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CASE STUDY

Effects of runoff harvesting through semi-circular bund on some soil characteristics

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ABSTRACT: In this study, to investigate the effects of runoff harvesting on soil properties in the semiarid forest, runoff harvesting through semi-circular bund was considered as a method to conserve soil and thereby combat tree mortality. In order to evaluate this hypothesis, runoff was harvested through the semi-circular bund affecting soil quality and moisture storage. The selected forest site is located in Kalehzard, Kermanshah, in Zagros region of western Iran. The experiment was a randomized complete block design with four treatment plots: bund with protection, protection treatment, bund without protection and control treatment. The results showed that the mean values of soil organic carbon in the bund with protection, protection treatment, bund without protection and control treatment were 2.35, 2.40, 1.90, and 1.80%, respectively, indicating no significant difference among them in the first year, while there were significant ($p > 0.05$) increases in the bund with protection and protection treatment after three years. Furthermore, coarse and very coarse soil aggregates increased significantly in the bund with protection treatment. This treatment also attributed to significant reduction in soil bulk density from 1.46 (in the first year) to 1.32 (in the third year), which enhanced soil moisture content. Finally it was found that bunds with protection significantly curtail dieback and adverse re-growing of stands due to the coupled effects of bund building and protection to curtail forest mortality in the semi-arid regions.

KEY WORDS: *Bund construction; Bulk density; Kalehzard site; Protection treatment; Soil aggregate; Soil moisture.*

INTRODUCTION

The impacts of drought on forests demonstrate the importance of interactions among climate, insects, fire, and anthropogenic deforestation (Allen *et al*., 2015; Čermák *et al.*, 2017; Clark *et al.*, 2016). Runoff harvesting is considered a soil conservation method that protects natural forests. The forests of Zagros are natural and they are not intact due to overgrazing, defragment tillage and cultivation practices. However, these forests not only sustain soil, agriculture, and the local environment, but also are considered as a source for approximately 45% of the local water supply (Taghimollaei and Karamshahi, 2016). In addition to the climate change-related dieback of the Zagros forests, anthropogenic deforestation is also increasing. In recent decades, mortality has been associated with large-scale urban population growth, climate change, and changes in landscape structure (Henareh Khalyani, 2012). Soil of this region is geologically inherited from marl deposits dominated by expanded minerals such as smectite (Karimi *et al.,* 2008; Heshmati *et al.,* 2011). This induces a type of soil with high degradation potential sharing

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off-site impacts such as global warming, siltation and eutrophication phenomena. Adversely, Zagros forests are subjected to severe anthropogenic deforestation mainly due to improper and heavy tillage practices. This tillage is practiced parallel to the slope direction using moldboard plow causing drastic soil disturbance which obviously affects soil properties including organic carbon, aggregate stability, bulk density, erosion and soil moisture lost (Nael *et al.,* 2004; Mohammad and Adam, 2010). The condition is more severe where canopy cover of Zagros forests in the degraded area is less than 50% (Gheitury and Tavakoli, 2008). Conserving these forests is crucial because they are the last landscape-scale, old-growth, mixed oak forests (Stephens and Gill, 2005; Soleymani *et al.*, 2012). The slow growing and long lifespan of some trees do not allow for rapid adaptation to changes in climate. A decreasing trend in mean annual rainfall and an increasing trend in mean annual temperature are expected under a regime of general climate warming (Dernbach and Kakade, 2008). Global mean annual temperatures are projected to increase between 2 and 5 C^{o} by the year 2100. As a result, future shortages of available water and shifts in seasonal precipitation patterns might lead to extended dry periods (Solomon *et al.*, 2009). Currently, climate change and its impacts on ecosystems are a subject of interest due to the high vulnerability of forests to changes in climate and occurrence of considerable dieback (Walther *et al.*, 2002; Sadeghi *et al.,* 2014). Moreover, some sophisticated studies are needed to show how drought stress can be reduced by increasing water and nutrient availability (McDowell and Levanic, 2014). Due to the severe drought stress conditions in Zagros, local autochthonous forests are certain to experience a reduction in available water (Attarod *et al.*, 2015). Generally, the major constraint on the survival of intact stands in exacerbated periods of drought is soil moisture deficit, which can be mitigated by enhancing soil quality and using a runoff harvesting system. To adapt to climate change, increasing soil resilience through carbon, water, and nutrient storage can solve some pressing issues such as water scarcity, declining biodiversity, and mortality. A better understanding of this will, in turn, lead to a better and more sustainable soil management Mol and Keesstra, 2012). Thus, a micro-catchment runoff harvesting technique can not only control local runoff and reduce transmission losses, but also preserve soil moisture available for plant root systems (Ali *et al.,* 2010). Applying this technique in arid and semi-arid regions would minimize the risk from drought (Adham *et al*., 2016). Runoff harvesting techniques have been adapted to and implemented in the Middle East for 3,000 years (Bisoyi, 2006; Mahajan *et al.,* 2006). Indeed, they are regarded as effective approaches to turn precipitation on soil to beneficial uses such as agriculture, pasture, and trees before it runs off or evaporates. Improvement of the physicochemical characteristics of soil can also enhance its moisture capacity and consequently curtail tree dieback in Zagros forests. Assuming that the way to achieve such a goal might be to apply runoff harvesting measures, the aims of this study are: i) to evaluate the contribution of a semi-circular bund (SCB) to soil moisture storage, and ii) to assess changes in soil aggregates, organic carbon, and bulk density through SCB and protection treatments as possible measures to mitigate climate change-induced dieback in the mainly semiarid region of Zagros, Iran. The current study has been carried out in Zagros region in Iran during 2014-2016.

