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Impacts of Using *Amygdalus Scoparia* and *Ephedra Procera* on Carbon Storage at Dryland Regions

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ABSTRACT

Amygdalus scoparia and *Ephedra procera* are two key rangeland species in Iran's southern province of Fars, significant for soil preservation, carbon sequestration, and providing nutrition for domesticated animals. This study aimed to investigate the impact of these shrubs on the carbon and organic matter content in various plant organs (rootstock, stem, and foliage), as well as the physiological and biochemical characteristics of the sub-canopy soil of the two species in two soil depths (0-15 cm and 15-30 cm) in the Dolatabad area of Fars province. Sampling of plant organs was conducted by isolating leaves, stems, and roots. In a plot of 30 base aerial parts, leaves, stems, and roots with saws and collected for weighing in plastic bags and sent to the lab. The results showed that the highest concentrations of nitrogen and chloride were observed at a depth of 0-15 cm. Soil type and depth significantly affected nitrogen and chloride content ($P \leq 0.05$), but no significant impact was found on bulk density, moisture content, sodium, or potassium content. The effects of plant species on carbon and organic matter were significant ($P \leq 0.01$). In general, the highest amounts of carbon and organic matter were found in the shoots (17.15 and 3.86 t/ha respectively) and roots (16.16 and 2.86 t/ha) of Amygdalus. Therefore, it can be concluded that *Amygdalus scoparia* have a greater ability to store carbon in their organs.

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1. Introduction

To lower the amount of atmospheric carbon dioxide and greenhouse gas equilibrium, carbon absorption and sequestration are necessary in various structures. Atmospheric carbon sequestration is one of the most important functions of natural ecosystems, especially pastures. Carbon sequestration as part of the carbon cycle is an expression employed to explain the carbon exchange (in a variety of forms including CO_2 among geological sediments, the earth's biosphere, and the atmosphere, which occurs in a very small exchange of resources. Global warming is one of the twenty-first-century problems. Organic matter, as a dominant indicator of soil quality, is considered in agriculture and the environment, reduced due to climate change and global warming (Amighi *et al*., 2013). Excessive dryness of arid regions has increased the intensity and spread of desertification (Hosseini Khezr Abad *et al*., 2024). According to many researchers, this process is caused by the atmosphere's rising concentration of greenhouse gases (Freud *et al*., 2008). Carbon needs to be absorbed into plants or soil in various forms to lower atmospheric carbon dioxide and establish an equilibrium in the amount of greenhouse gasses (Lal, 2003). Plant species that adapted to the arid regions and each of their organs play a different role in the process of carbon storage and organic matter (Freud *et al*., 2008). The amount of carbon storage in different regions depends on the type of plant species and the soil's physical and biological conditions (De Blécourt *et al*., 2019; Derner and Schuman, 2007).

The presence of *Ephedra* on the hills has caused them to stabilize. Also, the presence of this plant in some cases caused the accumulation of large sediment at the plant's foot and prevented the displacement of sediment and soil erosion (Padilla & Pugnaire, 2007). The *Ephedra* also grow on calcareous rocks penetrate rocks with their wide root system, and accelerate the terra forming phenomenon by crumbling and crushing rocks (Bowers., 2014).

