CGIAR Livestock, Climate and System Resilience

Capacity Development: Traveling Workshop

SILVOPASTORAL SYSTEM RESTORATION UNDER CHANGING CLIMATE AND LAND USE: IMPROVING SUSTAINABILITY AND EFFICIENCY

19–21 October 2022, Tunisia

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CGIAR Livestock, Climate and System Resilience

ABOUT LIVESTOCK, CLIMATE AND SYSTEM RESILIENCE (LCSR) INITIATIVE

Livestock, Climate and System Resilience (LCSR) One CGIAR global initiative aims to directly enable 600,000 producers (at least 40% women) in nine countries to better prepare for and manage uncertain futures by improving security of access to resources and adopting management practices that enhance their climate-related adaptive capacities (livestock assets) while ensuring household equity and reducing GHGe intensities.

Objective

This Initiative aims to address the "double burden" that climate change poses for livestock production across Africa and Latin America. Researchers are working with public and private actors to identify existing solutions and to co-create and deliver innovations that quantifiably help producers, businesses and governments adapt livestock agrifood systems to climate change and reduce greenhouse gas emissions.

Activities

- **Improving local capacities and inclusion in livestock production** through biometric and socioeconomic analysis of proposed on-farm technology packages to support inclusive scaling of resilient low-emission practices.
- **Developing digital services to manage climate risk and inform decision-making in livestock agrifood systems** by co-designing, testing and scaling digitally enabled services that bundle tailored climate information, risk transfer and credit strategies.
- **Undertaking system-level research and interventions for climate-resilient and low-emission livestock production systems**, focusing on understanding, measuring and rebuilding climate resilience within pastoral systems, with research-to-development partnerships that optimize scaling a priority.
- **Helping finance the transition to low-emission and resilient livestock agrifood systems** by creating a research program that builds investor awareness of and confidence in livestock investments with stated resilience and emission goals.
- **Improving the enabling policy environment** by generating data and developing systems to improve the design and implementation of policies and investment proposals at national and global level and supporting governments to monitor and quantify livestock contributions to climate commitments.

Engagement

This Initiative is working in Colombia, Guatemala, Senegal, Mali, Ethiopia, Kenya, Tanzania and Tunisia.

Outcomes

1. At least 80,000 households implement climate-smart practices and technologies that enable them to withstand climate shocks, reduce greenhouse gas emissions and generate benefits for women, as well as men.
2. At least 320,000 livestock producers (50% women and youth) and 13 public and private organizations access climate risk management strategies.
3. Pastoralists and farmers adopt improved governance, management and restoration practices on 500,000 hectares of land used for livestock production.
4. Impact investors, private-sector entities and international finance institutions mobilize US$25 million for socially inclusive resilience-building and/or low-emission livestock agrifood systems interventions.
5. International agencies and policymakers use the Initiative's products to shape at least four policies or investments to strengthen socially inclusive low-emissions livestock production system resilience, including at least three aimed at realizing climate change-related adaptation or mitigation progress.

Impact

CLIMATE ADAPTATION & MITIGATION

NUTRITION, HEALTH & FOOD SECURITY

POVERTY REDUCTION, LIVELIHOODS & JOBS

GENDER EQUALITY, YOUTH & SOCIAL INCLUSION

ENVIRONMENTAL HEALTH & BIODIVERSITY

Table of Contents

List of Acronyms 5
1. BACKGROUND 6
2. OBJECTIVES 8
3. TARGET SITES 8
4. SPEAKERS REMARKS 9
5. BENEFITS OF SULLA 11
5.1. Establishment of the sulla cultivation: 12
5.2. Use and conservation of the sulla production: 12
5.3. Advantages of two years cultivation: 12
6. LOCAL COMMUNITY INTERACTION AND DISCUSSION 12
7. RECOMMENDATIONS 14
REFERENCES 15
Appendix 1. Sulla Factsheet 16
Appendix 2. List of Participants 18

List of Acronyms

ASP	Agrosilvopastoral
CGIAR	formerly the Consultative Group for International Agricultural Research
DGF	Direction Générale des Forets
DM	Dry Matter
ESAM	Ecole Supérieure d'Agriculture de Mateur
FAO	Food and Agriculture Organization of the United Nation
GDA	Groupement de Développement Agricole
ICARDA	International Center for Agricultural Research in the Dry Areas
LCSR	Livestock, Climate and System Resilience
OEP	Office de l'Elevage et des Pâturages

