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# Prediction of Water Erosion and its Evaluation Using CORINE Model and Comparison with ICONA Method in Talesh City

Mohammad Mahboub Kheirkhah[a*]

[a]*M. Sc., Department of Surveying-GIS, Ramsar Branch, Islamic Azad University, Ramsar, Iran*

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**Abstract**

Soil erosion is one of the environmental hazards. The aim of this study was to predict water erosion and evaluate it with CORINE and ICONA models in the study area of Talesh city. In CORINE model, parameters such as topography, erodibility, erosion and land use and vegetation are required, and in ICONA model, slope, geology, land use, vegetation are required. The results showed that the highest area in the erosion risk map of 2000 is the CORINE model of the middle erosion class with an area of 63.22%. In 2020, the highest area is related to high erosion class with an area of 45.67%. These areas are seen in the western, eastern and central parts of the range. The results of the ICONA model for the period 2000 to 2020 showed that the high and very high risk classes in 2000 were 8.01 and 2.31 percent, respectively, while in 2020 these figures reached 8.80 and 3.44 percent. The results of the evaluation of the final zoning of the erosion risk map of the area, the study area with terrestrial realities, showed that in the best case, the overall image zoning accuracy of 2000 and Landsat 8 of 2020 CORINE model are equal to 0.87 and 0.91 and kappa coefficient of 0.86 and 0.89, respectively. It was estimated to be acceptable. In the ICONA model, the kappa coefficient and overall accuracy of 2000 were 0.85 and 0.86, and for 2020, 0.87 and 0.88, which were acceptable.

***Keywords**:* Water Erosion, CORINE Model, ICONA Model, Talesh City

## 1. Introduction

Changes in land cover and land use affect many natural processes such as soil erosion and the production of sediment, floods and physicochemical properties of the soil. One of the main effects of land cover type on processes in watersheds is its role on soil erosion. Soil erosion is one of the environmental problems that poses a threat to natural resources, agriculture and the environment. Soil erosion is one of the environmental problems that poses a threat to natural resources, agriculture and the environment. Studies show that about 58% of the world's land degradation is due to soil erosion, most of which has occurred since World War II and has reduced crop production by 17% and environmental damage (Bruce et al. 1995). The effects of soil erosion and sedimentation of sediments are both intra-regional and extra-regional. Intra-regional effects, especially in agricultural lands, lead to loss of farm soil, decomposition of soil structure and reduction of organic and nutrient matter which in

[*] Corresponding author Tel: +98-9118330042.
*Email address: mohammadmahboubkheirkhah@gmail.com*.

turn reduces the depth of arable land and reduces soil fertility and may further lead to land abandonment (Pimental et al., 1995). External effects are the result of sedimentation downstream which reduces the river carrying capacity and storage capacity of reservoirs and increases the risk of flooding and mudflow and shortens the useful life of reservoirs (1994; Boardman et al .; 1980, Clark). The fact that soil erosion is the result of poverty and misuse of land and it can not be overcome unless it is well considered by land use improvement and management. The rate of soil erosion is strongly correlated with land cover and land use (2014, Pacheco et al). Land use change or vegetation percentage has many effects on soil loss (Wijitkosum 2012). Therefore, identifying the trend of soil erosion changes along with examining the effect of land cover changes in watersheds has an effective role in management measures of erosion control and management of watersheds and soil resources. For this purpose, new models using GIS and RS technology in the study of soil erosion (both quantitative and qualitative) are among the cases Which is used in different parts of Iran and the world for the study of erosion and sediment in different basins. Given that GIS spatial information systems and RS remote sensing systems are capable of parsing and analyzing spatial data, The purpose of this study is to present a regional model for predicting water erosion with CORINE and ICONA models in the study area of Talesh city. Validation of the results of the two models CORINE and ICONA with existing studies are other objectives of the research. awareness of the risk of water erosion in the study watershed makes it possible to identify critical areas and prioritize management and conservation programs. Awareness of the risk of water erosion in the study watershed makes it possible to identify critical areas and prioritize management and conservation programs. In the present study, the following hypotheses have been investigated:

- CORINE model in comparison with ICONA model has higher accuracy in assessing water erosion of the study basin.
- Using multi-time and multi-spectral images in RS and preprocessing, processing and analysis techniques and using overlapping and analytical functions in GIS can help to better implement the CORINE and ICONA models. Research in this field has been conducted in Iran and the world.