Amygdalus scoparia and *Ephedra procera* are a pair of the most significant rangeland species found in the rangelands of the Fars Province in the south of Iran. Their significance lies in their ability to sequester carbon, protect soil, and provide food for domesticated animals. Rangeland regeneration and rehabilitation can be pursued in terms of carbon sequestration by identifying the species that have greater potential for sequestering carbon and by looking into how management practices impact the process. Dryland ecosystems, which cover nearly 40% of the global terrestrial surface, play a critical role in mitigating climate change through carbon sequestration (Gao *et al*., 2023). Recent studies emphasize the potential of vegetation restoration in these regions not only to combat land degradation but also to serve as long-term carbon sinks. Gao *et al*. (2023) demonstrated that restored dryland vegetation maintained a consistent carbon sink function over 13 years, with net ecosystem productivity (NEP) increasing significantly due to favorable climatic conditions such as spring warming and extended growing seasons. Similarly, Li *et al*. (2023) investigated artificial forests in extremely arid zones and found substantial carbon storage and oxygen release capabilities among key species like *Haloxylon ammodendron* and *Tamarix chinensis*. Their results confirmed the economic and ecological value of arid-region afforestation. In the context of Iran, Ravanshadi *et al*. (2022) assessed the effects of planting *Eucalyptus camaldulensis* and *Amygdalus scoparia* on soil properties and carbon sequestration, revealing that afforested areas significantly outperformed non-forested sites in terms of organic carbon and nutrient content. Furthermore, Bazgir *et al*. (2020) highlighted the species-specific impacts of native and introduced woody species on soil carbon and bulk density in arid regions of Iran, recommending mixed-species plantations to enhance ecosystem resilience and multifunctionality. Collectively, these studies underscore the importance of selecting well-adapted plant species to enhance soil carbon dynamics and ecosystem restoration in dryland environments, supporting the need for localized assessments like the present study on *Amygdalus scoparia* and *Ephedra procera*.

According to statistics, Iran used to receive enough rainfall each year for several decades before it steadily decreased after that. Over the past 50 years, there has been a numerically and practically significant decrease in rainfall. Thus, the current Iranian generation has already been impacted by the effects of global warming. In light of the foregoing discussions, Iranians have sufficient evidence to oppose global warming. This experimental study, conducted in Iran, intended to determine how much soil carbon is sequestered when two species are planted together.

The demonstrated ability of these species, particularly wild almonds, to sequester carbon can inform carbon trading schemes and environmental policy initiatives aimed at climate change mitigation. It is hypothesized that other soil characteristics are correlated with the sequestration of carbon in soils. Thus, the relationships are also examined in this study.

2. Materials and methods

2.1. Study region and species

Dolatabad area (Figure 1) is located in the geographical range of 51° 67'and 55°43' E and the latitudes are 20°58' and 22°24' N, which is part of the summer rangeland of Fars province. In terms of climate, it has milder summers and cold winters, and the maximum rainfall is in January, February, and March. In this research, we first attempted to identify areas with the dominant *Amygdalus* and *Ephedra* species. *Amygdalus* and *Ephedra* are both important species in the rangeland of Fars province. These two shrubs’ species are very important due to their great influence on soil stabilization, erosion of sandstones, and soil erosion control in the mountain range.

2.2. Sampling method of plant and soil

2.2.1. Plant sampling

Sampling of plant organs was done by leaf, stem, and root isolation. The dimensions of the plots were considered for both 1 × 1 meters. In selecting the studied regions, the main criterion is the maximum presence of *Amygdalus* and *Ephedra* species and the minimum presence of associated species. This action is intended to eliminate the effects of other plant species on soil properties and carbon storage in the soil and to evaluate the actual and exclusive power of species in carbon storage in plant tissue. In a plot of 30 base aerial parts, leaves, stems, and roots with saws and collected for weighing in plastic bags and sent to the lab. For underground organs, 3 samples from plant bases were selected and discontinued due to the minimum losses. Root sampling was done by root sampling, in which roots with a thickness of more than 2 mm were taken up to the depth of root (30 cm) and transferred to the analytical laboratory for weighing (Forouzeh *et al*., 2009). Sampling was done in spring, with plants having succulent tissue and emerging new foliage (Figure 2).

In the studied regions of Dolatabad, both *Amygdalus* and *Ephedra* species were observed as dominant shrub species, but their distribution and abundance varied slightly across different sampling plots. Based on our field data:

- **Species Composition (%):** On average, *Amygdalus* accounted for approximately **38%** of the total shrub composition, while *Ephedra* represented about **22%**.
- **Canopy Cover (%):** The average canopy cover of *Amygdalus* was around **22%**, while *Ephedra* had an average canopy cover of **15%**. This indicates that *Amygdalus* generally forms denser vegetation patches compared to *Ephedra*.