1. BACKGROUND

For centuries, the strategy for alleviating pressure on resources was to move from one area to other. The more recent sedentary land-use leads to overgrazing supported by the massive use of cheap supplemental feed (Martínez-Valderrama 2018). Improper management of arable land and overgrazing, under adverse climatic conditions – droughts, intense rainfall events, wind storms– has triggered rangelands degradation (Del Barrio et al. 2016). Degradation of rangelands highlight a critical need for the development of appropriate management strategies that enhance the sustainable use of natural resources. Silvopastoral production systems are very important ecologically, economically, and socially. They provide a range of ecological services including nutrient cycling, pollutant filtering, and biodiversity preservation. They also serve as a resource base for livestock production – a key source of income and livelihood. However, these ecosystems are suffering from cultivation encroachment, overgrazing, and harsh climatic conditions; particularly recurrent droughts (Alonso 2011; Chará et al. 2019).

Agrosilvopastoral systems (ASPs) provide a range of livelihood services, either directly through forage production or indirectly by the beneficial effects on soil conservation, nutrient cycling, pollutant filtering, and biodiversity enhancement. Agrosilvopastoral systems are also a promising integrated natural resources management system that combines trees, shrubs, crops, pasture, fodder, and animals to improve production and environmental outcomes in pastoral landscapes (Muthee et al. 2022). This integration offers great potential to increase production and diversification, enhance ecosystem services, and support rural livelihoods (Reith et al. 2020). However, efficiently using available resources within these systems is the key to sustainability and this requires in-depth knowledge and innovative techniques along with modern management to intensify land productivity (Reyes et al. 2017). Henceforth, improved silvopastoral systems have ample scope to rehabilitate degraded pastures to sustain livestock production, which remains a strong pillar for the livelihoods of the agrosilvopastoral communities (Louhaichi et al. 2021).

ASPs in the drylands are more challenging, they are characterized by variable biophysical elements, notably poor soil quality, low rainfall, recurrent drought, high stocking rates, and very poor vulnerable people who constantly cope with food scarcity. In north and central Tunisia, the overexploitation of ASPs is common and dates back to ancient times. Today, valuable resources are not sustainably managed in either social or environmental

terms. Improving ASPs is critical. One option is reseeding forage species established on natural pastures (Louhaichi et al. 2022; Slim et al. 2021).

To improve the productivity, resilience and livelihoods of agrosilvopastoral communities, ICARDA, the United Nations Food and Agriculture Organization (FAO), and the Direction General des Forêts de Tunisie (DGF) initiated a process for developing and implementing interventions in Sbaihia community pilot site. The process involves six steps: i) diagnose site-specific needs, ii) identify obstacles, iii) identify stakeholders, iv) adopt a participatory multidisciplinary approach. v) implement proven technologies aimed at sustainable development of the silvopastoral production system with a focus on climate change adaptation, and vi) enhance the capacity of all concerned parties.

The success seen at this pilot site has boosted willingness to scale out this approach to other farmers in the same site and to other areas within Tunisia to improve the livelihoods.

To start scaling out, the General Directorate of Forests planned to expand the Sbaihia community pilot site area by including more interested farmers and to repeat the same process in in other sites like the Gueffaya community site with the aim of providing feed and present new livestock feed and forage intervention options.

One successful sustainable silvopastoral practice was reseeding ecosystems with sulla (*Hedysarum coronarium*), a native biannual forage legume species providing feed and grazing biomass for livestock as well as soil and water conservation. However, it was found sulla cultivation adoption is faced with challenges of the inadequate supply of sulla seeds and farmers lack technical knowledge in sulla crop management practices.

To overcome these barriers and to scale up, ICARDA and the General Directorate of Forests, in collaboration with the Provincial Directorate of Forestry, developed a program for providing sulla seeds and technical assistance to smallholder farmers.

Therefore, travelling workshop was conducted during 19–21 October 2022. Participants were farmers from Oued Sbaihia and Gueffaya, Mannouba Governorate (58 farmers from Oued Sbaihia and 66 farmers from Gueffaya) experts from ICARDA, the General Directorate of Forests, and the Higher School of Agriculture of Mateur.