MATERIALS AND METHODS

Study area

This study was conducted in the forests of Zagros located in Kalehzard, Kermanshah at the west of Iran (38S682887E, 3748385N (UTM); (Fig. 1). These forests are natural reserves that are dominated by Quercus persica and occupy about 5,000,000 ha of land. However, these forests are currently suffering from drought and anthropogenic-induced dieback. The mean annual rainfall and temperature are 440 mm and 15.2 °C, respectively. Winters are cold enough for temperature to drop to below zero for 90 days on average in December, January, and February; however, summers are hot to cool and dry, indicating a sem-iarid region. The majority of studies classify Zagros forests in the Irano-Anatolian phytogeographic sub-region, in which the dominant species is Quercus persica (Zohary, 1973) which cannot be found in other areas. Q. persica is regenerated mainly as a coppice stand (vegetative regeneration) in Zagros forests, although there are also rare cases of native seedling regeneration. The soil in the region is shallow with the A and C horizons indicating that it belongs to the Entisol order. Human-induced soil degradation is being accelerated mainly through illegal cropping and tillage practices, heavy livestock grazing, conversion of rain-fed farmland, charcoal extraction, and fire.

Experimental design

A hill with a 15% slope and south-eastern aspect was chosen as experimental site to represent the dieback phenomenon in Zagros forests. The experiment was a randomized complete block design

