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# Carbon Sequestration Capability of Check Dams (Case Study: Nehzatabad Watershed of Kohgiluyeh County in Iran)

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ABSTRACT

**Aims:** Check dams are one of the common structures for controlling soil erosion in Iran. Sediment deposits behind them contain reallocated carbon, which plays a significant role in ecosystem carbon sequestration. Most studies related to check dams are in the field of their primary function, i.e., soil and water conservation. However, in this study, we evaluated their capability in carbon sequestration, which has received very little attention.
**Materials & Methods:** In this study, which was conducted in the Nehzatabad Watershed in Kohgiluyeh County in the southwest of Iran, using the sediments deposited in 11 check dams while analyzing the amount of sediment yield, the performance of these structures in carbon sequestration during the years 2017 to 2018 has also been investigated. The amount of soil organic carbon (SOC) was determined using the Walkley-Block method. The volume of sediments deposited behind the check dams was measured, and then the resulting sediment yield was measured and then estimated for three different sediment trapping coefficients.
**Findings:** Results show that the mean measured sediment yield in the study check dams is 0.13 t. $ha^{-1}$. $y^{-1}$, compared to mean annual soil erosion in Iran (16 t. $ha^{-1}$. $y^{-1}$), is simple soil erosion in the studied watershed. The estimated mean values for sediment yield in different check dams are 0.26, 1.69, and 3.59 t .$ha^{-1}$ .$y^{-1}$ for different TE coefficients. The mean of SOC deposited in check dams is 20637.79 g, equivalent to 12.9 and 2.16 $m^2$ of Oak forest in carbon sequestration and carbon dioxide absorption, respectively.
**Conclusion:** Erosion and sedimentation can make a net positive contribution to SOC sequestration, and this study reveals that check dams in the Nehzatabad Watershed conserve soil and water and sequester carbon. A small change in the soil carbon pool may cause a significant change in atmospheric carbon dioxide, which may have important implications for global climate. Therefore, building many of these dams in watersheds while controlling erosion and sedimentation makes it possible to deposit considerable carbon in these sediments and prevent the release of carbon dioxide as a greenhouse gas into the atmosphere.

**Keywords:** Soil Erosion; Sediment Control; SOC, Carbon Dioxide; Climate Change.

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## Introduction

With the increase in the human population and efforts to provide food and shelter, more intensive use of ecosystems and natural resources has increased. Human activities have always been associated with destructive consequences. Currently, the emission of greenhouse gases, global warming, and the climate change phenomenon are the most critical consequences of humans' inefficient and incorrect use of natural resources, which have affected the current generations and will cause problems for future generations. The emission of greenhouse gases has taken on a growing trend, which will increase the amount of emissions and its consequences every year [1]. The amount of greenhouse gas emissions in 2010 was reported to be approximately 109 x 49 mg of carbon dioxide [2], of which 21.2 to 24 % is related to the activities of agricultural ecosystems, forests, and other types of land use [2]. Although carbon dioxide is plants' most important source of photosynthesis, its excess leads to harmful environmental consequences [3]. The most considerable amount of greenhouse gas emissions is attributed to carbon dioxide. In this regard, solutions such as reducing the consumption of non-renewable fossil fuels, preventing land use change, modifying tillage patterns, and finally, the issue of carbon sequestration or carbon deposition have been proposed.

The carbon sequestration approach is one of the appropriate management principles to reduce environmental risks [1, 4]. Carbon sequestration or carbon deposition is an activity that increases carbon reserves and its transfer from the atmosphere into biomass and soil [4, 5]. Soil carbon is vital in the carbon cycle because it includes about two-thirds to three-fourths of the soil reservoir, twice the atmospheric carbon reserve, and three times the plant carbon reserve, respectively [6].

Soil erosion and deposition annually redistribute soil organic carbon (SOC) across landscapes. Thus, soil erosion can be substantial in the global carbon (C) cycle [7]. Worldwide erosion deposition induced a terrestrial C sink of 0.72 Pg. $C.y^{-1}$, estimated [7].

To reduce the adverse effects of soil erosion, there are many actions to protect water and soil worldwide, including revitalizing vegetation, soil management, terraces, and construction of check dams [8]. Check dams are one of the most common structures around the world [9-13] which are often built in the upstream areas of dams and mainly with the objectives of controlling soil erosion, stabilizing the longitudinal profile of waterways and controlling floods [14, 15]. Regulating the morphology of the river channel, improving habitat conditions, soil sedimentation, retention, and water supply are other functions of these dams [16-20]. Therefore, check dams are multi-purpose structures that can store a significant proportion of soil carbon in trapped sediments [21]. In other words, check dams, widely used to trap sediments in areas with high soil erosion, can also act as a carbon sink; however, only a few assessments of carbon sequestration by check dams have been performed [22]. Therefore, soil erosion, primarily through the construction of check dams, may profoundly affect the soil carbon pool in the carbon cycle process. However, there are still intense debates on the role of soil erosion as a carbon source or sink for the global carbon cycle [23, 24]. This study attempts to evaluate the role of check dams built in the Nehzatabad Watershed in Kohgiluyeh County on carbon sequestration. This evaluation makes estimates of the SOC sequestration by erosion and subsequent deposition in check dams.