2. OBJECTIVES

The main objective of the traveling workshop was to increase awareness of farmers about sustainable silvopastoral restoration under changing climate and land use. Specific objectives include 1) demonstrate best practices for introducing forage legume species (sulla), multi-purposes shrub/tree and grazing management and 2) distribute sulla seeds to interested farmers.

3. TARGET SITES

The Sbaihia community site (36°27'34.86"N, 10°13'52.17"E) is in the Zaghouan Governorate, Tunisia (Figure 1). The target area cover approximately 5,000 ha. Of which around 2,000 ha is occupied by forest land and 100 ha is purely pastoral area. Both are managed by the forestry department (DGF). The surrounding area is private land managed by livestock owners who would be allowed to have their animals graze once the site is rehabilitated. It is characterized by rugged terrain with structural surface limestone outcrops and marl. The altitude ranges from 180 to 200 m above sea level. Soils are shallow (0.5 to 1 m), poorly permeable and often showing crusts with a silt loam texture (47% silt, 29% sand, and 24% clay). The natural vegetation is highly degraded Mediterranean garrigue with very sparse individuals of *Olea europea, Eryngium campestre,* and *Rosmarinus officinalis*. The climate is semi-arid with an annual rainfall ranging from 350 to 600 mm.

Figure 1. Map of Sbaihia site showing the current landscape and associated vegetation types.

The Gueffaya community site (36°48'31.85"N, 9°37'07.96"E) covers an area of about 10,000 and is located in Mannouba Governerate, Tunisia. (Figure 2). The site includes 400 households and over 2,400 inhabitants representing Gueffaya, Mallaha, Jnaydia, and Lansarine communities. The average annual precipitation is between 400–500 mm. The soil is classified as clayey and gypsum-marl. Native vegetation is dominated by *Stipa tanacissima, Lygeum spartum, Rosmarinus officinalus, Thymbra capitata, Calicotome villosa* and *Plantago albicans.* The area is grazed by dairy and beef cattle (300 head), sheep (5,000 head), and goats (800 head). Forty hectares of this area is cultivated with olive trees (2,300 trees), 50 ha have transplanted Aleppo pine, 50 ha have been improved with Acacia, 55 ha with sulla, and 100 ha are covered in old forest plantations (Aleppo pine and Eucalyptus).

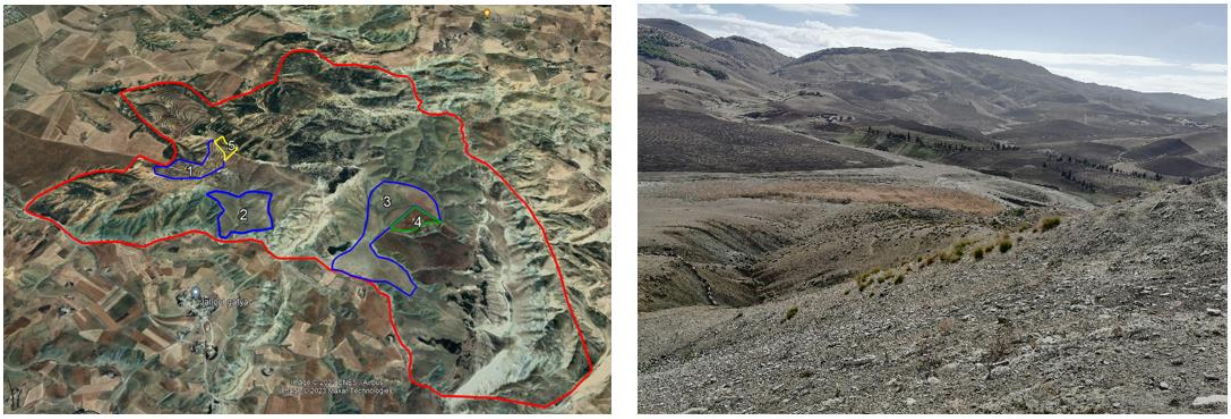

Figure 2. Map of Gueffaya site showing the plots of sulla cultivation, landscape and associated vegetation types.

