered them to make decisions that directly contribute to the sustainability of grazing systems.

The on-the-job and train-the-trainer components focused on promising young staff from key institutions involved in rangeland management, including the Office of Livestock and Pastures (OEP), the Commissariat Régional Développement Agricole (CRDA), the Institut des Régions Arides (IRA) and other national and local development agencies. These staff members were specifically selected for their potential to become trainers and were trained to pass on their newly acquired knowledge and skills to colleagues within their institutions. The trained staff became integral to the national programme's efforts to implement innovative, science-based grazing and rangeland management methods, such as opportunistic grazing, to promote rangeland restoration through natural regeneration. The training integrated advanced tools such as LandPKS and VegMeasure with traditional methods to improve rangeland monitoring and management accuracy and efficiency. These digital tools provide users with detailed, location-specific data, helping them to monitor and manage rangelands in a more precise and informed manner. By combining these modern tools with traditional knowledge, staff can approach rangeland management holistically, ensuring that grazing practices align with ecological sustainability goals.

To acknowledge the vital role of these trained professionals, it was recommended during the stakeholders' meeting on opportunistic grazing to submit a list of engineers' names to the Ministry of Agriculture for formal recognition, enabling them to perform their duties effectively and sustainably

in rangeland management programmes (Nefzaoui, et al., 2024).

The stakeholders involved in these capacity-building initiatives included a diverse range of professionals, including engineers, technicians, researchers and experts from government agencies such as OEP, CRDA, IRA and other development organizations. Pastoralists and livestock keepers, the primary users and managers of rangelands, also played a key role in the training sessions, particularly those focused on sustainable grazing management and carrying capacity principles. These collaborations ensured that the training was theoretically sound and grounded in the practical realities faced by those working directly with the land.

A total of 263 participants attended the capacity development events, with women comprising approximately 21% of the attendees. This demonstrates ongoing efforts to increase women's participation in technical fields related to agriculture and rangeland management. Some workshops, such as those on silvopastoral restoration and rangeland plant identification, saw women's participation rates up to 34%. This inclusive approach helps foster a more diverse, gender-balanced workforce in rangeland management, encouraging greater innovation and collaboration across all levels of stakeholders (Appendix 2).

Opportunistic grazing has proven highly effective in restoring degraded arid rangelands, enhancing livestock productivity and ecosystem health. Livestock performance improved significantly, with a 10% increase in sheep and goat fertility and prolificacy, alongside cost savings from reduced feeding expenses. These economic benefits were complemented by balanced herd growth and ecological sustainability. Ecosystem restoration efforts led to a sixfold increase in collective rangeland productivity, a 270% improvement in vegetation recovery and significant biodiversity gains, including the return of extinct species. This transformation strengthened ecological resilience and supported sustainable pastoral economies.

Economic and ecological benefits from resting grazing lands were substantial, with annual values ranging from 9.55 million to 12.48 million TND. Environmental services constituted 70% of pastoral profits, underscoring their importance in sustainable land management. Improved forage availability was notable, generating four million feed units annually from 19,000 hectares, equivalent to 4,000 tons of barley, while reducing wind erosion and improving soil moisture retention.

Empowered local communities were central to the success of this approach. Groupements de Développement Agricole (GDAs) played a transformative role in fostering collective rangeland management, infrastructure development and sustainable practices. Membership in GDA Dhaher surged from 69 to nearly 600 in six years, reflecting community buy-in and commitment. Capacity-building initiatives equipped 263 individuals, including 75 women, with skills in sustainable grazing and ecosystem management, supported by integrating modern tools like LandPKS and VegMeasure to enhance precision in rangeland monitoring. Women gained new economic opportunities, engaging in activities like essential oil distillation and wool valorization, while youth found employment as rangeland guards and service providers, driving local innovation and sustainability.

The impact on ecosystem services was equally impressive, with a 216.7% increase in plant cover under resting management compared to open grazing. Enhanced vegetation recovery reduced wind erosion, stabilized soil and boosted moisture retention, supporting healthier ecosystems. Early reliance on subsidies transitioned to autonomous rangeland management, demonstrating the community's growing conviction in sustainable practices.