## 2. Research Background

Entezari and Khodadadi (2017) evaluated the risk of water erosion in Taleghanrud watershed using ICONA model. The results showed that of the total area of the basin, 9.3% very low erosion risk class, 12.7% low erosion risk class, 22.4% moderate erosion risk class, 18.9% high erosion risk class and 36.7 % Have a high erosion risk class. (Nejad Afzali et al., 2018) studied the estimation of soil erosion using the RUSLE model and identifying its most effective factor in the Dehkahan watershed in southern Kerman. The results showed that the topographic factor with the highest value of 0.96 had the greatest effect on basin erosion. (Gupta & Uniyal, 2012) evaluated the risk of soil erosion using the CORINE method in the Ramgad watershed, Ninalit. The results of the study showed that in Ramgad watershed 24.9%, 52.2% and 22.76% of areas are at low, medium and high erosion risk, respectively. (Farooq Iqbal & Ahmad Khan, 2014), investigated the effects of land use change on soil erosion in Pakistan's Jammu and Kashmir Free Zone. In their study, LandsatTM satellite imagery was used to study land use changes. The results showed that 59% of the area has a low erosion risk, 24% moderate, 5% high and 12% very high erosion risk. (Alewell et al, 2019), in a study to address soil erosion by water (excluding ditches and landslides), examined this issue with a statistical evaluation of nearly 2,000 journals. (Safwan et al, 2020), the main purpose of their study was to predict soil erosion in Latakia province (western Syria) using the water erosion prediction project model (WEPP) and comparing the results with the RUSLE results stated. R2 between WEPP and RUSLE models was 0.56, which indicates a good correlation between the two models. Reis et al (2021) mapped the erosion risk using the CORINE method for a catchment area in the Kahramanmaras region of Turkey. (Saffari et al.,2022) in their research using RUSLE model using images of TM, ETM + and OLI sensors of Landsat satellite in a 30-year period for 1985, 2000 and 2015. The effect of land cover changes on soil erosion potential in Qarahsu watershed Examined.

A review of the research background showed that the present study presents a new model in the study of erosion that has been done in limited numbers in the world and in Iran. The models used in the research are a combination of GIS and RS, some layers have been prepared by image processing and some by analysis, and the multiplicity of effective parameters in the model is one of the advantages of the present research.

## 3. Material and Method

### 3.1. Geographical Location of the Study Basin

Hassan Dirmani watershed study area (Hassan Dirmani) is located in the northwestern part of Gilan province (Talesh city) and the western alborz heights and includes a part of the watershed of the great river Kargan River. This basin is located between "53´31 ° 48 to" 10 ´38 ° 48 east longitude and "48 ´46 ° 37 to" 48 ´46 ° 37 north latitude and "7 ´56 ° 37" in the UTM imaging system. Figure 1 shows the research study area.

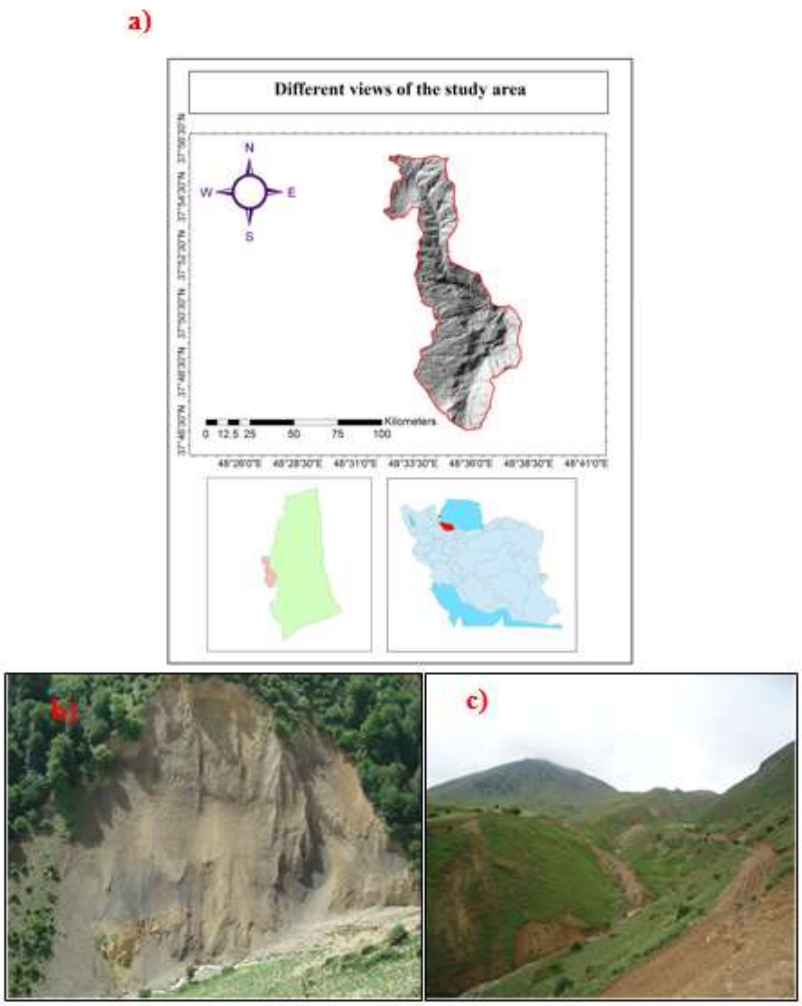


**Figure 1.** a. Hassan Dirmani study area, b, c. Erosion in the study basin (Source: Author)

## 3.2. Research Method

CORINE and ICONA models were used to determine the real risk of soil erosion. In the CORINE model, the parameters of topography (slope), erodibility, erosion and vegetation are required. Slope maps were prepared from 1: 25000 topographic curves of the surveying organization and sorted according to CORINE model classes. The erodibility map was obtained by multiplying the gravel layer layers in the soil depth class in the soil texture class. The erosion map was obtained by multiplying the MFI index class by the BGI index class. Vegetation maps were also obtained from satellite data and images by preparing NDVI maps for 2000 and 2020. In ICONA model, slope and lithology layers were prepared based on the model. Due to the fact that the slope and lithology are effective factors in the occurrence of erosion, an erodible layer was created by merging these two layers. Vegetation and the type of land uses available are the layers required for soil protection. According to the ICONA model, land use plans and vegetation are integrated according to the model and a soil protection layer is created. Finally, the erodibility and soil protection maps of the study areas in 2000 and 2020 were combined. It is necessary to explain that in the map, the erodibility of the classes shows the sensitivity of the study area to erosion. In contrast, the soil protection map is the resistance of the basin to erosion. Figures 2 and 3 show the flowchart of the research steps.