## Materials & Methods

### Study Area

Nehzatabad Watershed, with an area of 5570 ha, is a part of Sarpari catchment, one of the




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sub-catchments of Jarahi-Zohreh basin in the southwest of Iran, Kohgiluyeh and Boyer-Ahmad Province, Kohgiluyeh County (Figure 1). The studied area is geographically located at 50° 25' to 50° 35' east longitude and 30° 37' to 30° 42' north latitude. The average annual rainfall in this area is about 520 mm. Dehdasht City, the center of Kohgiluyeh County, is the closest and most populated city to this watershed [25].

### Check dams built in the Nehzatabad Watershed

In line with the purpose of the research and considering the location of the constructed structures, in the first step, the watershed area was divided into five hydrological units, Sub-W1 to Sub-W5, where each hydrological unit includes one or more waterways with some check dams. In this way, there are two check dams in hydrological unit Sub-W1, two check dams in hydrological unit Sub-W2, two check dams in hydrological unit Sub-W3, four check dams in hydrological unit Sub-W4, and one check dam in hydrological unit Sub-W5 (Figure 2).

## Materials & Methods

### Check dams' selection

Due to the critical erosion conditions of the Nehzatabad Watershed and following the preparation of its implementation plan, 19 check dams with an effective height of one to two meters were built from 2016 to 2018. After a field survey and visiting the locations of the check dams in the watershed, 11 check dams were selected for study (Table 1).