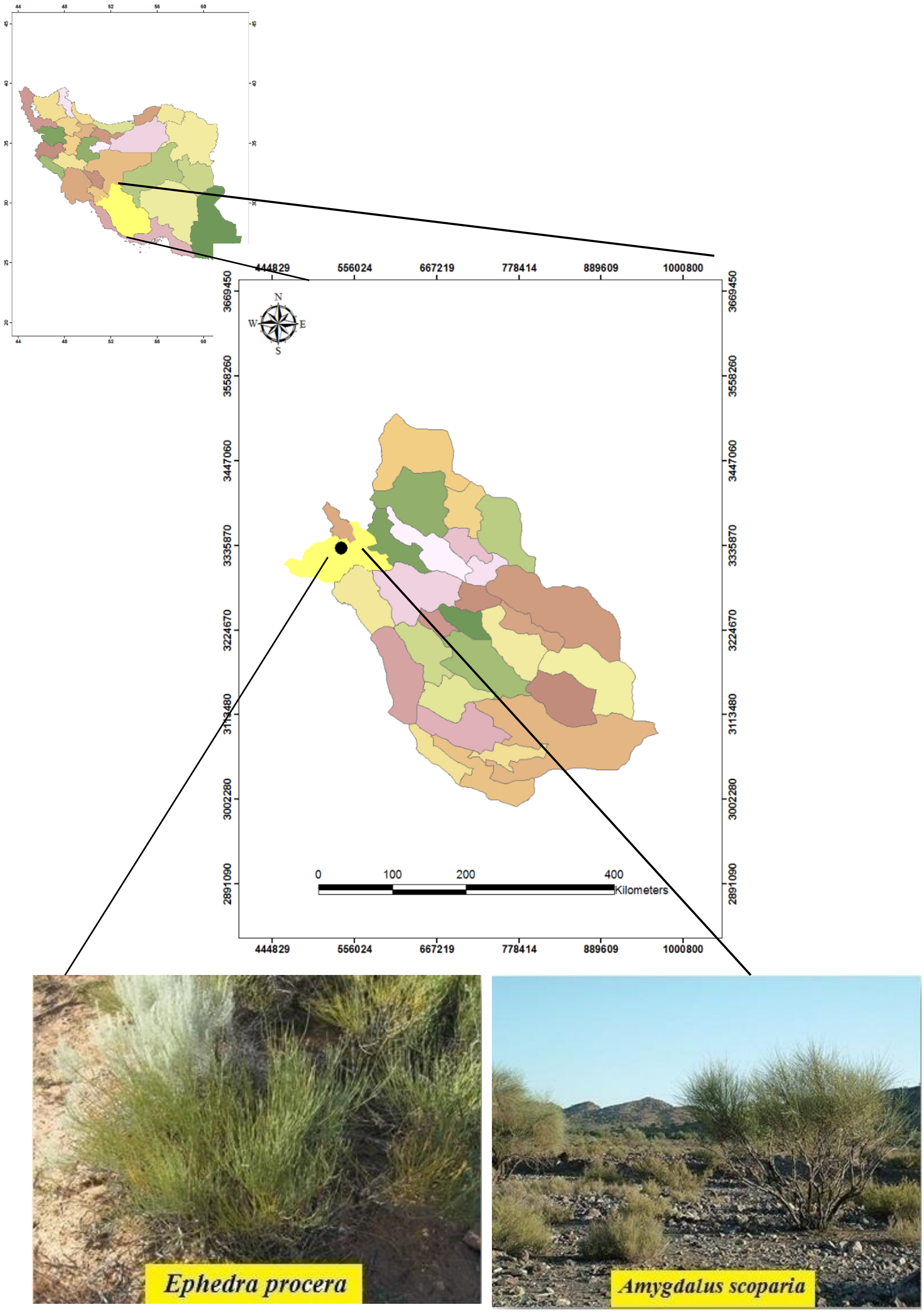

Figure 1. The Site study

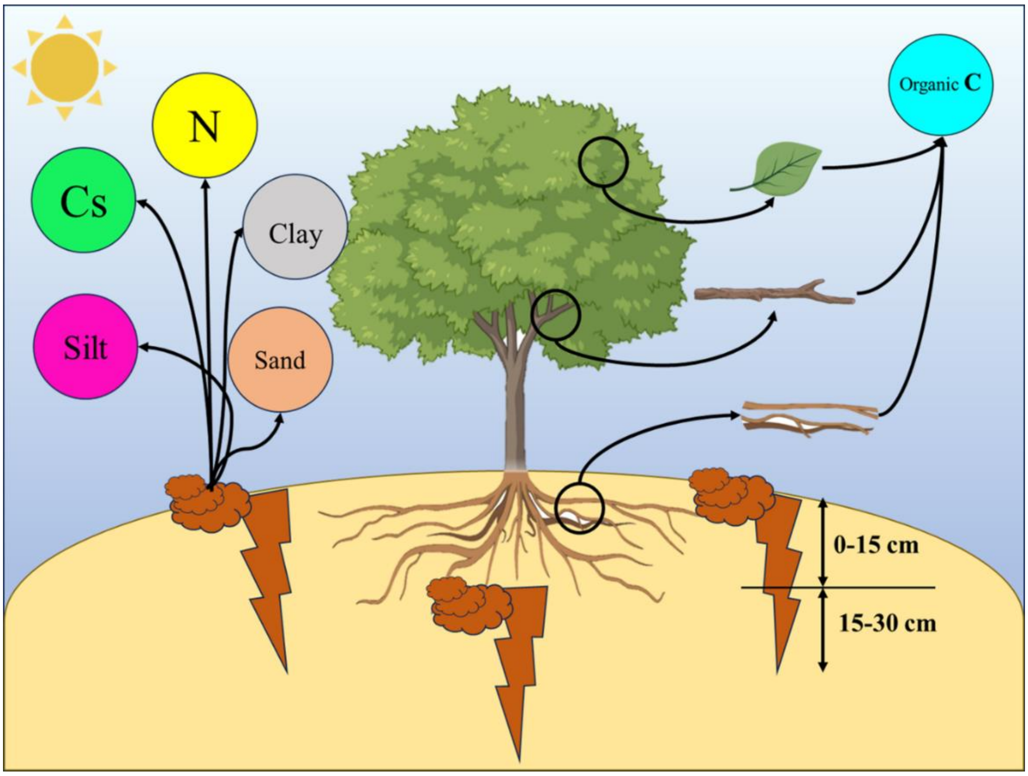

Figure 2. Method scheme of soil and plant sampling from *Amygdalus* and *Ephedra* species

- **Density (individuals per hectare):** The density of *Amygdalus* was estimated at approximately **160 individuals/ha**, while *Ephedra* had a density of around **125 individuals/ha**.
- **Frequency (% of plots in which species occurred):** *Amygdalus* was present in **93%** of the surveyed plots, and *Ephedra* appeared in **85%** of the plots, showing that both species are widely distributed, though *Amygdalus* has a slightly higher ecological prevalence.

The *Amygdalus* and *Ephedra* species are extensively spread in the Fars rangeland and at the identical age, 32 years old, they were planted. The information related to site history and soil characteristics before planting and shown in Table S1 of supplementary material. Therefore, there is time zero (control) with which to compare soil data after 32 years (Figure 1).

2.2.2. Soil sampling

After removing the litter, 10 profiles of 60 centimeters (in each lump of 5 profiles) were drilled and in these profiles, sufficient soil was collected from two depths of 15-0 and 30-15 cm and moved into the laboratory (Figure 2). It was also considered that the most crucial element influencing soil fertility and carbon storage in soil was soil organic matter (Varamesh *et al*., 2010).

2.3. Laboratory method

After weighing the fresh weight of the plant organs, the specimens were dried for 24 hours at 70 °C in the oven and then the drought weights of the specimens were weighed (Varamesh *et al*., 2010). Drought samples were powdered by an electric mill and prepared from each laboratory sample for the measurement of organic carbon. First soil samples dry by fresh air. The roots, rocks, and other impurities were separated and crushed after grinding and then passed through a 2 mm sieve. These samples are utilized to measure some soil's physicochemical properties including bulk density, moisture present, nitrogen, potassium, sodium, and chlorine. After determining the average dry weight of the species harvested from the area, the organic carbon content in the air, ground, and soil was evaluated. To measure the plant's content of organic carbon, all leaf, branch, and root samples were dried at 105 ° C for 24 hours. To determine the organic carbon, the combustion method was used within an electric furnace. After the samples were entirely dry, an electric mill was used to ground them, and a total of 4 specimens of a specified weight were obtained from these samples. Then samples were weighed with a digital scale, placed in a furnace, and burned at 600 ° C for 4 hours. Then the desiccator was used to weigh the burnt samples. By determining the initial weight, ash weight and organic carbon to organic matter ratio, the amount of organic carbon in each plant organ was calculated separately using the following equation.