Opportunistic grazing has emerged as a transformative and inclusive strategy for restoring rangeland ecosystems, enhancing biodiversity and promoting sustainable livelihoods. Empowered local governance, robust capacity building and the creation of economic opportunities for women and youth have contributed to its success. This approach offers scalable solutions for addressing land degradation in other arid regions and provides a blueprint for sustainable land management that balances ecological restoration with socioeconomic resilience.



▲
Small ruminant grazing: degraded rangeland (top) compared to a restored rangeland site using opportunistic grazing (bottom) in southern Tunisia. Photo credits: ©Mounir Louhaichi.

6

Conclusion

The project has achieved commendable progress in improving governance, restoration practices and inclusive participation, positively affecting 180,000 hectares and empowering 6,212 beneficiaries. Women's participation and the creation of sustainable economic opportunities underscore the initiative's commitment to equity and resilience.

The evidence-based success of opportunistic grazing offers a replicable and scalable blueprint for sustainable land management. With its transformative impacts on ecological restoration, socioeconomic empowerment and community-led governance, this approach is poised to contribute significantly to the overarching goal of sustainably managing and restoring 400,000 hectares of degraded rangelands while fostering inclusive development

An integrated approach that combines opportunistic grazing during favourable years with resting techniques has been adopted to address rangeland degradation due to poor grazing management. This approach centres on rural pastoral communities and their institutions (GDAs) as key partners in all interventions. Key components include

- ▶ (i) strengthening national capacities across all relevant dimensions,
- ▶ (ii) piloting, demonstrating and scaling up innovative technologies and practices, including traditional systems like the *gdel* system and adapting these local methods to fit current social, economic and cultural contexts,
- ▶ (iii) generating and disseminating new data, information and knowledge and
- ▶ (iv) accelerating ground-level actions by building communities of practice to share experiences, best practices and lessons, while fostering demand-driven partnerships that benefit Tunisia.

Opportunistic grazing presents a promising ecological and economic revitalization framework in arid rangelands. By enhancing livestock productivity, lowering feed costs, generating additional income and strengthening ecosystem services, this approach provides a scalable solution for degraded landscapes. It promotes long-term environmental health and economic resilience within arid pastoral communities. These findings underscore that opportunistic grazing offers a balanced strategy for conserving degraded rangelands, improving vegetation cover and supporting sustainable livestock production.

Incorporating such practices into land management policies could be instrumental in combating land degradation and sustaining pastoral livelihoods.

These efforts align with the needs and preferences of pastoralists, which greatly encourages the adoption of opportunistic grazing schemes. Beyond the work of the Office of Livestock and Pastures, we have also observed that opportunistic grazing innovations have been institutionalized and supported by development projects under the Ministry of Agriculture, specifically within collective rangelands as part of the IFAD-funded PRODESUD and PRODEFIL projects.

Furthermore, the initiatives undertaken through the Livestock and Climate Initiative have led to the formation of well-trained operational teams for rangeland monitoring and management. These teams are now ready to sustainably manage pastoral resources while addressing environmental shocks and adapting to climate change.

Recommendations

Harmonize existing legal texts, particularly concerning compensation (extend compensation for resting private rangelands to also include collective rangelands). Communal rangelands represent about 80% of all rangelands in the country's south.

Prepare a list of pastoral governance experts in the Regional Agricultural Development Commissions of Médenine, Tataouine and Kébili and begin the necessary steps for their formal recognition (ministerial decree); this is a valuable achievement as many technicians have received the training necessary to make informed decisions during the implementation of opportunistic grazing.

A draft pastoral law project has been developed by ICARDA in collaboration with the General Directorate of Forests. This law is necessary for the good governance of rangelands and needs to be updated and submitted to the relevant authorities for approval and formal recognition by the government.

Finally, it is necessary to support concerned departments, such as the Directorate General of Forests, in using modern geographic information tools to map and delineate rangeland areas. This will improve their management and protect them from any misuse. These lands are the last stronghold against desertification.