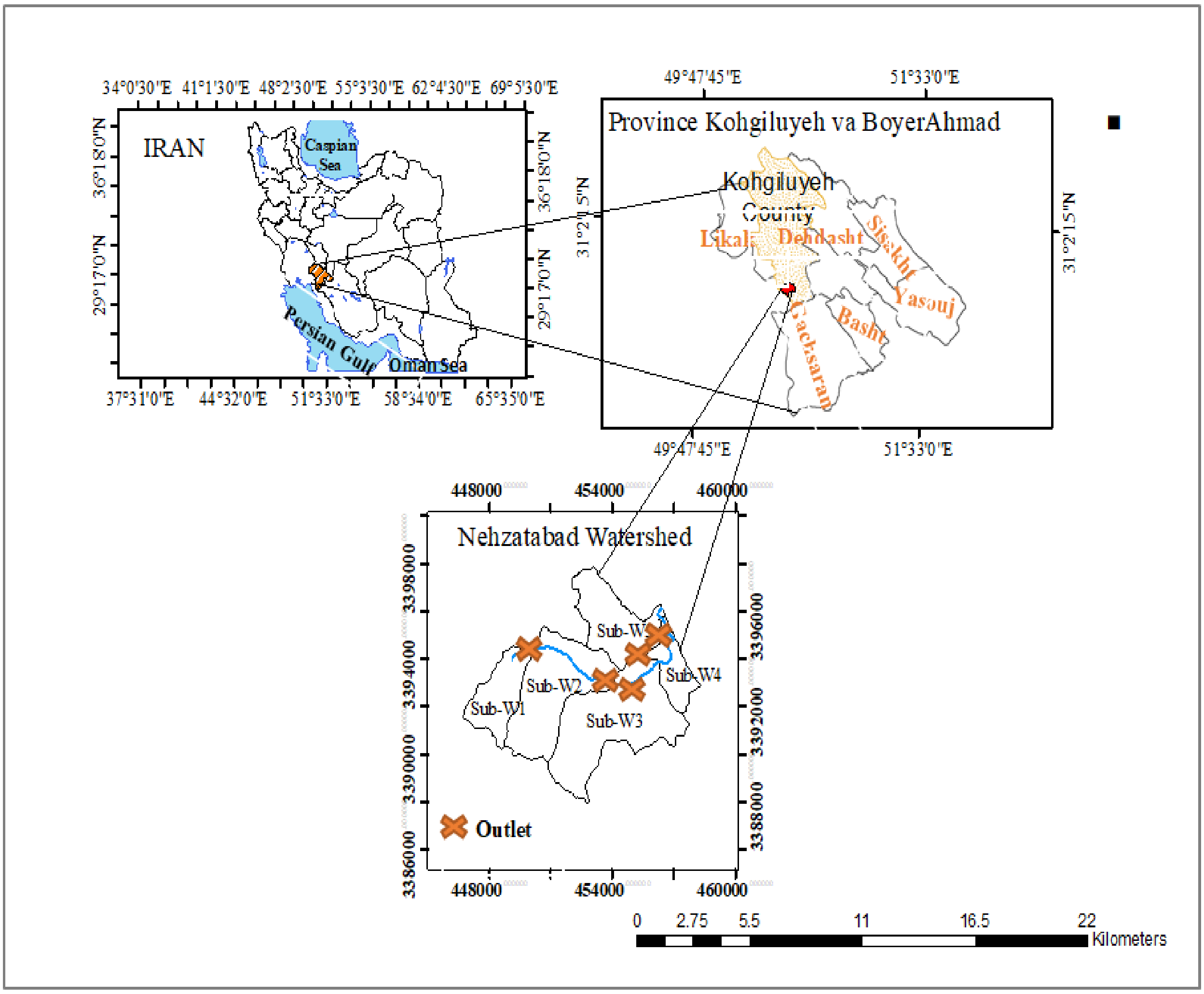


**Figure 1)** Location of the Nehzatabad Watershed in Kohgiluyeh and Boyer-Ahmad Province and Iran.


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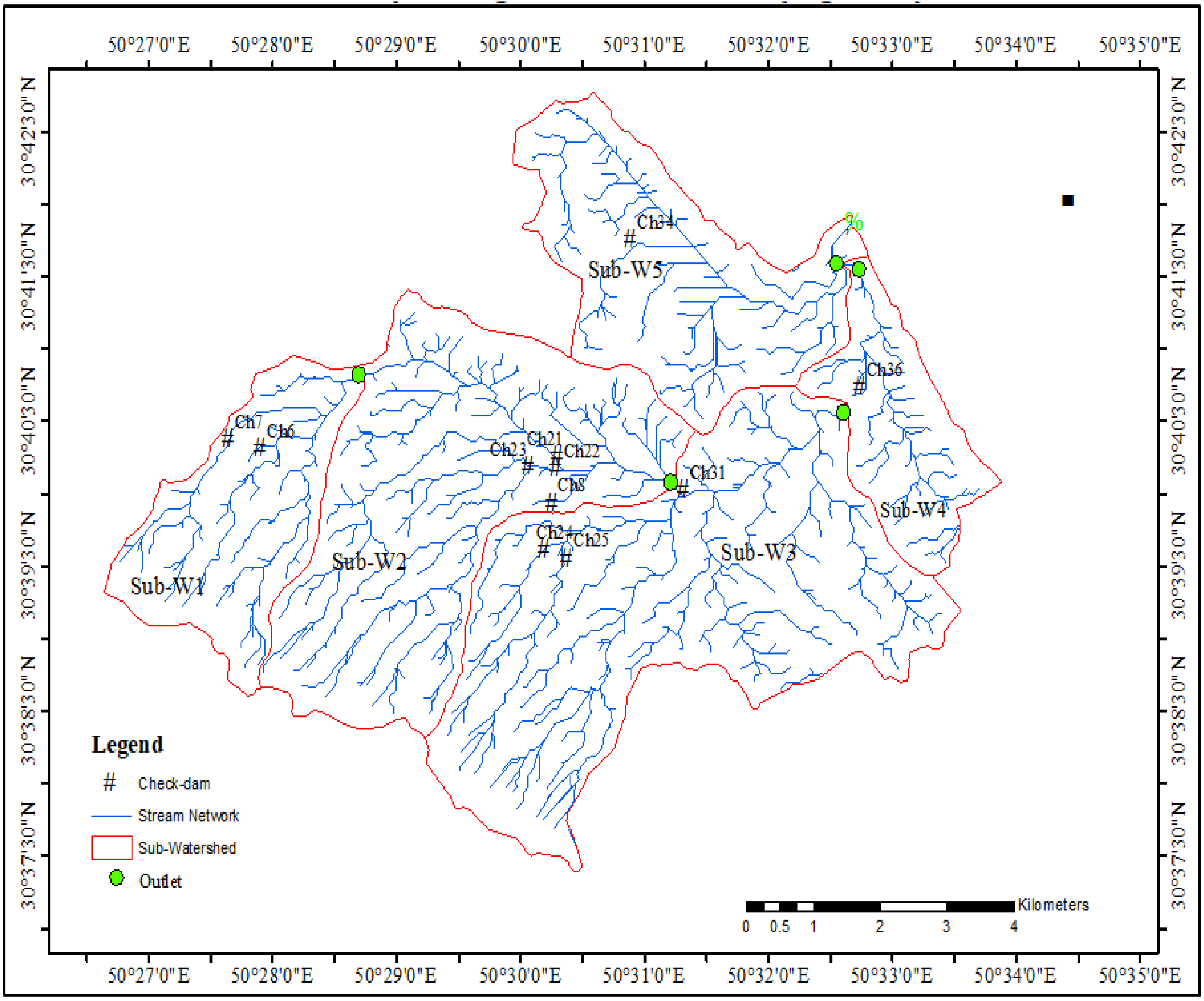


**Figure 2)** Location of hydrological units and check dams in the study area.

**Determination of soil organic carbon (SOC) in soil and sediment samples**

Sediment and soil samples were collected from 0 to 30 cm behind each check dam and the upstream source soils. To take a wholly indicative and representative sample, each sample indicates three smaller samples taken from three different places behind the check dams and the upstream source soils. First, the samples were air-dried and then passed through a 2 mm sieve in the soil science laboratory of the Khatam Al Anbia Behbahan University of Technology. The amount of organic carbon was determined by the Walkley-Block method [26]. The normality test was done using the Kolmogorov–Smirnov test. The comparison of the average amount of organic carbon in two groups of soil and sediment samples has been investigated using an independent t-test (Independent Two Sample Mean Test).