4. SPEAKERS REMARKS

Mr. Jamel Kailene, Director of Rangeland Development at the General Forestry Administration, welcomed all participants and expressed his gratitude to the community members for their active cooperation in the program (Figure 3). He emphasized the importance of involving all stakeholders to reach the goal of long-term profitability through sustainable productive silvopastoral systems. An important success factor was the active collaboration between international organizations such as ICARDA and national

organizations, including development and research organizations (e.g., General Forestry Administration (DGF), Livestock and Pasture Office (OEP), Higher School of Agriculture of Mateur (ESAM) as well as farmers and pastoralists.

The success of the participatory approach in the Sbaihia pilot site resulted in transformative changes in the DGF and OEP approaches to including farmers in forest and rangelands restoration and rehabilitation.

Figure 3. Participants in silvopastoral system management traveling workshop in Sbaihia and Gueffaya, Tunisia.

By applying this approach, all involved parties are winners. The objective set by the government can be achieved, farmers will be trained on how and when and for how long to use resources while their own capacities are enhanced through training and frequent meetings. Overall, the site can be sustainably improved. To reduce pressure on these lands, we started the program of encouraging the farmers to grow their own forage crops with high value for their animals. The farmers participating in the Silvopastoral System Restoration Program can get sulla seeds along with information about cultivation and use.

Mr. Kailene added that local communities have a major role to play in this program because they have deep knowledge of their local area and technical, practical, historical, and cultural insights. The engagement of local communities in the program encourages responsibility and accountability by enhancing community ownership of these state lands.

Mr. Kailene stressed the importance of these areas as efficient pastures for livestock grazing. The aspect that determines silvopastoral system sustainability is maintaining these ecosystems and their functions. Damaging s site is a loss for everyone.

The farmers confirmed that one reason for the absence of pasture management is the lack of water in Oued Sbaihia. There is an existing well, but it needs to be reconstructed. Mr. Kailene pledged that the General Directorate of Forests would ensure the preparation of a watering point for animals.

Dr. Sawsan Hassan also emphasized the importance of cooperation between local communities and government and international organizations to achieve the program goals. She expressed her appreciation for the full participation of women in the program and said the commitment of all parties is the key to the success of this program. Dr. Slim Slim reviewed the importance and benefits of sulla fodder, when it should be seeded, and how it should be grazed for best results.

5. BENEFITS OF SULLA

Sulla is highly palatable, nutritious and productive forage for ruminant production. It is cultivated throughout the Mediterranean basin, where it is extensively grown as a 2-year forage crop for grazing and/or hay and/or silage production. The species plays a key role in cereal-based systems of semi-arid regions, particularly in organic and low-input agriculture, and is commonly used to enhance the productivity and sustainability of farming systems.

One of the main values of sulla is its water requirement coupled to its ability to provide large amounts of palatable forage in steppe areas. There has been a growing interest in sulla due to its excellent adaptability to marginal and drought-prone environments, versatility as a good quality, high-protein forage crop, and its moderate levels of condensed tannins beneficial to ruminant production. Sulla is also a melliferous plant (Appendix 1).

The main three points raised during field day are:

5.1. Establishment of the sulla cultivation:

- A plowing of 20-25 cm is indicated or a passage of chisel to 30-35 cm of depth.
- Usually sown from the end of September.
- The density per ha is 25 - 40 kg of seed in pods.
- Depth of seeding is generally superficial from 1 to 2 cm deep.

5.2. Use and conservation of the sulla production:

- Sulla is suitable as green forage crop or grazing or for hay or silage.
- Sulla should be cut at early flowering as the stems can become woody after flowering and quality will be much lower despite higher yields.
- Sulla makes good silage. Including large amounts of sulla in silage (e.g., 75% and above) wilting may be necessary. A good fermentation was achieved when sulla was ensiled at a dry matter (DM) content of at least 35%.
- For hay, it should be cut before peak flowering, preferably around 10% flowering.