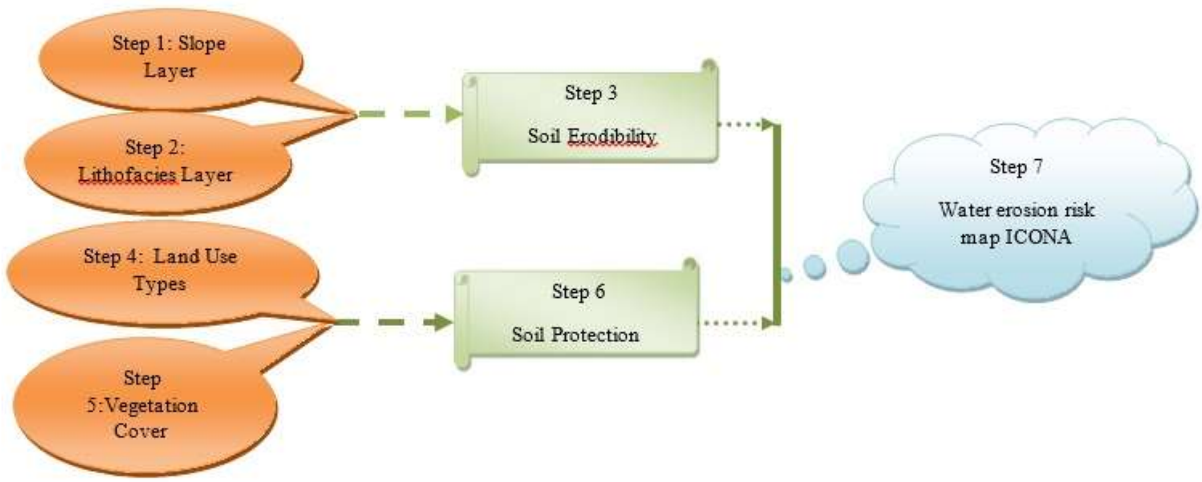


**Figure 2.** ICONA model flowchart

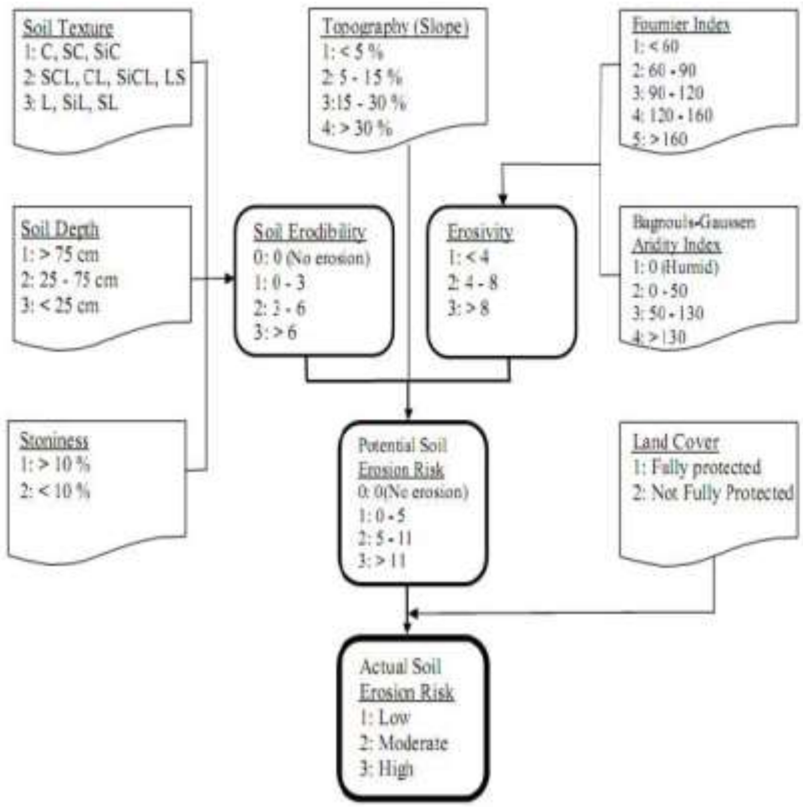


**Figure 3.** CORINE model flowchart

## 3.2.1. Implementation in CORINE Model

Soil erodibility was obtained by multiplying the gravel class in the soil depth class in the soil texture class.

The MFI index is calculated by two parameters: total monthly rainfall Pi and average total annual rainfall Pa By dividing these two parameters in the study stations, the MFI index map was obtained and then during the interpolation operation, zoning was performed as shown in Figure 5a. The BGI index, as stated, is obtained by two climatic parameters, including the average annual temperature Ti and the average total annual rainfall Pi, which is shown in Figure 5b. Finally, the erosion index is calculated from Formula 2:

Relation 2: Erosion = MFI index class B BGI index class

The slope layer is prepared from the digital model of the height of the area. In this model, the slope layer is classified into five groups. Classes less than 5%, 5-15%, 15-30 and more than 30%. Figure 5c shows the slope map of the research study area.