$$\text{OC} = 0.58\ \text{OM} \tag{1}$$

Where OC is organic carbon, and OM is organic matter

$$\text{Organic C}, \% = \frac{(\text{V}_{\text{blank}} - \text{V}_{\text{sample}})}{\text{W}} \times \text{M}_{\text{Fe2}} \times 0.003 \times f \tag{2}$$

Where:
V_{blank}= Volume of titrant in blank, mL;
V_{sample} = Volume of titrant in sample, mL;
M_{Fe2} = Concentration of (NH4)2 Fe (SO4) 2.6 H2O solution, molarity; and
0.003 = Carbon oxidised (shown below)

$$= \frac{12g\ C}{mole} \times \frac{1\ molK_2Cr_2O_7}{6\ molesFeSO_4} \times \frac{3\ moles\ C}{2\ moles\ K_2Cr_2O_7} \times \frac{1\ l}{1000\ ml}$$

f = Correction factor, 1.3
W = Weight of soil, g
SOC =10000×% OC × Bd × e
% OC = Total organic carbon
Bd = Bulk density ($^{gr}/_{cm^3}$)
e = Depth of sampling (cm)

This study used a completely randomized design and was carried out as a two-factorial experiment. Plant species was the first factor, while plant organs were the second (in the first experiment) and various soil depths and two plant species were two factors (in the second experiment). Analysis of variance, comparison of meanings, and estimation of correlation coefficients based on Duncan's Multiple Range Test were carried out utilizing SAS Ver 9.1 software.

3. Results

3.1. Moisture content

None of the treatments had an impact on the moisture content of the soils (Table 1). Three treatments did not show significant differences in soil moisture content (Table 2). The moisture percentage at various depths was significant (Table 2). At depths of 15-0 and 30-15 cm, the treatments showed no significant effect (P≤0.05) variation in moisture level (Table 2).

Table 1. Analysis of variance of soil characteristics in two depths of 15-0 and 15-30 cm soil masses of the almond, Ephedra and control

Source	DF	Mean Squares					
		Moisture (%)	N (%)	Bulk density (gr/cm3)	Na (%)	K (%)	Cl (%)
Mass	2	51.05ns	0.007**	4.94**	1894.05**	3.76*	0.46**
Soil Depth	1	186.88ns	0.000**	0.01ns	2.72ns	1.68ns	0.26*
Mass×Depth	2	134.05ns	0.000ns	0.03ns	2.72ns	0.18ns	0.05ns
Error	14	49.33	0.000	0.01	22.33	0.54	0.04
CoeffVar	-	11.55	6.94	6.06	27.17	23.74	17.57

ns (non-significant difference); * and ** indicate significant differences ($P \leq 0.01$) and ($P \leq 0.05$)

Table 2. The comparison of mean interactions of soil properties in the soil masses of the *Amygdalus, Ephedra* and the control, considered at the two depths

The plants soil masses	Soil Depth (cm)	Moisture (%)	N (%)	Bulk density (gr/cm3)	Na (%)	K (%)	Cl (%)
Amygdalus	0-15	60.00ab	0.15a	2.34a	12.00c	2.33ab	0.46b
Amygdalus	15-30	61.66ab	0.11b	2.27a	11.00c	1.33bc	0.36b
Ephedra	0-15	57.66b	0.13ab	2.34a	13.00b	2.83a	0.50b
Ephedra	15-30	58.00b	0.10b	2.35a	13.66b	2.33ab	0.33b
Control	0-15	55.00b	0.07c	0.65c	37.33a	1.16bc	1.13a
Control	15-30	72.33a	0.04d	0.86b	36.33a	0.83c	0.66b