5.3. Advantages of two years cultivation:

- During the establishment year, sulla should be lightly grazed to ensure good root development and plant density in the second year.
- Sulla does not tolerate heavy grazing as the relatively high soft crowns and succulent stems can be easily damaged by heavy grazing.
- In its first year, sulla gives about 20 - 30 T of green fodder/ha and in the second year it can reach 30 - 50 T of green forage/ha.
- It should be grazed when it reaches about 40–50 cm in height.
- Sulla is best managed by cutting for forage/silage or strip grazing.
- When grazing, it is advisable to move large numbers of stock onto small areas for rapid grazing and prompt stock removal when the desired grazing height is achieved.

6. LOCAL COMMUNITY INTERACTION AND DISCUSSION

- Since the workshop was interactive, the farmers shared their knowledge of sulla with the speakers and the other participants. The local community has ancient

knowledge of sulla benefits and recognize that it is ideal for animal feeding (sheep, goat and cattle) and for soil protection (reinforcement in organic matter and protection against water erosion). However, farmers appear to totally ignore its requirements, exploitation and its conservation. The major problem encountered is the unavailability of sulla seeds in the market, which reduces the overall cultivation of sulla in the region.

- After the sulla workshop, farmers wishing to cultivate sulla indicated that they have benefited from a quantity of free sulla seeds (Figure 4) provided by DGF of 20 kg and this from sowing areas of 0.5 to 1 ha.
- The aim of distributing the seeds of the sulla for cultivation on private land, in addition to what will be accomplished in the forest rangeland, where the responsibility of each farmer in the success of cultivating the assigned amount of the sulla seeds has been emphasized, which will contribute to providing pastoral stock, which in turn contributes to reducing the pressure on the forest rangeland.
- Working to establish the principles of cooperation between the administration and the farmers to ensure the permanence of pastures in the region and good management of the available capabilities.
- After that, a dialogue was exchanged between those present, where all farmers welcomed the initiative to implement the aforementioned process and their intention to make it successful, especially since the cultivation of sulla is one of the traditions of the region and that the formation of the GDA (French acronym for the Group for Agricultural Development). will contribute positively to cooperation with the administration.
- In conclusion, all attendees pledged to work for the success of the initiative and their desire to organize others training sessions.

Figure 4. Sulla seeds distribution to farmers in Oued Sbaihia and Gueffaya, Tunisia.

7. RECOMMENDATIONS

After discussion and exchange of dialogue between the attendees, the most important recommendations were as follows:

- The need to support participatory work between all parties to achieve the goals of sustainable productive silvopastoral systems
- The GDA pledged to cooperate with, DGF and research institutions to transfer and disseminate the technical knowledge and management skills of sulla utilization to the farmers
- Enhance farmers knowledge on how to grow and utilize sulla through providing technical backstopping and capacity development trainings.

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Appendix 1. Sulla Factsheet

CGIAR RESEARCH PROGRAM ON LIVESTOCK

Aims to increase the productivity of livestock agri-food systems in sustainable ways across the developing world.

Managing rangelands: promoting sustainable legume species

Hedysarum coronarium L.: a biennial herbaceous legume used for forage in the Mediterranean basin.

Scientific name:
***Hedysarum coronarium* L.**
Common names:
Sulla, Italian sainfoin, Spanish sainfoin, French honeysuckle, cock's-head
Locations:
Tunisia, Algeria, Morocco, Malta, southern Italy & Spain

Arid and semi-arid rangelands face increasing climate variability and grazing pressure as the world's demand for food increases. ICARDA is promoting drought-tolerant species as a crucial means of assisting rangeland rehabilitation efforts, helping to conserve rapidly depleting water resources and maintain grazing at sustainable levels. The result: a win-win situation for rural communities and the environment.

Sulla (*Hedysarum coronarium* L.) is deep rooted and drought resistant. This species native to the Mediterranean is effective in biological fixation of sloping land, and improving organo-mineral soil fertility and yields and protein value of cereals. It is a biennial or short-lived perennial with semi-erect to erect growth, height of 0.3–2 m, strongly rooted, with root depth exceeding 2 m and numerous secondary roots.