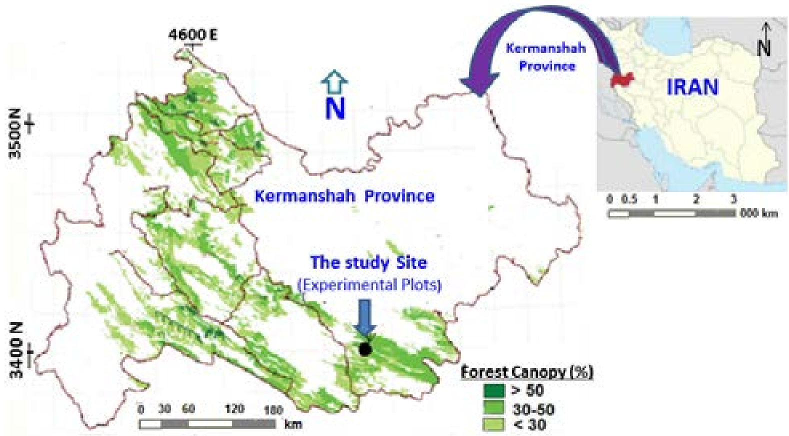

Fig. 1: Location of the study area

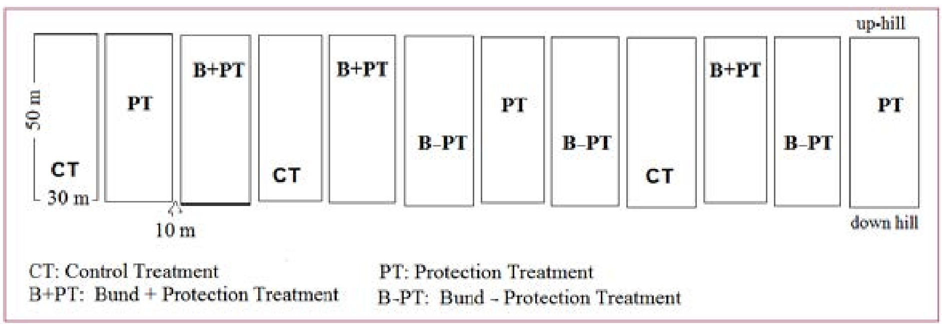

Fig. 2: Schematic diagram of experimental plot in the study area

with four treatments and three replications. The following treatments were used: B+PT, PT, B-PT and CT, resulting in a total of 12 plots (50 × 30 m each) spaced at 10 m intervals. Field survey and data collection were carried out during September 2012–2015 using a database maintained for the plots (Fig. 2). Zagros forests in Iran are nationalized and should be protected as a natural reservoir. These forests and their soils are mainly impacted by deforestation factors such as overgrazing, fragmented tillage and cropping, logging and fire. Thus, effective soil moisture storage in the forest depends upon control of these human-induced deforestation activities. Both B-PT and CT are subjected to common deforestation practices (mainly overgrazing and brunch cutting) that are more frequent in the study area.

Micro-catchment runoff harvesting

The bunds were designed in the form of semi-circle and perpendicular to the direction of the slope to capture the runoff and storage within the bund (Ackermann *et al.,* 2002). The bunds therefore reduce the loss of water and fertile layers of soil. They were also arranged in staggered rows along the natural contour of the land with the open end facing uphill, which consequently slowed runoff and enabled the harvested water to be used effectively. This was particularly advantageous in increasing the moisture available to vegetation, especially when precipitation was scarce. When used for reforestation, these bunds increase the survival rate of the trees planted in them, achieving a remarkable re-greening of the environment and promoting the biodiversity (Fig. 3). Responses to climatic stresses at the stand or landscape scale are not well understood (Chmura *et al.,* 2011). There have been no signs that Zagros forests are adapting to climate change; therefore, utility of runoff preservation is more visible in this semi-arid region. The location of each bund was benchmarked and built by local workers after the sites were selected and the plots established in a way that minimized soil disturbance. The upper levels of the embankments were covered by rocks, leading to the dryness of the tree branches. Depending on soil depth and tree density, the bunds were 40–60 cm deep and followed the contour of the land. However, the lower levels of the soil on the embankments were compact and covered by loose rocks and dry tree branches. There were approximately 183 CSBs per hectare in total. The planning and construction were economical and there were no negative environmental impacts compared to other mechanical measures. According to the evaluations, approximately 25 man-days of labor per hectare was needed to build this type of bund in the forests of Zagros areas.

Soil sampling and analysis

The soil was sampled from the surface (0–20 cm depth) once a year during the study period. The soil samples were dried and sieved through a 2 mm sieve, and their physicochemical characteristics were determined in the Kermanshah soil laboratory. The particle size distribution and texture of the soil were determined using the hydrometer method (Van Reeuwijke and Vente, 1993; Teh and Talib, 2006). The pH of the soil, as a saturated paste, was measured by a pH meter. A core was taken from the surface soil (0–20 cm) for BD measurements using an Eijikelkamp apparatus with a 100 cm^3 cylinder. In plots with bund, the core samples were taken from bottom of the bund (not basin or embankment areas). The samples were weighed before and after drying in an oven at 105 ^oC for 24 h. The BD values were calculated by dividing the weight of the oven-dried soil by the volume of the undisturbed soil, which was equal to the volume of the cylinder. Soil organic carbon (SOC) content was determined using the Walkley and Black method (Nelson and Sommers, 1982). Soil aggregate size distribution (SASD) was analyzed using wet sieving as outlined by Ryan et al. (2001). A 50 g of soil less than 5 mm was subjected to a soil aggregates analysis. The obtained aggregates were classified into six particles according to their mean size: very coarse (4.6 mm), coarse (1.5 mm), moderate (0.75 mm), fine (0.375 mm), and very fine (< 0.175 mm).