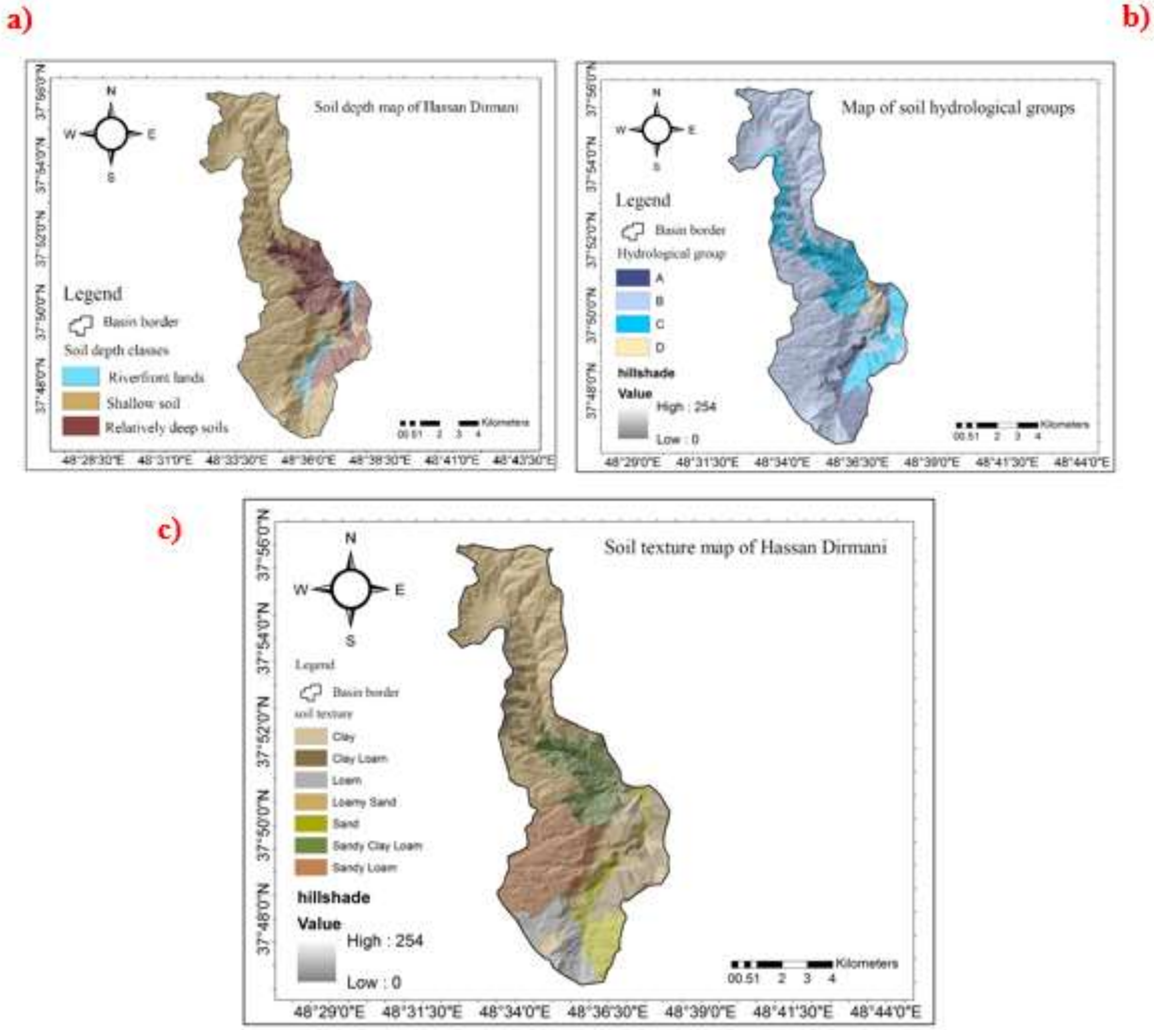


**Figure 4.** Erodibility index parameters, a) soil depth map, b) soil hydrological groups map, c) Soil texture map of Hassan Dirmani