Benefits:

- Ideal for short pasture rotations in both mixed farming and livestock production systems
- Improves soil fertility and erosion control
- Excellent forage with high protein content
- Highly palatable, nutritious, and productive forage
- Multipurpose species with melliferous properties

Flowering begins in early spring, and the melliferous inflorescences are in racemes with up to 35 florets, ranging from dark red to purple pink. It prefers well drained, medium to fine-textured soils. Performes well in slightly acid to alkaline soils (pH 5.5–8.5), sandy loams, and loams to clays. Sulla is a highly palatable, nutritious, and productive forage for ruminants. It is cultivated throughout the Mediterranean basin, where it is extensively grown as a forage crop for grazing, hay, or silage. The species plays a key role in cereal-based systems of semi-arid regions, particularly in organic and low-input agriculture, and is commonly used to enhance the productivity and sustainability of farming systems (e.g. as a nitrogen supply and to maintain soil organic matter). One of the main values of sulla is its water requirement coupled to its ability to provide large amounts of palatable forage in steppe areas.

Biological fixation of sloping land using sulla, Zaghouan, Tunisia

Sulla mellifluous inflorescences

Sheep grazing sulla, Mateur, Tunisia

There has been growing interest in sulla due to its excellent adaptability to marginal and drought-prone environments, versatility as a good quality and high-protein forage crop, and its moderate levels of condensed tannins beneficial to ruminant production. Sulla is also a melliferous plant (supporting 15 hives/ha).

Establishment and management

A well-cultivated, uniform, and weed-free seed bed is required for good establishment. Plowing to depths of 20–25 cm is indicated or passage of a chisel plow to 30–35 cm. Usually sow from the end of September and avoid seeding in December. Sow 25–40 kg/ha of seed in pods and 10–20 kg/ha of husked seeds. The use of manure in cultivation of sulla is beneficial for its establishment and development, but not advisable for economic reasons and because sulla is a pioneer plant that tolerates poor soil. Seeding is generally superficial at 1–2 cm deep. With its high dry matter yields and ease of cutting, sulla is suitable for green forage, grazing, or hay/silage. Sulla should be cut at early flowering as the stems can become woody after flowering and quality will be much lower despite higher yields. Sulla makes good silage. Including large amounts of sulla in silage (e.g. 75% and above) increases the level of lactic acid, resulting in lower pH and higher quality silage. Sulla has a high water-soluble carbohydrate content, which enhances silage quality. However, fresh sulla has a dry matter (DM) content of about 25% that can hinder the ensiling process, and wilting may be necessary. Good fermentation is achieved when sulla is ensiled at a DM content of at least 35% at the early bud stage, and fermentation is also acceptable when ensiled at 25% DM at the early flowering stage.

For hay, sulla should be cut before peak flowering, preferably around 10% flowering. Like other legumes, it tends to shed leaves during hay making but leaf retention is better than for alfalfa. Sulla retains most leaf if conditioned and raked carefully. In the establishment year, sulla should be lightly grazed to ensure good root development and plant numbers for the second year. Sulla does not tolerate heavy grazing as the relatively high soft crowns and succulent stems are preferentially grazed and easily damaged. In its first year, sulla gives about 20–30 t of green fodder/ha and 30–50 t in the second year. Sulla must be rotationally grazed. It should be grazed when it reaches about 40–50 cm in height and should not be grazed lower than 15 cm because regrowth is faster from the leaf axils than from crowns. Sulla is best managed by cutting for forage/silage or strip grazing. When grazing, it is advisable to move large numbers of stock onto small areas for rapid grazing and promptly remove stock when the desired grazing height is achieved.

Effective Management

- Prefers slightly acid to alkaline soils
- Superficial seeding of 1–2 cm deep
- Good fermentation when ensiled at DM content of at least 35%
- Should be grazed when height is 40–50 cm
- For hay production, sulla should be cut before peak flowering (around 10%)
- For silage production, sulla should have at least 35% dry matter

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www.icarda.org

ICARDA's Rangeland Ecology and Management Unit

ICARDA's Rangeland Ecology and Management Unit aims to address the unsustainable use of resources induced by adverse effect of climate change and an increasing demand for food and feed in the dry areas. ICARDA programs promote the enhanced quality and productivity of crop, forage, livestock, and the improved management of water resources through close cooperation with farmers and national researchers.