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Appendix 1.

Guideline of the semi-structured interview

The process

- ▶ 1.1. Genesis of the innovation
- ▶ 1.2. Concept/design of the process
- ▶ 1.3. Implementation of the process
- ▶ 1.4. Stakeholders involved.
- ▶ 1.5. Participatory vs top-down approaches
- ▶ 1.6. Formalization of the agreements
- ▶ 1.7. Tools used for conflicts management.
- ▶ 1.8. Devolution of the pastoral space governance

Achievements/ Results

- ▶ 2.1. Rangeland area under opportunistic grazing and its evolution
- ▶ 2.2. What is the current situation?
- ▶ 2.3. What is the estimated amount of biomass gained by the opportunistic grazing.
- ▶ 2.4. Is there any improvement in biodiversity of both annual and perennial species?
- ▶ 2.5. What is the estimated improvement of the flock's productivity or the flock's size?
- ▶ 2.6. What is the estimated improvement of end-user's income?
- ▶ 2.7. How much is the estimated reduction of feeding costs due to opportunistic grazing?
- ▶ 2.8. What is the amount of government/project incentive received per surface area?
- ▶ 2.9. As an individual or as a community, how did you use the incentives received?
- ▶ 2.10. What are the climatic shocks or events during the implementation of the opportunistic grazing and their impact on the rangelands?
- ▶ 2.11. What is your assessment (degree of satisfaction or dissatisfaction) of opportunistic grazing, especially in relation to soil type and climatic shocks?
- ▶ 2.12. Using a Likert scale (1 to 5), estimate the degree of compliance of end users with the grazing rules of the innovation.
- ▶ 2.13. What measures are taken in case of non-respect of the opportunistic grazing rules?

Constraints

- ▶ 3.1. What are the major constraints you faced in implementing the opportunistic grazing technique?
- ▶ 3.2. What are the constraints engendered or faced by the end users?
- ▶ 3.3. What are the constraints faced with the management councils?
- ▶ 3.4. What are the constraints the community or individuals face with the regional or national agricultural authorities?
- ▶ 3.5. What are the constraints engendered by climate variability and/or shocks like droughts or heat waves?
- ▶ 3.6. What are the constraints related to funds availability?
- ▶ 3.7. What are the constraints related to flocks from the community or the neighbours?

Impacts

- ▶ 4.1. As stakeholders what are the positive and negative impacts of the opportunistic grazing?
- ▶ 4.2. What is the financial impact of this innovation on the community and livestock owners?
- ▶ 4.3. As stakeholders are you willing to adopt this approach? If yes, what is required? If not, for what reason?
- ▶ 4.4. What is the impact of this innovation on your household's members, especially on women and youth?
- ▶ 4.5. Based on your experience, what is the impact of opportunistic grazing on the environment in general?
- ▶ 4.6. What is the impact this innovation has on your income and livelihoods?

Outcomes

Outcomes are the changes you expect to result from opportunistic grazing. These can be changes in individuals, systems, policies or institutions. Ask stakeholder to designate three major outcomes achieved by regenerative grazing.

Recommendations

- ▶ 6.1. Can this innovation be improved further (flexibility)?
- ▶ 6.2 Should farmers benefiting from opportunistic grazing continue to receive incentives during a favourable year when grazing is open?
- ▶ 6.3 What alternative incentives should be in place to guarantee the sustainability of this type of management?
- ▶ 6.4. What measures should be in place to implement such a grazing scheme in communal rangelands?

Appendix 2.