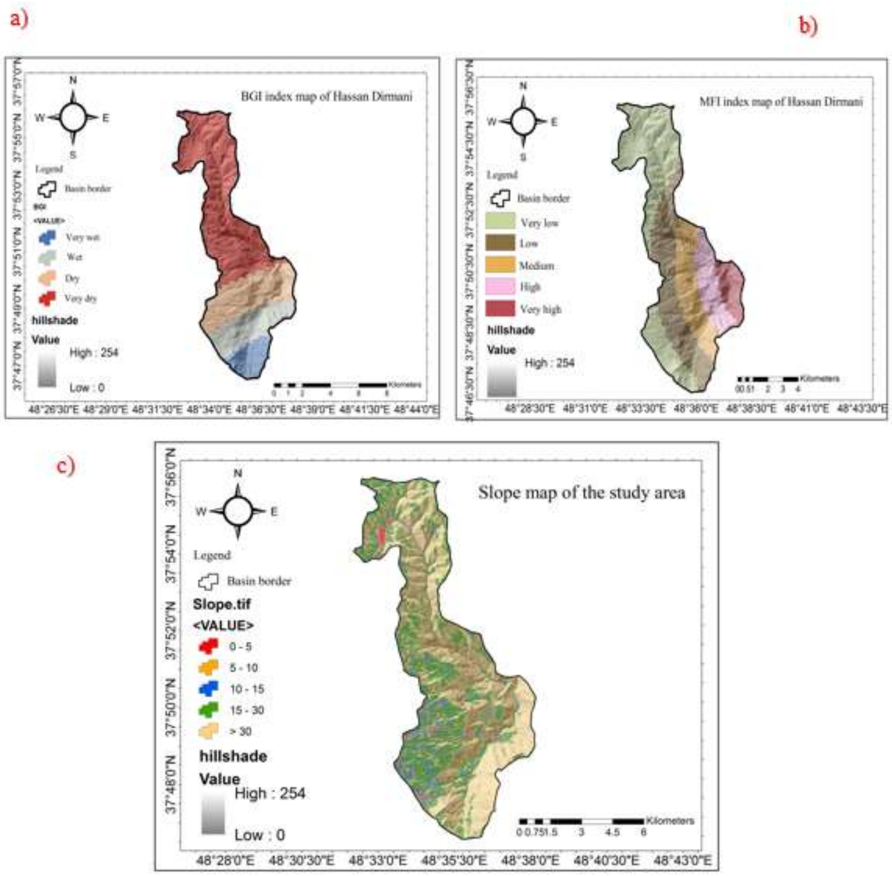


**Figure 5.** a) BGI index map, b) MFI index map, c) Slope map

In the CORINE model, vegetation is classified into two classes. 1) Fully covered with vegetation (forests, permanent pastures and dense grasslands), 2) Uncovered (barren lands, agricultural areas). This map is obtained using satellite data and images. To do this, the Landsat 8 satellite image is downloaded from the USGS website and the coverage map is extracted. Figures 6a and 6b show the coverage map of the selected image processing.

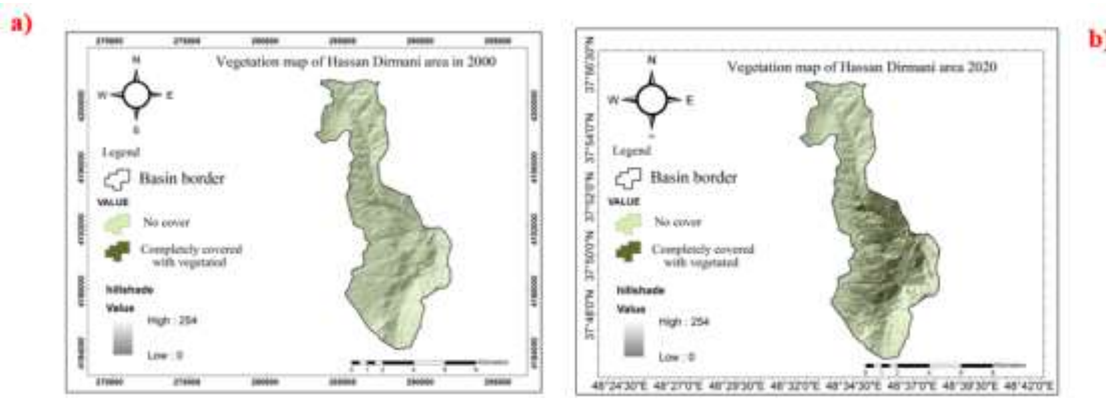


**Figure 6.** a) Vegetation map in 2000 b) Vegetation map in 2020

The layers of topography, erosion and erodibility are overlapped to map the potential for erosion risk. In order to calculate the potential for erosion risk, Equation 3 is used:

Relationship 3: Erosion risk potential = topography class × erodibility class × erosion class

Erosion risk potential is classified into 3 classes: 1- Low potential class 2- Medium potential class 3- High potential class. Actual erosion risk: In the last step, the potential erosion risk layer and the vegetation layer overlap to form the actual erosion risk map. Actual erosion risk is classified into 3 classes: low, medium and high (Kazemi and nohegar, 2011).

### 3.2.2. Implementation in ICONA Model

To prepare the slope layer, as stated in the slope map of the CORINE model, the digital elevation model was used. The map prepared in the CORINE model is shown in this step based on the standard table of the ICONA model, in Figure 7a. The 1: 100,000 sheet of the Geological Survey was used to prepare the lithological map. Thus, the study area shape file was received from the site of the Geological Survey of Mineral Exploration and the different classes of lithology are shown in Figure 7b. Sensitive formations, such as igneous rocks, have very low resistance to erosion and sedimentary formations such as Miocene period marls with high amount of gypsum and salt have more erosion potential, and limestone has more resistance to erosion (Makhdoom, 2010).