**Calculation of sediment volume and sediment yield in sub-watershed**

Using the data of structural parameters of each check dam, deposited sediment depth (Figure 3), and deposited sediment wedge area, the volume of sediments deposited behind the dams was determined. Sediment check dams are usually deposited in the form of a pyramid with a trapezoidal base [15, 27], the volume of which is calculated using the following formula:

$$V = {}^{1}/_{3} \times B \times H \qquad \text{Eq. (1)}$$





[ DOI: 10.22034/ecopersia.12.1.67 ]

**Table 1)** Geographical location and characteristics of check dams in Nehzatabad Watershed.

| Dams Name | UTM X | UTM Y | Year of Implementation | Structure Type | Effective Height (m) | Total Height (m) | Structure Volume ($m^3$) | Reservoir Volume ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| Ch8 | 452524 | 3392630 | 2019 | Mortared Stonework | 1.5 | 2 | 95 | 145 |
| Ch23 | 452228 | 3393095 | 2019 | Mortared Stonework | 1.3 | 2 | 90 | 122 |
| Ch31 | 454222 | 3392781 | 2017 | Mortared Stonework | 2.7 | 4.8 | 700 | 2100 |
| Ch6 | 448786 | 3393939 | 2017 | Mortared Stonework | 2 | 3 | 210 | 580 |
| Ch7 | 448361 | 3393460 | 2017 | Mortared Stonework | 1 | 2 | 100 | 240 |
| Ch34 | 453560 | 3395982 | 2017 | Gabion | 1 | 2 | 100 | 350 |
| Ch36 | 456341 | 3393802 | 2017 | Mortared Stonework | 2.9 | 4 | 750 | 1740 |
| Ch21 | 452605 | 3393219 | 2018 | Mortared Stonework | 1.4 | 2.4 | 171.4 | 2140 |
| Ch22 | 452594 | 3393068 | 2018 | Mortared Stonework | 1.4 | 2.5 | 187.4 | 240 |
| Ch24 | 452430 | 3392038 | 2018 | Mortared Stonework | 1.3 | 2 | 79.4 | 130 |
| Ch25 | 452717 | 3391925 | 2018 | Mortared Stonework | 1.35 | 2 | 101.2 | 120 |

where V is the volume of deposited sediments ($m^3$), B is the base area of the sedimentary wedge ($m^2$), and H is the length of the deposition wedge (m). In some studied check dams, a combination of several geometric shapes was used to calculate the volume of sediments deposited behind them.

**Figure 3)** Measurement of the sediment deposited depth.

By multiplying the bulk density of sediments ($t\ m^{-3}$) by the volume of sediments ($m^3$), the weight of sediments was obtained in t (Eq. 2).

$$t = \rho \times v \qquad \text{Eq. (2)}$$

Where t is the weight of sediments (t), ρ is the bulk density of sediments ($t\ m^{-3}$), and v is the volume of sediments ($m^3$). By dividing the weight of sediments (t) by the area of the watershed upstream of the check dam (ha), the sediment yield rate was obtained in $t.\ ha^{-1}$, which was divided by the number of years of the structure's life (years), and the rate of sediment yield was obtained in $t\ ha^{-1}.y^{-1}$:

$$SY = \left(\frac{t}{A}\right) \Big/ T \qquad \text{Eq. (3)}$$

where t is the weight of sediments (t), A is the area of the sub-watershed upstream of the check dam (ha), T is the life span of





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the structure (year), and SY is the sediment yield of the watershed (t. $ha^{-1}$). The behavior of check dams is similar to that of small dams, so the runoff accumulated in the dam reservoir either evaporates, penetrates the soil, or crosses through the dam's body [28]. Based on the type of check dams surveyed in this research, part of the sediments in the runoff passing through the dams were transferred downstream of the dam, and thus, the sediment trapping efficiency (TE) was calculated for each dam. The coefficient of sediment trapping in check dams changes according to the ratio of incoming runoff to the dam reservoir volume, the dam reservoir type and its implementation method[29], and the duration of runoff retention in the dam reservoir [13]. In this research, to calculate TE, we used the simple method of Brown (1943), which has been used in many studies worldwide [13, 30, 31].

$$TE = 100\left(1 - \frac{1}{1 + 0.0021\, D\, \frac{C}{W}}\right) \qquad \text{Eq. (4)}$$

where C is the storage capacity of the check dam reservoir ($m^3$); W is the watershed area upstream of the dam ($km^2$). Depending on the characteristics of the dam reservoir, the value of D is from 0.046 to 1 and, on average, is 0.1. In the dams where the runoff is stored behind them, the value of D is close to one; in other words, the sediment trapping efficiency is higher.

In this study, we named the sediment yield calculated using the volume of sediments deposited behind the check dams as measured sediment yield, and the sediment yield was calculated by considering the sediment trapping coefficients as estimated sediment yield.

### Calculation of SOC deposited in sediments behind check dams and SOC loss

The amount of carbon deposited in the sediments behind the check dams was calculated as follows: First, by multiplying the volume of the deposited sediments ($m^3$) by their bulk density (t .$m^{-3}$), the weight of the sediments was obtained in t. Then, by multiplying the weight of sediments (kg) by the amount of soil organic carbon in the sediments behind the dams (% = g .$kg^{-1}$sediment), the amount of deposited carbon (g) was obtained.

By multiplying the amount of soil organic carbon in the sediments behind the dams (% = g. $kg^{-1}$ sediment) by the measured sediment yield (kg. $ha^{-1}$.$y^{-1}$) and the estimated sediment yield for three different sediment trapping coefficients, the amount of soil organic carbon losses is calculated in g. $ha^{-1}$.$y^{-1}$.