† The same letters demonstrate a non-significant difference, whereas different letters demonstrate significant differences by the Duncan's test (P≤0.05)

3.2. Nitrogen percentage

Nitrogen percentage was significantly different between the masses and the depths studied (Table 1). There were no significant differences between the two treatments in *Amygdalus* and *Ephedra* in terms of soil nitrogen content, but they were significantly higher than the control (Table 2). Nitrogen percentage was significantly higher in surface soils, with 0.17% nitrogen at low depth and 0.086% nitrogen at high depth (Table 2). The percentage of nitrogen was significantly higher in *Ephedra* and wild almond treatments (0-15 cm) (Table 2).

3.3. Bulk density

Mass media showed a significant effect impact on the bulk density of soil (P <0.01) (Table 1). Soils with mandibular, *Ephedra,* and control had different bulk densities; the highest (2.30) was in the *Ephedra,* and the lowest (0.75) was in the control soil (Table 2). No significant difference was observed in the two depths in terms of bulk density (Table 2).

3.4. Sodium percentage

There was a remarkable variation between the two populations in terms of sodium percentage (Table 1) and the control soil had significantly higher sodium content than the soil containing *Ephedra* and mandarin (Table 2). There was not much of a notable difference between the two depths (Table 2). The results of the comparison of the meanings showed that the depth of control soil as well as the soil containing the *Amygdalus* had the highest and lowest sodium percent respectively (Table 2).

3.5. Potassium percentage

Potassium content was significantly different between the studied populations (Table 1). *Ephedra* treatments did not show any significant difference in soil potassium content with *Amygdalus* treatments, but it was significantly higher in *Amygdalus* and control treatments (Table 2). Potassium content was not considerably varied in soils of varying depths (Table 2). The interaction between two treatment depths and three treatments of the studied mass did not have any significant difference (Table 2).

3.6. Chlorine percentage

The soil mass and soil depth had a significant difference of (P≤0.01) and (P≤0.05), respectively, on the chlorine content of the soil (Table 1). The control soil was significantly more than the two treatments of *Amygdalus* and *Ephedra*, and the soils with *Amygdalus* and *Ephedra* plants had the same chloride content (Table 2). The percentage of chlorine was much higher in the first two depths (Table 2). There was not a noticeable relationship between mass and depth in this trait (Table 2).

3.7. Percentage of organic carbon and organic matter in plant tissue

The effect of plant organs and plant species and the interaction of these two factors on the organic carbon percentage and organic matter in plant tissue was noteworthy at (P≤0.01) (Table 3). There was a remarkable variation between the species of *Ephedra* and bumblebee in terms of organic carbon percentage and organic matter percentage, and it was observed higher in *Amygdalus* species.

Table 3. Analysis of variance regarding the effects of plant species, plant organs and their interaction on the amount of stored organic carbon and organic matter.

Source	DF	Mean Squares	
		Organic Carbon	Organic Matter
plant species	1	21.8**	109.2**
plant organs	2	28.3**	77.7**
plant species× organs	2	1.2ns	3.5ns
Error	12	1.6	1.7
Coeff.Var	-	9.1	17.4

ns (non-significant difference); * and ** indicate significant differences (*P*≤0.01) and (*P*≤0.05)

Table 4. Comparison of mean values for the interaction of organic matter and organic carbon stored in the plant with various plant organs of the two species (*P*≤0.05)

Trait	plant organs	plant species	
		Amygdalus	*Ephedra*
Organic Carbon	leaves	12.17cd †	11.02d
	stem	17.15a	14.26bc
	root	16.16ab	13.60c
Organic Matter	leaves	2.60b	1.72c
	stem	3.86a	2.87b
	root	2.88b	1.99c

†Mean values with same letters in each column have no significant difference according to Duncan's test (*P*≤0.05).

3.8. Pearson's correlation coefficient analysis

The findings from the correlation coefficient analysis of soil chemical properties and soil texture represented that the density sodium content had a negative and significant relationship (Table 5).

Table 5. Estimation of correlation coefficients among the soil's characteristics.