ESAM

Appendix 2. List of Participants

Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

الاستعادة المستدامة للنظم الحرجية الرعوية في ظل التغيرات المناخية: تعزيز القدرة على الصمود وتحسين سبل العيش

19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
1	سامي الرقراق	زغوان		✓
2	منير بو عاوية	زغوان		✓
3	عبد المجيد الرقراق	زغوان		✓
4	عبد الكريم مسعورة	زغوان		✓
5	وليد مسعورة	زغوان		✓
6	حسام الاسلامي	زغوان		✓
7	ليلى الشنوي	زغوان		✓
8	محمد فتحي حميدة	زغوان		✓
9	دليلة حميد	زغوان		✓
10	عادل مسعورة	زغوان		✓
11	حمادي مسعورة	زغوان		✓
12	سالم العوارم	زغوان		✓
13	سالم حميدة	زغوان		✓
14	محمد بوبكر مسعورة	زغوان		✓

*بتحديد المربع، أمنح المركز الدولي للبحوث الزراعية في المناطق الجافة (إيكاردا) الحق باستخدام وإعادة الإستخدام والنشرو/أو إعادة النشر بشكل كلي أو جزئي في أية وسيلة (بما في ذلك موقع إيكاردا على الانترنت ووسائل التواصل الإجتماعي، و وسائل النشر الأخرى) لكافة المعلومات الشخصية الموجودة بما في ذلك الصور الخاصة بي بشكل إفرادي أو في أي مجموعة أنا موجود فيها) التي تم التقاطها خلال هذا النشاط دون قيود فيما يتعلق بالتغييرات أو التعديل، على أن يتم استخدامها بالتوافق مع تمثيل المركز والترويج له. أقر بانني أتفهم أن جميع التسجيلات والوثائق، بأي وسيلة كانت، ستبقى ملكاً لايكاردا فقط، و لن يكون لي أي حق أو مصلحة فيها. كما أنني أسمح لأيكاردا ووكلائها المعتمدين باستخدام صورتي أو إسمي أو عنوان عملي حيث يتم استخدامها بالإقتران مع تمثيل إيكاردا و الترويج لها.

Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

الاستعادة المستدامة للنظم الحرجية الرعوية في ظل التغيرات المناخية: تعزيز القدرة على الصمود وتحسين سبل العيش

19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
15	رشيدة مسعودة	زغوان		
16	محسن ورغمي	زغوان		
17	محمد علي بوعلاوية	زغوان		
18	حاتم بوعلاوية	زغوان		
19	أحمد بن عبد القادر	زغوان		
20	لسعد بوحالة	زغوان		
21	العنجاني مسعودة	زغوان		
22	بركية بوعلاوية	زغوان		
23	عزيزة حميدة	زغوان		
24	محمد العابدي مسعودة	زغوان		
25	العابدي بوبكر	زغوان		
26	البدوي حميدة	زغوان		
27	عبد الكريم مسعودة	زغوان		
28	حمادي بوعلاوية	زغوان		

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Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

الاستعادة المستدامة للنظم الحرجية الرعوية في ظل التغيرات المناخية: تعزيز القدرة على الصمود وتحسين سبل العيش

19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
29	بوفاوية	زغوان		
30		زغوان		
31		زغوان		
32		زغوان		
33		زغوان		
34		زغوان		
35		زغوان		
36		زغوان		
37		زغوان		
38		زغوان		
39		زغوان		
40		زغوان		
41		زغوان		
42		زغوان		

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19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
43	عبد الكريم صقور	زغوان		
44	بسام بن حمد	زغوان		
45	بدر الزغواني	زغوان		
46	خالد الماجري	زغوان		
47	المولدي عمون	زغوان		
48	سوسن عمن	زغوان		
49	هال الحيلان	زغوان		
50	خليفة جلالي	زغوان		
51	سليم سليم	زغوان		
52	بلقاسم بوخاوية	زغوان		
53	نعيمة بوخاوية	زغوان		
54	الحبيب الزغواني	زغوان		
55	منى الهجيمي	زغوان		
56	معاوية بوخاوية	زغوان		

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Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

الاستعادة المستدامة للنظم الحرجية الرعوية في ظل التغيرات المناخية: تعزيز القدرة على الصمود وتحسين سبل العيش

19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
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Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