## Findings

### Measured and estimated sediment yield

The measured sediment yield in the upstream sub-watershed of check dams varies from 0.001 t. $ha^{-1}$ .$y^{-1}$ in dam No. Ch36 to 1.08 t .$ha^{-1}$ .$y^{-1}$ in dam No. Ch6 (Table 2). Based on the equation of Brown (1943), the minimum, mean, and maximum values of the sediment trapping coefficient calculated for the study check dams are 0.79 (D=0.046), 1.76 (D=0.1), and 15.25 (D=1) percent (Table 3). The mean measured sediment yield in check dams is 0.13 t. $ha^{-1}$ .$y^{-1}$, but considering coefficients for sediment trapping, the estimated mean values for sediment yield in different check dams range from 0.26, 1.69, and 3.59 t .$ha^{-1}$ .$y^{-1}$ for different TE coefficients. In some selective check dams, the sediment trapping coefficient has been up to 99 % (Table 3).

### Carbon sequestration and SOC loss

The minimum and mean organic carbon in the sediment samples behind the check dams are higher than in the upstream soils, which indicates the leaching of organic carbon in the soils of the study area as a result of soil erosion and its accumulation in the sediments behind the check dams (Table 4, Figure 4). In a way, this expresses the role that check dams can play in carbon



[ DOI: 10.22034/ecopersia.12.1.67 ]

**Table 2)** Sediment volume trapped behind each check dam and measured sediment yield.

| Check Dams Name | Year of Implementation | Sediment Volume ($m^3$) | Sediment Bulk Density ($t.\ m^{-3}$) | Sub-watershed Area of Check Dams (ha) | Measured Sediment Yield ($t.\ ha^{-1}.y^{-1}$) |
|---|---|---|---|---|---|
| Ch8 | 2019 | 2.83 | 1.7 | 16.4 | 0.14 |
| Ch23 | 2019 | 3.54 | | 67.55 | 0.044 |
| Ch31 | 2017 | 20.9 | | 3027 | 0.002 |
| Ch6 | 2017 | 26.13 | | 10.24 | 1.08 |
| Ch7 | 2017 | 23.92 | | 172.54 | 0.058 |
| Ch34 | 2017 | 3 | | 94.7 | 0.013 |
| Ch36 | 2017 | 18 | | 4006 | 0.001 |
| Ch21 | 2018 | 68.75 | | 888 | 0.043 |
| Ch22 | 2018 | 37.33 | | 296 | 0.071 |
| Ch24 | 2018 | 11.2 | | 437 | 0.014 |
| Ch25 | 2018 | 7 | | 198.63 | 0.019 |

**Table 3)** Measured an estimated sediment yield considering different coefficients of sediment trapping.

| Check Dams Name | Measured Sediment Yield ($t.\ ha^{-1}.y^{-1}$) | Reservoir Volume ($m^3$) | Sub-watershed Area of Check Dams ($km^2$) | Coefficients of Sediment Trapping | | | Estimated Sediment Yield ($t.\ ha^{-1}.y^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | D=0.046 | D=0.1 | D=1 | D=0.046 | D=0.1 | D=1 |
| Ch8 | 0.14 | 145 | 0.16 | 9 | 16.96 | 65.51 | 1.55 | 0.82 | 0.21 |
| Ch23 | 0.044 | 122 | 0.67 | 0.99 | 2.91 | 16.3 | 4.44 | 1.51 | 0.26 |
| Ch31 | 0.002 | 2100 | 30.27 | 0.59 | 98.61 | 10 | 0.33 | 0.002 | 0.02 |
| Ch6 | 1.08 | 580 | 0.1 | 36 | 55 | 99.3 | 3 | 1.96 | 1.08 |
| Ch7 | 0.058 | 240 | 1.72 | 1 | 1.96 | 57 | 5.8 | 2.95 | 0.1 |
| Ch34 | 0.013 | 350 | 0.95 | 2.91 | 0.69 | 40.82 | 0.44 | 1.88 | 0.031 |
| Ch36 | 0.001 | 1740 | 40.06 | 0.39 | 0.89 | 8.25 | 0.25 | 0.11 | 0.01 |
| Ch21 | 0.043 | 2140 | 8.88 | 1.96 | 4.76 | 33.33 | 2.19 | 0.9 | 0.12 |
| Ch22 | 0.071 | 240 | 2.96 | 0.69 | 1.67 | 14.52 | 10.28 | 4.25 | 0.48 |
| Ch24 | 0.014 | 130 | 4.37 | 0.19 | 0.59 | 6 | 7.36 | 2.37 | 0.23 |
| Ch25 | 0.019 | 120 | 1.98 | 0.49 | 0.99 | 10.71 | 3.87 | 1.91 | 0.17 |
| Mean | 0.95 | | 8.37 | 0.79 | 1.76 | 15.25 | 3.59 | 1.69 | 0.26 |



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sequestration.

The amount of SOC in sediment samples is higher than in soil samples, but this difference is not statistically significant (Table 5).

Bordbar (2020) stated that the amount of carbon sequestered and carbon dioxide absorbed in the soil in the Iranian *Oak* forest habitat is 16 t. $ha^{-1}$ (1600 g .$m^{-2}$) and 95.58 t. $ha^{-1}$ (9558 g .$m^{-2}$) respectively [32]. The mean of SOC deposited in check dams is 20637.79 g, which, based on the study of Bordbar (2020), is equivalent to 12.9 and 2.16 $m^2$ of *Oak* forest in carbon sequestration and carbon dioxide absorption, respectively (Table 6). It should be noted that the studied watershed ecosystem is similar to Iranian *Oak* forests.