Statistical analysis

Statistical analyses were performed by SAS version 6.12. The main statistical process used was ANOVA, and p-values of 0.05 or less were considered significant.

RESULTS AND DISCUSSION

Effects of treatments *on soil organic carbon*

As shown in Table 1, the initial mean SOC levels (0-20 cm soil depth) in the B+PT, PT, B+PT, and CT plots were 23.4, 24.0, 1.90, and 18.0 g/kg, respectively, indicating no significant difference among them. However, after three years, the SOC levels in the respective treatments were 32.5, 29.0, 20.5, and 19.0

Table 1: The effects of three years treatments on soil organic carbon (g/kg)

Year	Treatments				Pr > F*
	B+PT	PT	B-PT	CT	
1st	23.4 (a)	24.0 (a)	19.0 (a)	18.0 (a)	0.156
3rd	32.5 (a)	29.0 (ab)	20.5 (b)	19.0 (b)	0.042

*Statistically significant trends at the 95% confidence level

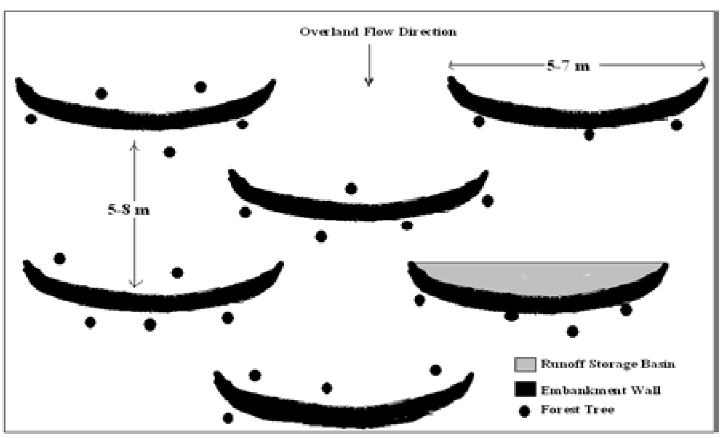

Fig. 3: Schematic map of semi-circular bund in the study area

g/kg, with significantly higher ($p > 0.05$) levels in the B+PT and PT plots. The stock of SOC was enhanced by construction of the bunds and protection measures. The B+PT and PT helped enhance soil moisture and curtail the effects of soil disturbance factors such as illegal tillage and livestock overgrazing. Field verification showed that tillage was being practiced up and down the slope with moldboard ploughs in adjacent to the study area. This tillage practice contributes to the loss of high-level soil nutrients compared to other ploughing practices (Bertol *et al.,* 2007). Mohammad *et al.* (2014) showed that, in contrast, zero and minimum tillage practices with the retention of crop residue significantly improved soil moisture storage and fertility of rain-fed agricultural land. Thus accelerated erosion and overland flow are more frequent in these areas (Heshmati *et al.,* 2012) and, as a result, significant amounts of SOC are released to the atmosphere within 100 days and transported off-site from erosion at the top of the slope (Polyakov and Lal, 2008). CO_2 emissions were higher in depth and areas of ridge tillage, highlighting the complex interactive influences of the presence of cover crops, tillage, and topography-driven variations in soil properties on soil greenhouse gas emissions (Negassa *et al.,* 2015). Construction of bunds had positive effects on vegetation cover and soil properties and significantly enhanced SOC (Khosrvi *et al.,* 2016).