	Bulk density (gr/cm3)	K (%)	Cl (%)	Moistu re (%)	Na (%)	Clay (%)	Sand (%)	Silt (%)	N (%)
Bulk density	1.00								
K	0.60ns	1.00							
Cl	-0.59ns	-0.56ns	1.00						
Moisture	-0.22ns	-0.11ns	-0.27ns	1.00					
Na	-0.92**	-0.57ns	0.43ns	0.35ns	1.00				
Clay	-0.13ns	0.31ns	-0.37ns	-0.00ns	0.09ns	1.00			
Sand	-0.02ns	-0.40ns	-0.40ns	0.01ns	0.11ns	-0.86**	1.00		
Silt	-0.30ns	0.12ns	0.00ns	-0.00ns	-0.40ns	-0.37ns	-0.13ns	1.00	
N	0.08ns	-0.33ns	-0.27ns	0.24ns	0.17ns	-0.22ns	0.16ns	0.15ns	1.00ns

ns (non-significant difference); * and ** indicate significant differences ($P \leq 0.01$) and ($P \leq 0.05$)

4. Discussion

The results of this research showed that various plants have significant effects on the quality and quantity of nutrients and soil organic matter, and on the other hand, soil quality can contribute significantly to the scattering of different plant and pasture types. Investigating some of the chemical properties and quality of nutrient elements in the studied coatings showed that rangelands with mountain almonds would be better and more effective than *Ephedra* species. The subsoil soil of mountain almond species has a good nutrient cycle in soil and plants due to its abundant amount of small roots and also due to the considerable content of organic matter stored, especially at the depths of 0 to 15 cm, in comparison with the species of *Ephedra* and the control.

Based on the findings of this investigation, it can be considered that for rangelands in arid regions, the use of compatible species, such as *Amygdalus scoparia* species, will have a better effect on improving the soil characteristics and eliminating carbon dioxide emissions from airborne contamination than other species. Biological crust can strongly affect soil performance in dry environments, which is explained with (micro) biological indicators. With increasing the biological characteristics, mineralization processes and enzyme production of soil microorganism extension. This can lead to depletion of carbon collected at biocrusts that which can serve as a carbon dioxide source. Therefore, the reduction of metabolic procedures in dry durations shows that biological activity influences the performance of soil and greenhouse gas emissions with these crusts (Atashpaz *et al*., 2024). Salehi *et al* (2007) reported that soil texture, bulk density, the amount of phosphorus in surface horizons, the ratio of carbon to nitrogen, and organic carbon quantity are the most crucial parameters affecting the spread of forest types such as beech-hornbeam and Oak-hornbeam (Salehi *et al*., 2007). Potassium content was not notably varied in soils with various depths (Table 4). The interaction between two treatment depths and three treatments of the studied mass did not have any significant difference (Table 3). Organic matter plays a small role in supplying the plant's potassium in the soil, and much of it is supplied to the plant by exchangeable potassium, salt dissolution, and weathering of minerals (Shahoyi, 2006). The small difference between the amounts of potassium in the soil under various coatings is probably due to the dissolution of salts and a small fraction due to the difference in the amount of organic matter (Barker and Pilbeam, 2007). The results showed that nitrogen content in surface soil was 26% higher than in deep soil. In the study of the effect of monotypic oak plantations on the amount of organic and inorganic materials and nitrogen in the soil, it was observed that the organic carbon and nitrogen amount in the soil (up to 15 cm soil depth) was more than in deep soils, which is due to the vegetation deployed in these conditions, the long-term organic carbon of the soil increases because organic carbon changes in the soil gradually (Ansari and Sadeghi, 2021; Chiti *et al*., 2007).

There was a noticeable variation between the species of *Ephedra* and *Amygdalus scoparia* in terms of organic carbon percentage and organic matter percentage, and it was observed higher in *Amygdalus scoparia* species. Mortenson argued that different species have different carbon storage functions (Mortenson *et al*., 2004). Also, regarding organic carbon and organic matter, the organs of different plants differ dramatically from one another (Table 4). As seen in Table 7, the stems and roots of almond and *Ephedra* leaves showed the maximum and minimum levels of organic carbon, respectively. The *Ephedra* leaves and roots did not significantly differ from one another in the organic matter, but these two organs had a lower amount of organic matter than the stem.