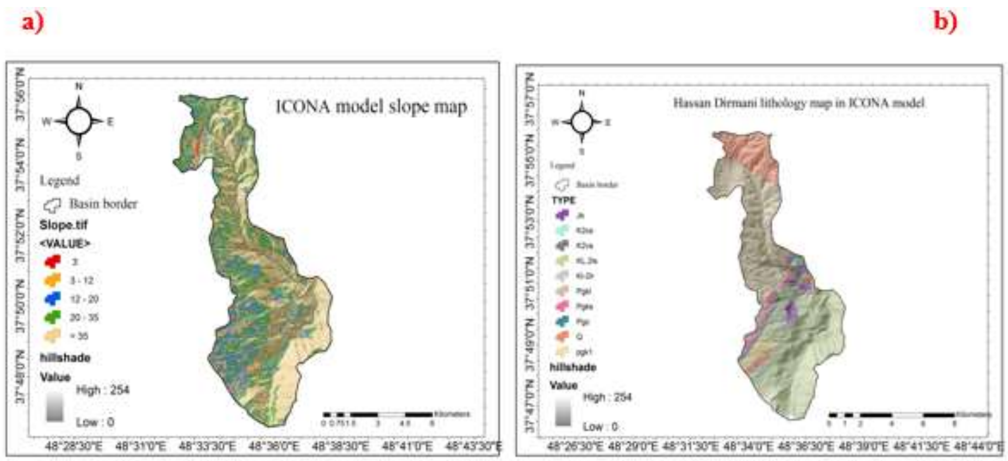


**Figure 7.** a) Slope map in ICONA model, b) Lithology map in ICONA model (Source: Classification researcher based on Makhdoom book and ICONA model)

Due to the fact that slope and lithology, for example, high percentage slopes with sensitive lithology are important factors in erosion, at this stage, in order to prepare a soil erodibility map, the slope and lithology overlap and the erosion risk potential map and the level of erodibility is obtained. The context and level of erosion are given in the table below. For example, a compact rock erosion class has a class (1a) and a slope of less than 3%, minimum or (EN). Or sediment / sticky soil classes with a slope of more than 35% have a maximum erodibility class or (EX). The erodibility index is given in Table (1).

**Table 1.** Erosion Index Table (ICONA, 1991)

| Classes | Symbol | Description of Erodibility |
|---|---|---|
| 1 | EN | Very low |
| 2 | EB | low |
| 3 | EM | Medium |
| 4 | EA | High |
| 5 | EX | Very High |

In order to prepare the land use map, the images of 2000 and 2020 were used. In this way, the images were first geometrically corrected. Then, the educational sample points were selected to classify the image and were collected using GPS and then, the image was classified using the support vector machine classification method, which is shown in Figures (8a) and (8b).

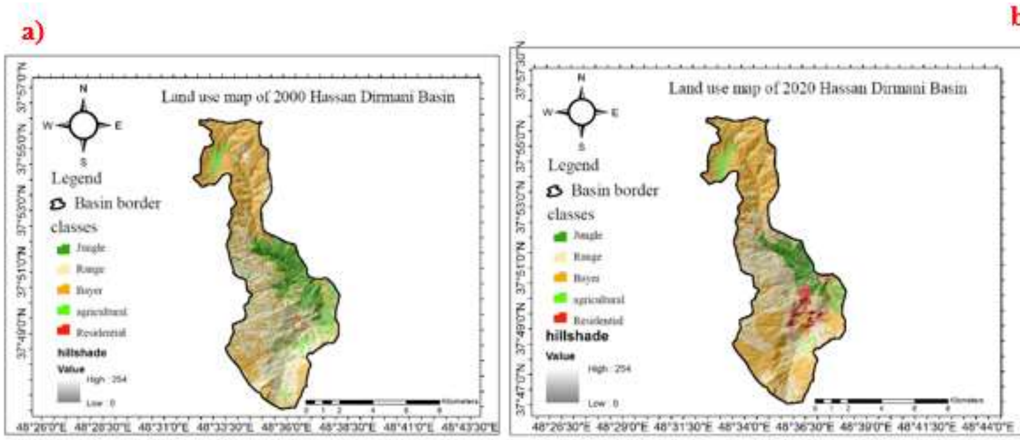


**Figure 8.** a) Land use map of 2000 Hassan Dirmani Basin b) Land use map of 2020 Hassan Dirmani Basin

NDVI index was used to prepare the vegetation map. Vegetation indices are mathematical relationships that are defined based on different bands of sensors and are designed to evaluate and study plants in multispectral satellite observations (Fatemi & Rezaei, 2006).

**Table 2.** Class table of percentage of vegetation cover of ICONA model (ICONA, 1991)

| Class | Description |
|---|---|
| 1 | Vegetation cover less than 25 % |
| 2 | Vegetation cover between 25 % and 50 % |
| 3 | Vegetation cover between 50 % and 75 % |
| 4 | Vegetation cover greater than 75 % |