Effect of treatments on soil aggregate size distribution

The results of SASD analysis between the treatments within the first and third years are shown in Tables 2 and 3 respectively. The treatments affected SASD after three years in the following ways:

Very coarse aggregates (mean size 4.6 mm)

In the first year, mean percentages of the proportions of very coarse aggregates in the samples from the B+PT, PT, B-PT, and CT plots were 47.0, 24.5, 26.8, and 35.0% respectively, showing that they were significantly higher in the B+PT treatment compared to others. However, due to the coupled effects of three years of runoff harvesting and preservation, the proportion of very coarse aggregates increased significantly.

Coarse aggregates (mean size 1.5 mm)

Coarse aggregates were found in the ratios of 17.5, 17.6, 15.5 and 17.2% for the B+PT, PT, B-PT, and CP plots, respectively, in the first year. Except for B+PT, there were no significant differences in coarse aggregates among the plots in the third year. Unlike very coarse aggregates, however, there was

Table 2: Comparing change in soil aggregate size distribution between treatments in the first and third years

Year	Mean soil aggregate size (mm)	Mean weighted diameter (g)				Pr > F*
		B+PT	PT	B-PT	CT	
1st	4.6	47.0 (a)	24.5 (ab)	26.8 (ab)	35.0 (b)	0.0446
	1.5	17.5 (a)	17.6 (a)	15.5 (a)	17.2 (a)	0.5664
	0.75	13.5 (b)	19.2 (b)	25.2 (a)	18.3 (b)	0.0464
	0.375	9.0 (b)	19.0 (a)	18.6 (a)	15.7 (a)	0.2017
	0.175	7.3 (b)	17.2 (a)	11.4 (ab)	11.4 (ab)	0.0498
	0.075	5.7 (a)	2.5 (b)	2.4 (b)	2.6 (b)	0.3195
3rd	4.6	53.6 (a)	35.7 (b)	32.7 (b)	34.0 (b)	0.0039
	1.5	12.4 (b)	20.3 (a)	20.5 (a)	18.5 (a)	0.1179
	0.75	15.2 (a)	15.4 (a)	19.8 (a)	18.0 (a)	0.0430
	0.375	8.5 (b)	15.7 (a)	16.5 (a)	17.6 (a)	0.0485
	0.175	7.7 (b)	13.5 (a)	8.5 (b)	9.5 (b)	0.0053
	0.075	3.4 (a)	1.4 (b)	2.0 (b)	2.5 (ab)	0.0914

*Statistically significant trends at the 95% confidence level

Table 3: Change in soil aggregate size distribution within first and third years (t-test) in the study area

Year	Mean Weighted Diameter (%)					
Aggregate size (mm)	4.6	1.5	0.75	0.375	0.175	0.075
1st	30.10	14.18	18.21	15.38	16.84	4.88
2nd	39.80	16.15	15.20	14.50	11.80	2.55
Pr > F	0.0530	0.2427	0.0091	0.1256	0.0452	0.0056

*Statistically significant trends at the 95% confidence level a significant reduction (from 8.2 to 6.2%) of coarse aggregates in the B+PT plot in the third year; these were transformed to very coarse aggregates.

Moderate aggregates (mean size 0.75 mm)

In the first year, the mean percentage of moderate soil aggregates in the B+PT, PT, B+PT and CT plots were 13.5, 19.2, 25.2 and 18.3%, respectively, with significantly higher values in the B-PT than in the other plots. In the third year, this value decreased in the B-PT, and therefore no significant difference was observed among the other plots.

Fine and smaller aggregates (mean size less than 0.375 mm)

There were almost no significant differences among the plots in this category in the first year; however, by the third year, fine and smaller aggregates were reduced mainly in the CSB+P and PT plots (Table 2).

Furthermore, t-test analyses of the measurements from the first and third years showed significant ($P < 0.05$) changes in the distribution of soil aggregates over time (Table 3). The proportion of very coarse aggregates increased significantly because of the treatments, leading to a reduction in the fine and smaller sized aggregates. On the other hand, the trend in the proportion of smaller sized aggregates was linked to that of coarse sizes (1.5-4.6 mm) in the B+PT treatment. This trend was clearly affected by SOC that was found to be considerably higher in the B + PT plot (Table 3). The differences in SOC in the different management systems were most evident in the topsoil (Eynard *et al.*, 2005). Soil aggregation is obviously an extrinsic characteristic that mainly depends on management (spatial) factors. Increase of aggregates size has a greater effect by management and an increase in the proportion of coarse aggregates indicated improvement of soil properties (USDA, 2010). An *et al*. (2010) found that re-vegetated soil in Loess Plateau (China) showed that a high carbon: nitrogen ratio resulted in rapid turnover of organic matter in topsoil and subsequent increases in soil macro aggregates.