Capacity building

Title	Date	Key areas covered / Objectives
<i>Group Training Course: Techniques of Survey of Vegetation Cover and Determination of Carrying Capacity</i>	<i>Feb 28-29, 2024</i>	Gain sufficient knowledge about environmental sciences and rangeland management. Acquire the appropriate skills to collect and analyze vegetation cover characteristics data. Acquiring sufficient skills to determine the condition of the rangelands and the appropriate ways to improve their productivity. Accurate determination of carrying capacity and the suitable grazing management programme.
<i>On-the-Job-Training in Rangeland Survey and Restoration</i>	<i>Nov 1-2, 2023</i>	The objective of this training is to enhance and build the capacity of Engineers and technical staff involved in rangeland survey, management and development from various institutional partners and stakeholders.
<i>Training -of -Trainers in Rangeland Monitoring & Assessment: Integrating LandPKS, VegMeasure and Traditional Methods</i>	<i>25 March to 10 April 2023</i>	The primary aim of these events is to enhance trainers' capacity in rangeland monitoring, assessment and data collection, enabling effective knowledge transfer and strengthening institutional capacity. This, in turn, supports local institutes in providing informed recommendations to decision-makers, contributing to national development.
<i>Resting Technique Workshop</i>	<i>7-22 July</i>	The objective of this workshop is to strengthen institutional arrangements that link national developing agencies dealing with rangeland rehabilitation and management with the end users (pastoralists and livestock keepers).
<i>Group Training Course: Silvopastoral systems: Improvement and Evaluation</i>	<i>Nov 1-5, 2021</i>	The course aimed to develop and improve the skills of participants in learning the principle of experimental design, data collection and analysis, the overview of sustainable rehabilitation techniques for silvopasture systems in semi-arid Tunisia, demonstrating silvopasture monitoring and assessment methods, learning directly from experts representing national development agencies and sharing experiences on improvements used in different regions.
<i>Developing a Rangeland Restoration and Rehabilitation Toolbox (Experts meeting)</i>	<i>16-18 April 2019</i>	Exchanges on terminologies, tools and techniques for restoring and rehabilitating rangelands Case study, approaches and lessons learned Define and describe key sustainable rangeland management practices Contribution to the development of a practical guide (Toolbox) for the restoration and rehabilitation of rangelands. Illustrate how the toolbox is used (context/site-specific) through scenarios from the region.

	Participants	Women	Monitoring, Evaluation and Learning link	CG space link
	28	12	https://hdl.handle.net/20.500.11766/69416	https://hdl.handle.net/10568/149126
	13	4	https://hdl.handle.net/20.500.11766/68982	https://hdl.handle.net/10568/137312
	6	1	https://hdl.handle.net/20.500.11766/68818	https://hdl.handle.net/10568/134768
	27	3	https://hdl.handle.net/20.500.11766/67898	https://hdl.handle.net/10568/126891
	25	10	https://hdl.handle.net/20.500.11766/66964	
	11	2	https://hdl.handle.net/20.500.11766/66479	

Title	Date	Key areas covered / Objectives
<i>Rangeland Improvement using Rest Technique in Southern Tunisia</i>	17-19 July 2019	The objective of this workshop is to explore the potential for using improved pastures that are part of a resting programme during years of favourable rainfall. This would be done after evaluating their productivity using scientific and technical indicators that guide their optimal exploitation. Furthermore, this approach aims to enhance the working methodology of the Office of Livestock and Pasture in Tunisia, supporting its efforts in sustainable pasture management.
<i>On the job training Rangeland Assessment and Monitoring</i>	26 Feb to 20 March 2020	The main focus of this training was on rangeland inventorying and monitoring and aimed to develop and improve the capabilities of engineers and technicians in the Office of Livestock and Pastures (OEP) of Medenine and Tataouine governorates. Furthermore, the training presented an opportunity to evaluate and assess recovery potential of the natural vegetation following the adoption of controlled grazing management of restored sites.
<i>Group Training Course on Rangeland Plant Identification and Vegetation Classification</i>	19 -21 Feb2019	The course training session was implemented to equip participants with plant identification skills. The audience were engineers and technicians of the Office of Livestock and Pasture (OEP) and other departments and universities.
<i>Group Training Course on Rangelands Plant Terminology and Basic Plant Identification</i>	11-14 Dec 2018	This course aimed to develop and improve the capabilities of engineers and technicians in the Office of Livestock and Pasture (OEP, Tunisia) and other governmental departments and universities on the identification and classification of rangeland plants by conducting field surveys and statistical analyses to identify plant species and the vegetation communities they belong to.
<i>Group Training Course: Rangeland Monitoring & Assessment Training Workshop</i>	10-14 April 2017	The aim of the training course is building capacity of the engineers and technical staff involved in rangeland management and development from the Office of Livestock and Pastures (OEP), Commissariat Régional Développement Agricole (CRDA - Tataouine) and Institut des Régions Arides (IRA - Medenine).
<i>International Conference: Balancing livestock production and sustainability of natural resources</i>	Sept 25-27, 2023	At the FAO Global Conference on Sustainable Livestock Transformation in Rome (September 25-27, 2023), the presentation highlighted livestock's critical role in supporting over one billion people and covering 54% of global land amidst rangeland degradation and underinvestment. It emphasized livestock's contributions to transforming inedible vegetation, providing nutrition and fostering ecosystem health while noting the significant water use and dual impacts on soil health (42% of agricultural water for feed). The presentation called for an integrated, agro-ecological approach to livestock management, advocating for best practices, innovative technologies and increased research to balance livestock production with responsible resource use.