The amount of carbon losses for sediment yield measured in check dams and sediment yield estimated by considering three different sediment trapping coefficients are 135.38, 2173.35, 1085.37, and 199.33 g. $ha^{-1}$ .$y^{-1}$ respectively (Table 7, Figure 5).

## Discussion and Conclusion

Based on the characteristics of studied check dams (Table 1), the minimum, average, and maximum ratio between the volume of the reservoir ($m^3$) and the volume of the structure ($m^3$) in the study dams are 1.19, 3.04, and 12.49 respectively. In the same context, Armin et al. (2018) stated that the ratio between the volume of the reservoir and the volume of the structure in small dams should be at least 8 [33]. The higher the value of this indicator, the more economical the implementation of these dams will be because we can control a larger volume of sediment at a lower cost. In 9 cases of selected check dams studied, the value of this indicator is less than 3, which means that we have been able to create a reservoir volume less than three times the volume of the dam structure to store and control sediment. Compared to the cost of building one cubic meter of concrete (stone and cement), at first glance, the construction of most of the studied check dams could

**Table 4)** The organic carbon content of soil and sediment samples in check dams in the Nehzatabad Watershed.

| Samples | N | SOC (g. $kg^{-1}$) | | | |
|---|---|---|---|---|---|
| | | Low | High | Mean | SE |
| Soil | 11 | 0.13 | 1.15 | 0.49 | 0.14 |
| Sediment | 11 | 0.42 | 1.15 | 0.66 | 0.11 |

**Table 5)** Independent Samples Test in SOC of soil and sediment samples.

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95 % Confidence Interval of the Difference Lower | Upper |
| SOC | Equal Variances Assumed | 0.248 | 0.624 | -1.584 | 20 | 0.129 | -0.16727 | .10558 | -.38751 | .05297 |
| | Equal Variances not Assumed | | | -1.584 | 18.712 | 0.130 | -0.16727 | 0.10558 | -0.38849 | 0.05395 |

**Table 6)** SOC deposited in check dams (g) and its role in carbon sequestered and carbon dioxide absorbed.

| Check Dams Name | SOC Deposited in Check Dams (g) | Equivalent to the Oak Forest ($m^2$) in Carbon Sequestration | Equivalent to the Oak Forest ($m^2$) in Absorption of Carbon Dioxide |
|---|---|---|---|
| **Ch8** | 3832.02 | 2.4 | 0.4 |
| **Ch23** | 3883.71 | 2.43 | 0.41 |
| **Ch31** | 17971.57 | 11.23 | 1.88 |
| **Ch6** | 50887.54 | 31.8 | 5.32 |
| **Ch7** | 17731.4 | 11.08 | 1.86 |
| **Ch34** | 4299.42 | 2.69 | 0.45 |
| **Ch36** | 18146.51 | 11.34 | 1.9 |
| **Ch21** | 62514.53 | 39.07 | 6.54 |
| **Ch22** | 26934.03 | 16.83 | 2.82 |
| **Ch24** | 13837.21 | 8.65 | 1.45 |
| **Ch25** | 6987.79 | 4.37 | o.73 |
| **Min** | 3832.02 | 2.4 | 0.4 |
| **Max** | 62514.53 | 39.07 | 6.54 |
| **Mean** | 20637.79 | 12.9 | 2.16 |

**Table 7)** Amount of SOC losses for measured and estimated sediment yield considering three different sediment trapping coefficients.

| Check Dams Name | SOC Losses in Measured Sediment Yield (g. $ha^{-1}$ .$y^{-1}$) | SOC Losses in Estimated Sediment Yield (g. $ha^{-1}$ .$y^{-1}$) | | |
|---|---|---|---|---|
| | | D=0.046 | D=0.1 | D=1 |
| **Ch8** | 111.51 | 1234.59 | 167.27 | 653.14 |
| **Ch23** | 28.4 | 2865.35 | 167.79 | 974.48 |
| **Ch31** | 1.01 | 166.92 | 10.12 | 1.01 |
| **Ch6** | 1236.98 | 3436.05 | 1236.98 | 2244.88 |
| **Ch7** | 25.29 | 2529.07 | 43.60 | 1286.34 |
| **Ch34** | 10.96 | 370.93 | 26.13 | 1584.88 |
| **Ch36** | 0.59 | 148.26 | 5.93 | 65.23 |
| **Ch21** | 23 | 1171.40 | 64.19 | 481.4 |
| **Ch22** | 30.13 | 4362.02 | 203.72 | 1803.8 |
| **Ch24** | 10.17 | 5248.84 | 167.15 | 1722.38 |
| **Ch25** | 11.16 | 2272.5 | 99.83 | 1121.57 |