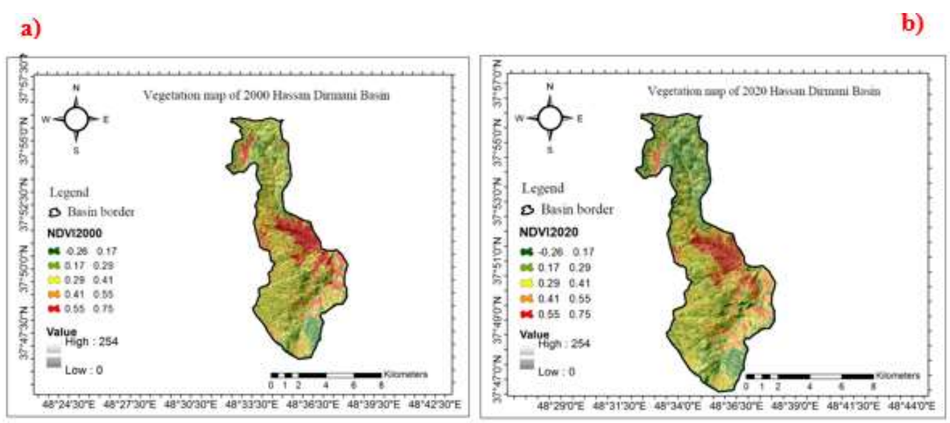


**Figure 9.** a) Vegetation map of 2000 Hassan Dirmani Basin b) Vegetation map of 2020 Hassan Dirmani Basin

Different values of NDVI represent different coatings, for example, NDVI values between 0.05 to 0.1 for sparse plant areas, values between 0.1 to 0.5 for normal plant areas and from 0.5 up for plant areas. It is very dense and rich. Water, snow and ice have negative NDVI values and soils have values less than 0.05 and clouds usually have values around zero (Fatemi and Rezaei, 2005).

**Table 3.** Soil protection classes (Source: ICONA, 1991)

| Class | Label | Description |
|---|---|---|
| 1 | MA | Maximum protection |
| 2 | A | High protection |
| 3 | M | Medium protection |
| 4 | B | Low protection |
| 5 | MB | Minimum protection |

One important objective of this study was to assess and map the location of the erosion risk zone based on the degree of qualitative or risk level, so in the final stage, layer of soil protection and soil erosion layer to create soil erosion risk maps were overlapped. It can be expected that such soil protection areas where are in very good and good conditions that means they have good coverage and use) are less vulnerable to erosion and areas with high slopes and rock is susceptible to erosion; the greater is the risk of erosion. Soil erosion areas in the Table (4) are presented. Erosion Class is shown in Table (5).

**Table 4.** Integrate soil conservation and erosion classes

| Erosion Risk | | Level of erodibility | | | | |
|---|---|---|---|---|---|---|
| | | 1 EN | 2 EB | 3 EM | 4 EA | 5 EX |
| Level of soil protection | MA 1 | 1 | 1 | 1 | 2 | 2 |
| | A 2 | 1 | 1 | 2 | 3 | 4 |
| | M 3 | 1 | 2 | 3 | 4 | 4 |
| | B 4 | 2 | 3 | 3 | 5 | 5 |
| | MB 5 | 2 | 3 | 4 | 5 | 5 |

**Table 5.** Soil erosion risk classes

| Erosion Risk | Class |
|---|---|
| 1 | Very low |
| 2 | Low |
| 3 | Medium |
| 4 | High |
| 5 | Very high |

## 4. Result and Discussion

### 4.1. Findings of CORINE Model

In order to determine the real risk of soil erosion using the CORINE model, parameters such as topography (slope), erodibility, erosion and vegetation are needed and in the research method section, the preparation process was explained. Which are shown in Figures 10a, b, c, d, e.

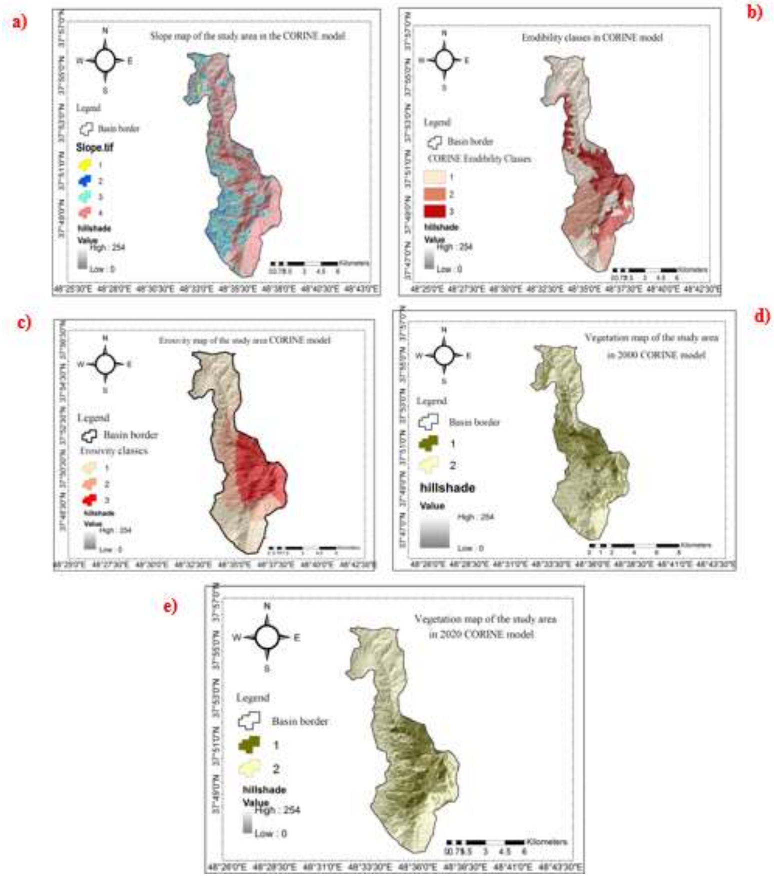

**Figure 10.** a) Slope map b) Erodibility map c) Erosivity map d) Vegetation map of 2000 e) Vegetation map of 2020

The erosion risk potential map was obtained by multiplying the topography class by the erodibility class in the Erosivity class, which was classified according to the CORINE model into 3 classes: 1- low potential class, 2- medium potential class and 3- high potential class, shown in Figure 11.