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19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
71	عمار الدعبي	منوبة		✓
72	ابراهيم الدعبي	منوبة		✓
73	سويح الدعبي	منوبة		✓
74	عبد الله الدعبي	منوبة		✓
75	صالح بالتوهامي	منوبة		✓
76	توفيق بن محمد	منوبة		✓
77	بلقاسم الدعبي	منوبة		✓
78	كريم بن منصور	منوبة		✓
79	الطيب القابسي	منوبة		✓
80	محمد الصالح بالتوهامي	منوبة		✓
81	الياس الدعبي	منوبة		✓
82	جلال الدين بن منصور	منوبة		✓
83	الطيب بن منصور	منوبة		✓
84	لسامة الدعبي	منوبة		✓

*بتحديد المربع، أمنح المركز الدولي للبحوث الزراعية في المناطق الجافة (إيكاردا) الحق باستخدام وإعادة الإستخدام والنشر و/أو إعادة النشر بشكل كلي أو جزئي في أية وسيلة (بما في ذلك موقع إيكاردا على الانترنت ووسائل التواصل الإجتماعي، و وسائل النشر الأخرى) لكافة المعلومات الشخصية الموجودة بما في ذلك الصور الخاصة بي بشكل إفرادي أو في أي مجموعة أنا موجود فيها) التي تم التقاطها خلال هذا النشاط دون قيود فيما يتعلق بالتغييرات أو التعديل، على أن يتم استخدامها بالتوافق مع تمثيل المركز والترويج له. أقر بانني أتفهم أن جميع التسجيلات والوثائق، بأي وسيلة كانت، ستبقى ملكاً لايكاردا فقط، و لن يكون لي أي حق أو مصلحة فيها. كما أنني أسمح لأيكاردا ووكلائها المعتمدين باستخدام صورتي أو إسمي أو عنوان عملي حيث يتم استخدامها بالإقتران مع تمثيل إيكاردا و الترويج لها.

Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

الاستعادة المستدامة للنظم الحرجية الرعوية في ظل التغيرات المناخية: تعزيز القدرة على الصمود وتحسين سبل العيش

19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
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*بتحديد المربع، أمنح المركز الدولي للبحوث الزراعية في المناطق الجافة (إيكاردا) الحق باستخدام وإعادة الإستخدام والنشرو/أو إعادة النشر بشكل كلي أو جزئي في أية وسيلة (بما في ذلك موقع إيكاردا على الانترنت ووسائل التواصل الإجتماعي، و وسائل النشر الأخرى) لكافة المعلومات الشخصية الموجودة بما في ذلك الصور الخاصة بي بشكلٍ إفرادي أو في أي مجموعة أنا موجود فيها) التي تم التقاطها خلال هذا النشاط دون قيود فيما يتعلق بالتغييرات أو التعديل، على أن يتم استخدامها بالتوافق مع تمثيل المركز والترويج له. أقر بانني أتفهم أن جميع التسجيلات والوثائق، بأي وسيلة كانت، ستبقى ملكاً لايكاردا فقط، و لن يكون لي أي حق أو مصلحة فيها. كما أنني أسمح لأيكاردا ووكلائها المعتمدين باستخدام صورتي أو إسمي أو عنوان عملي حيث يتم استخدامها بالإقتران مع تمثيل إيكاردا و الترويج لها.

Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

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19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
99	عبد الجليل الدجاجي	منوبة		✓
100	عبد القادر الدوجي	منوبة		✓
101	خالد الدوجي	منوبة		✓
102	فدية الدوجي	منوبة		✓
103	الشاذلي الدوجي	منوبة		✓
104	عبد المجيد الدوجي	منوبة		✓
105	خيار الشاذلي الفارسي	منوبة		✓
106	عبد المجيد يوسف	منوبة		✓
107	هالة السامي	منوبة		✓
108	علي بالهادي الدوجي	منوبة		✓
109	الهادي السويح	منوبة		✓
110	الشاذلي الدوجي	منوبة		✓
111	عادل الدجاجي	منوبة		✓
112	كمال حوشي دجاجي	منوبة		✓

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Sustainable silvopastoral restoration under changing climate: strengthening resilience and improving livelihood

الاستعادة المستدامة للنظم الحرجية الرعوية في ظل التغيرات المناخية: تعزيز القدرة على الصمود وتحسين سبل العيش

19-21 October 2022 - Tunisia

List of participants

No	Name/ الاسم	Governorate / الولاية	Signature/ التوقيع	*
113				
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