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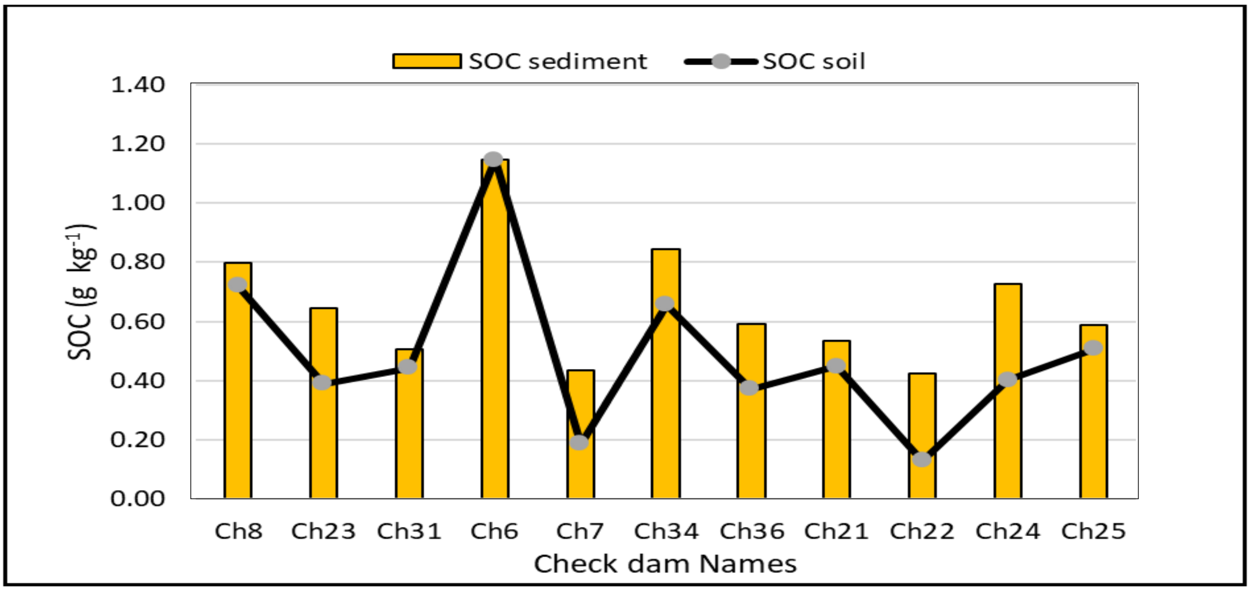


**Figure 4)** SOC amount (g. kg$^{-1}$) in soil and sediment samples.

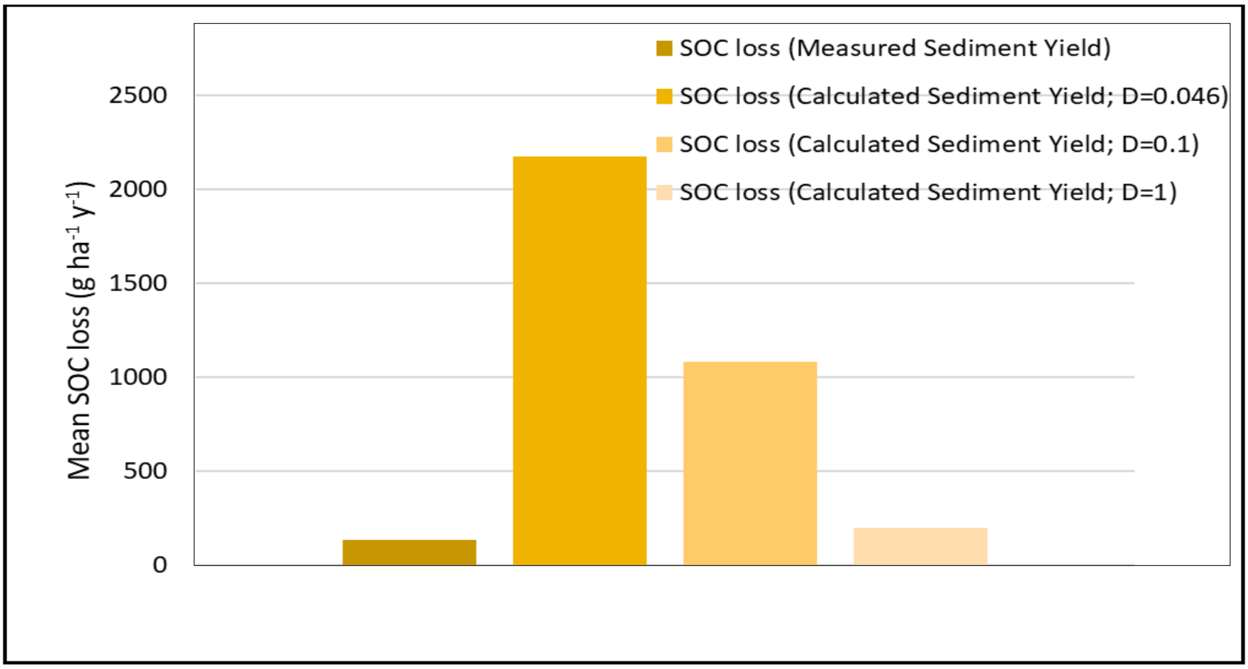


**Figure 5)** Mean soil organic carbon loss for measured sediment yield and estimated sediment yield considering three sediment trapping coefficients.

have been more economical regarding the mentioned indicator.