Effect of treatments on BD and SM

In the first year, the mean soil BDs of the B+PT, PT, B-PT, and CT plots were 1.46, 1.32, 1.27, and 1.51 g/cm^3, respectively, with significantly lower values in the B-PT plot. However, three years of treatment resulted in a change in this soil variable (Table 4). In the third year, the BDs of the B+PT, PT, B-PT, and CP plots were 1.32, 1.22, 1.30, and 1.50 g/cm^3, respectively, showing significantly lower values in the B+PT and PT plots compared to others. Simple linear regression between BD and SM was analyzed. The results showed that SM significantly correlated to BD (R^2=0.6259, pr=0.0014). Such bunds can be considered as a possible runoff harvesting combating mortality event in semi-arid areas, particularly in a semi-arid forest like Zagros forest of Iran. Conversely, the proportion of fine aggregates increased with deforestation mainly due to other uses, illegal tillage practices, overgrazing, charcoal extraction, and logging. Field verification showed that moldboard ploughs were used in tillage practices, which contribute to the destruction of coarse soil aggregates and movement of soil particles in slope lands (Morgan, 2005). Li and Pang (2010) reported a 22% reduction and a 34% increase in coarse and fine aggregates, respectively, with the long-term use of this tillage practice in silty loam soil. A high level of fine soil aggregates contributes to high levels of SOC loss on the hillside. Nie *et al.* (2016) revealed that SOC is linked to fine soil particles, downslope water erosion, and tillage practices. The breakup of initial soil aggregates by erosive forces is responsible for

Table 4: Simple regression parameter between BD and soil moisture (SM)

Equation	a	b	CV	R-square	Pr > F
Y= -18.938 BD+ 44.71	-18.938	44.71	11.47820	0.6259	0.0014

*Dependent variable (Y) = SM; Independent variable = BD

Table 5: Re-growth of dried tree and reduction in dieback rate through semi-circular bund in the study area (Kalezard forest, Kermanshah, Iran)

Treatment	Restored mortal tree		Reduction in dieback rate*		Total (ha)
	average change/ plot (1500 m^2)	ha	average change/ plot (1500 m^2)	ha	
B+PT	3	19	5.5	36.7	55.7
PT	-	-	5.7	38.0	38.0

* Compared with CT

Fig. 4: Semi-circular bunds (A and B) and their effect on re-vegetation of oak (C and D) after three years

increased CO_2 emissions (Polyakov and Lal, 2008). Likewise, conversion of Zagros forests to rainfed agricultural land is accelerating, resulting in negative changes in soil BD, SOC and aggregate stability through tillage methods practiced up and down the slope as well as the conversion of land to other uses (Rezaei *et al*., 2012; Heshmati *et al*., 2015). In contrast, minimum and chisel tillage enhance soil quality, water retention and crop yield (Crittenden *et al.,* 2015). BD was also significantly reduced by construction of a micro-catchment (Aydrous *et al.,* 2015). Mean soil moisture in all treatment plots was about 15% in the first year. Unlike BD, which showed a decrease, soil moisture increased significantly during the study period in the CSB+P and PT. Hosseini *et al*. (2011) found that micro-catchments aid the storage of soil moisture at depths of 30–50 cm. Field verification demonstrated considerable effects of the bunds built on reclaimed soil and the vegetation that improved thereby over three years. Unfortunately, the pristine forests of Zagros are being adversely affected by illegal grazing, logging, and fragmented crop cultivation, which change the physical properties of soil, mainly compactness. Compacted soils often have fewer macropores, higher BDs, lower water infiltration capabilities, and higher runoff coefficients (Blanco and Lal, 2008). The mean BD of soil is strongly affected by livestock grazing, particularly when soil is moist. BD increased from 1.06 to 1.46 g/cm^3 in the areas converted from un-grazed land into livestock tracks (Zhou, 2010).