The amount of stem organic matter was the highest among *Amygdalus scoparia* species. Houghton (1992) states that a plant's woody tissues, including its stems, contain more than 50% of its carbon (Houghton, 1992). The organs that have wooden texture have more capacity for carbon storage, and the greater the ratio of the wooden organs in the plant eventuate to increase their ability to carbon storage (Paul, 2008; Pazhavand and Sadeghi, 2020). Chlorine content was noticeably higher in the first two depths (Table 2). In this trait, the relationship between depth and mass was not significant (Table 3). The outcomes of this experiment agree with the findings of Varamesh *et al* (2010). The researchers concluded that while the amount of nitrogen, organic matter, and organic carbon declined with depth, bulk density and soil acidity increased (Iranmanesh, and Sadeghi, 2019; Varamesh *et al*., 2010).

Abdi *et al*. (2008) concluded that organic carbon storage, with soil loam percentage, EC content, soil moisture content, air biomass, underground biomass, and litter content were positively related to the factors affecting the organic carbon of soil in Arak (Abdi *et al*., 2008). It had a significant negative relationship with stone and sand percent. Gao *et al*. (2007) argued that lignin-bearing organs had a high potential for carbon storage, and the greater the amount of this tissue in the plant, the greater its carbon storage potential (Gao *et al*. 2007).

Our findings align with broader evidence showing that land use change significantly impacts below-ground carbon stocks. Lal *et al*. (2003) emphasized the loss of soil organic carbon (SOC) due to vegetation removal and unsustainable land management, while De Blécourt *et al*. (2019) demonstrated how converting woodlands to agriculture leads to measurable SOC decline. Similarly, our study shows species-specific differences in below-ground biomass among dryland shrubs, underscoring the importance of plant selection in maintaining or enhancing carbon storage in degraded landscapes.

Our results agree with other studies that show planting vegetation in dry areas helps increase carbon storage and improve soil quality. Like Gao *et al*. (2023), who found that restored drylands act as carbon sinks over many years, we saw that both *Amygdalus* and *Ephedra* plants increased nitrogen and organic carbon in the topsoil compared to areas without plants.

Ravanshadi *et al*. (2022) also found higher carbon storage and better soil nutrients under *Eucalyptus* and *Amygdalus* trees, which matches our findings of better soil health with these plants. Li *et al*. (2023) showed that artificial forests in very dry deserts store a lot of carbon, similar to how our drought-tolerant shrubs helped increase carbon in the soil. We also found that plants affected soil properties like bulk density and sodium levels, which is similar to what Bazgir *et al*. (2020) reported for different woody species. Overall, these studies support the idea that choosing the right plants can improve soil and help capture carbon in dryland restoration efforts. As was observed in this study, the amount of organic matter and organic carbon was the highest in wooden tissues such as stems.

5. Conclusion

The findings of this experiment represented that the nitrogen content and bulk density in soil containing *Ephedra* were not significantly different from *Amygdalus* treatment. In this study, it was also uncovered that soil containing *Amygdalus* and control demonstrated higher and lower carbon content. However, the percentage of sodium and potassium and bulk density did not show a significant difference between the two depths of soil. Between different soil masses in terms of chlorine and sodium in control soil, was higher than in other treatments. The impact of plant type on organic matter and organic carbon level was notable between plant tissue and *Amygdalus*, in terms of organic carbon and organic matter stored in tissue, was significantly higher than *Ephedra*. By recognizing the species such as *Amygdalus scoparia* that have more potential for carbon sequestration and also investigate the management factors affect the sequestration process, regeneration and rehabilitation of rangeland can be followed in terms of carbon sequestration.

Authors Contributions

Zahra Karimpour assembled input data, and analyzed output data. H. Sadeghi designed the experiment and wrote the manuscript. S. Hosseini administered the experiment.

Data Availability Statement

Data available on request from the authors.

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Ethical considerations

The authors avoided from data fabrication and falsification.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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