The mean measured sediment yield in the study check dams is 0.13 t .ha$^{-1}$ .y$^{-1}$. According to the study of Mohammadi et al. (2021), Iran's mean annual soil erosion is 16 t .ha$^{-1}$, equivalent to about 2.7 billion tons of soil lost [34]. This issue can be analyzed and investigated from two aspects: firstly, the yield of sediment in the study area is meager, and the phenomenon of soil erosion in this watershed is not very complicated, and secondly, the check dams built in the Nehzatabad Watershed were not placed



[ DOI: 10.22034/ecopersia.12.1.67 ]

technically properly which have a good performance in depositing sediments, and therefore the measured sediment yield is different from the reality, so we need more and more detailed studies in this field.

The amount of measured sediment yield (Table 2) is for the condition that all the sediment entering the dam reservoir settles at the bottom. As explained in the materials and methods section, none of the studied check dams were completely impervious to the passage of water, and not all sediments were deposited behind them. As a result, the sediment trapping coefficient should be calculated. The sediment trapping coefficient is a function of the storage capacity of the dam reservoir, the area of the watershed upstream of the dam, and a coefficient that varies between 0.046 and 1 depending on the properties of the dam reservoir. In Ch6 check dam and the case of D=1, the sediment trapping coefficient is about 99 %; this means that almost all the sediments entering the reservoir have settled at the bottom, and this is the reason that the measured and estimated sediment yield both show the same number of 1.08 t. $ha^{-1}$ .$y^{-1}$. In the Ch22 dam and the case of D=0.046, the sediment trapping coefficient was calculated to be 0.69; this means that less than one percent of the sediments entering the dam have settled in the bottom of the dam, and for this reason, the amount of sediment measured is 0.071 t .$ha^{-1}$ .$y^{-1}$, which has a huge difference with the estimated sediment yield, i.e., 10.28 t. $ha^{-1}$ .$y^{-1}$. It can be seen that the estimated sediment yield values are higher than the measured sediment yield values, and compared to the mean annual soil erosion in Iran [33], this amount of erosion and sediment yield in the watershed cannot be ignored. Therefore, the general conclusion regarding the characteristics of the check dams built in the Nehzatabad Watershed is that most of these dams needed to be placed properly along the waterways. This incorrect placement led to a lower storage capacity of the reservoir, an increase in the area of the watershed, and finally, a sediment trapping coefficient in dams. As a result, the measured sediment yield significantly differs from the estimated sediment yield. It is not an accurate amount of the actual sediment yield of the watershed. Although the difference between the amounts of SOC in the sediments deposited in the check dams and the source soil upstream of the check dams was not statistically significant, the amount of SOC in the sediments deposited in the check dams was, on average, 52 % higher than the source soil upstream of the check dams. As mentioned before, it should be noted that the measured sediment yield seems to be different from the actual amount of sediment yield in the watershed, and therefore, naturally, the amount of carbon deposited in the sediments behind the check dams must be more than the measured amount.

However, the richness of the sediments behind the check dams in organic carbon compared to the original soils shows that we have organic carbon losses in the studied area due to soil erosion. In this context, Berhe et al. (2007) reported that up to 70 % of the SOC in eroded soil could be decomposed during transport and deposition. Thus ,erosion and deposition can positively contribute to C sequestration [7].

The sediments accumulated in the check dam reservoir are rich in terms of carbon content and, accordingly, organic matter and the environment behind the check dams can be used on a large scale as a substrate for the cultivation of fodder needed by the local community's livestock in non-rainy seasons. Unfortunately, most of the check dams have been built in the first and second-order waterways and are far from the reach of the local community. Of course, in terms of fodder production, depending on



[ DOI: 10.22034/ecopersia.12.1.67 ]

the geological formations upstream of the dams, the presence of other elements in the sediments behind these dams should not be ignored.

The mean of SOC deposited in check dams is 20637.79 g, equivalent to 12.9 and 2.16 $m^2$ of *Oak* forest in carbon sequestration and carbon dioxide absorption, respectively (based on the study of Bordbar, 2020). It was estimated that soil erosion and subsequent sedimentation on land can sequester 1 Pg. $C.y^{-1}$ globally [35, 36]. The amount of carbon loss in the calculated sediment yield mode with the coefficients D=0.046 and D=0.1 is 16 and 8 times the amount of carbon loss in the measured sediment yield mode, respectively (Table 7, Figure 5). In other words, as the measured and calculated sediment yield is different, the measured and calculated carbon loss will also be different.

As a hydro-engineering approach introduced by humans, check dams are widely used worldwide to manage watersheds with various goals, including erosion and sedimentation control, water supply and regulation, groundwater recharge, and agricultural production. In Iran, these dams are used as a common technique mainly to control soil erosion and sedimentation, so in the last few decades, many of these dams have been built in critical watersheds of the country. For this reason, most studies in Iran have dealt with these structures from the aspect of erosion control. Nevertheless, the fact is that the implementation of these structures brings more ecosystem services. In this study, we tried to analyze the sediment yield and soil erosion in the Nehzatabad Watershed in Kohgiluyeh County in Iran and use the sediments trapped in the study check dams to indicate carbon sequestration.

Soil erosion and deposition may play essential roles in balancing the global atmospheric carbon budget through their impacts on the net carbon exchange between terrestrial ecosystems and the atmosphere [37]. Therefore, by building a large number of these dams in watersheds while controlling erosion and sedimentation, considerable carbon can be deposited in these sediments, and carbon dioxide can be prevented from being released into the atmosphere, an issue that can be important on the national scale in terms of preventing the increase in ambient temperature and climate change.

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