Dieback forest change

The change in tree dieback rates through treatments are shown in Table 5. The total restored trees and reduction in mortality rate by B+PT treatment are 19 and 36.7 tree per ha, respectively. In contrast, the reduction of 38.0 tree ha^{-1} in dieback through PT treatment was estimated, showing that the effect of B-PT treatment was significantly lower ($p<0.05$). The significantly lower effect of B-PT treatment on soil moisture storage can be related mainly to the soil disturbance factors such as tillage practice, overgrazing, illegal tillage and logging practices. These factors make sealing and crusting on the surface of soil, leading to the failure of infiltration and intensification of evaporation. Smectite is a dominant clay mineral in both soil and parent material in the study area and most parts of Zagros area (Owliaie *et al.,* 2006; Heshmati, *et al*., 2011) where are more susceptible to dispersion of soil aggregate, seal formation, runoff and soil loss (Lado *et al*., 2004).

Therefore, B+PT has two dimensional effects including restoration of some dead trees and curtailing forest mortality event. The results revealed that the built bunds should be conserved for protection measure; otherwise, this measure without protection can only combat 11% of mortality compared to B+PT treatment. Runoff harvesting system enhances the nutrient use efficiency by conserving soil and water (Rehman *et al*, 2014). However, taking measures to promote water and soil conservation is of priority in this regard (Iglesias and Garrote, 2015). As indicated by Allen *et al*. (2010), climate change raises the concern that forests may become increasingly vulnerable to higher background tree mortality. So far, there is no sign of abilities of trees to adapt to climate change and subsequently, in semi-arid regions, runoff utility is more seriously considered by experts and researchers (Chmura *et al.,* 2011). In the current study, it was suggested to develop and test this adaptive measure at a landscape pilot in Zagros forests or other similar forests evaluating their numerous aspects. Attempts for adaptive management of biodiversity may be improved by better collaboration, better communication of the risks of not doing and ensuring pass by relevant managers (Westgate *et al.,* 2013).

CONCLUSION

Knowing that forests are vulnerable to drought, runoff harvesting and protection can be considered as valuable allies against the degradation of soil. This study shows that extrinsic soil factors are significantly affected by runoff harvesting and preservation in the semi-arid Zagros forests. In drought conditions, building a semi-circular-shaped bund with protection treatment (B+PT), and implementing protection treatments (PT) alone, increased soil organic carbon from 1.90 to about 2.4% after three years. The proportion of very coarse soil aggregate also was increased about 8% due to the coupled effects of three years of runoff harvesting and preservation. Enhancement on both bulk density and soil moisture were also related to the semi-circular bund. Subsequently, runoff harvesting can protect 56 tree per hectare against dieback phenomenon. Furthermore, the semi-circular bund was found to be an adapted micro-catchment runoff harvesting system that could possibly be used in Zagros forests with minimum soil disturbance and low operational cost. However, results from the third treatment (B-PT) showed that there is no significant contribution from a bund built without protecting the soil against disturbances like grazing, tillage, fire, and logging. It is concluded that enhancing moisture by runoff harvesting depends on improvements in soil quality due to the coupled effects of building bunds and enacting preservation measures to overcome climate change in Zagros forests.

CONFLICT OF INTERESTS

The author declares that there is no conflict of interests regarding the publication of this manuscript.

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ABBREVIATIONS

ANOVA	Analysis of variance
BD	Bulk density
B+PT	Bund with protection
B-PT	Bund without protection
CT	Control treatment
CO_2	Carbon dioxide
CV	Coefficient of variation
°C	Celsius degree
cm	Centimeter
F	F-value
g	Gram
g/cm^3	Gram per cubic centimeter
g/kg	Gram per kilogram
ha	Hectare
km	Kilometer
m	Meter
mm	Millimeter
P	p-values
PT	Protection treatment
Pr	Probability
R^2	R-squared
SAS	Statistical analysis software
SASD	Soil aggregate size distribution
SCB	Semi- circular bund
SM	Soil moisture
SOC	Soil organic carbon
UTM	Universal Transverse Mercator
%	Percent

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