	Participants	Women	Monitoring, Evaluation and Learning link	CG space link
	24	4	https://hdl.handle.net/20.500.11766/13574	
	5	0	https://hdl.handle.net/20.500.11766/12331	
	28	10	https://hdl.handle.net/20.500.11766/10066	
	32	11	https://hdl.handle.net/20.500.11766/9062	
	28	8	https://hdl.handle.net/20.500.11766/9065	
	1		FAO Global Conference on Sustainable Livestock Transformation	Conference: FAO Global Conference on Sustainable Livestock Transformation

Title	Date	Key areas covered / Objectives
<i>International Conference: How can extensive grazing be beneficial for the restoration of dryland ecosystems?</i>	29 Sept 7 to October 2022	Presentation on knowledge on the beneficial role of extensive grazing for the restoration of dryland ecosystems. The presentation was given by Dr. Mounir Louhaich during the FAO-GLF Digital Forum. The digital forum is hosted jointly by the Global Landscapes Forum and the Food and Agriculture Organization of the United Nations.
<i>International Forum: Scalable measures for sustainable large-scale rangelands rehabilitation</i>	May 29-3, 2022	ICARDA participated in the International Exhibition and Forum for Afforestation Techniques held at the Riyadh International Center, organized by the Saudi Ministry of Environment, Water and Agriculture, in cooperation with the National Center for the Development of Vegetation Cover and Combating Desertification, May 29-31. Dr. Mounir Louhaichi gave a presentation on sustainable large-scale rangelands rehabilitation in the dry areas.
Not relevant or directly involved		
<i>Agroforestry for Sustainable Production and Resilience Landscape</i>	24-27 July 2019	
<i>Sustainable Silvopastoral Restoration to Promote Ecosystem Services in Tunisia</i>	21-22 March 2019	To discuss the best approaches needed to establish and manage silvopastoral system practices, with a special focus on the silvopastoral pilot site in Sbaihia, Tunisia.

Participants	Women	Monitoring, Evaluation and Learning link	CG space link
1		Conference: 8th World Forest Week: FAO-GLF DIGITAL FORUM: Transforming agrifood systems with forests	https://www.fao.org/forest-monitoring/resources/videos/videos/fao-glf-digital-forum-transforming-agrifood-systems-with-forests/en
1		The Food and Agriculture Organization Participates in Greening Arabia (The International Exhibition and Forum for Afforestation Techniques) United Nations in Saudi Arabia	International Exhibition and Forum on Afforestation Technologies kicks off in Riyadh
1		https://hdl.handle.net/20.500.11766/10387	
32	10	https://hdl.handle.net/20.500.11766/9812	



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The CGIAR Research Initiative on Livestock and Climate is designed to address the challenges that climate change poses to livestock production, providing livestock-keeping communities with the support they need without accelerating greenhouse gas emissions or degrading land, water, and biodiversity.

To learn more about this Initiative, please visit [this webpage](#).

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