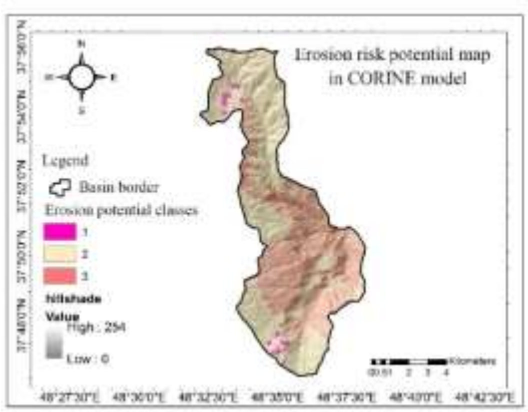


**Figure 11.** Erosion risk potential map in CORINE model

Finally, a real erosion risk map was obtained by merging the erosion risk potential layer and the vegetation layer, which plays the role of basin soil protection. This map is classified into three classes: low, medium and high, for the years 2000 and 2020, shown in Figures 11a, b.

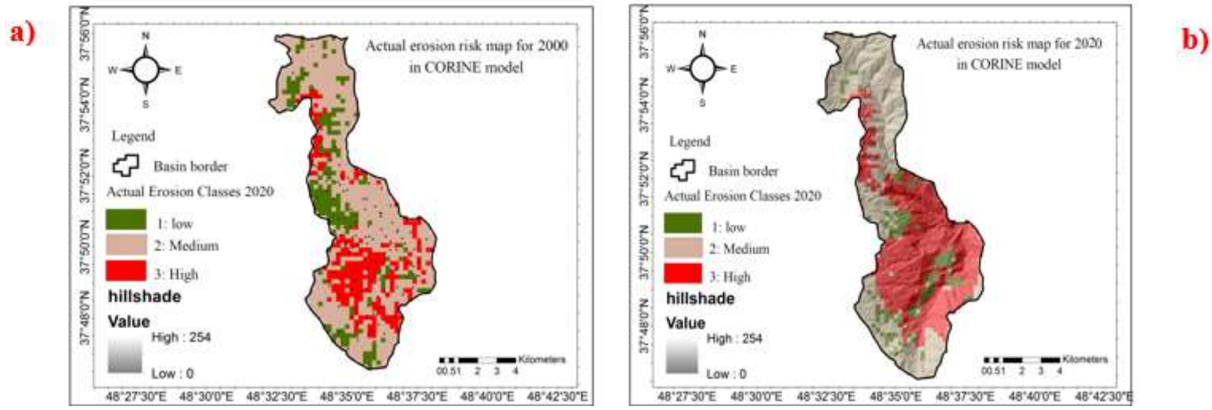


**Figure 11.** a) Actual erosion risk map for 2000 b) Actual erosion risk map for 2020

**Table 6.** Area of actual erosion risk classes in 2000 and 2020

| Class name | 2000 (hectares) | 2000 (percent) | 2020 (hectares) | 2020 (percent) | Area changes (hectares) | Area changes (percentage) |
|---|---|---|---|---|---|---|
| Low erosion | 1109.55 | 16.72 | 667.94 | 10.06 | -441.61 | -6.66 |
| Medium erosion | 4195.33 | 63.22 | 2936.73 | 44.25 | -1258.6 | -18.97 |
| High erosion | 1330.36 | 20.04 | 3030.57 | 45.67 | 1700.21 | 25.63 |

The highest area in the actual erosion risk map of 2000 is related to the average erosion class with an area of 63.22%, which covers 4195.33 hectares of the basin area. But in 2020, the highest area is related to the high erosion floor with an area of 45.67%, which occupies 3030.57 hectares of the basin area. These sensitive areas are found in the western, eastern and central parts of the study area.

## 4.2. Findings of ICONA Model

In preparing the ICONA erodibility map, slope and lithology layers were prepared based on the model. Due to the fact that the slope and lithology are effective factors in the occurrence of erosion, the erodibility layer was created by merging these two layers, which can be seen in Figure 12a, the output map and in Table 9, the distribution of its classes. The highest area in erosion classes is related to EA class (high erosion capability) with an area of 32.49%, which covers 2143.94 hectares of basin area, followed by EX floor (very high erosion capability) in the second degree of importance in terms of area with percentage. The area is located at 27.61. It is noteworthy that more than 84.32% of the area of the talent basin is capable of moderate to high erosion. These sensitive areas are found in the southern, southeastern and central parts of the study area. Considering that the erosion map is created from the overlap of slope maps and rocky surfaces, it can be concluded that these areas in one of the two parameters of slope and rocky surfaces or both parameters have a high sensitivity to erosion that in The output of the erodibility map is clearly visible. According to the ICONA model and the explanations given in the discussion of the research method, land use maps and vegetation according to the integrated model and soil protection layer is created. Figures 12b and 12c show the resulting soil conservation map.

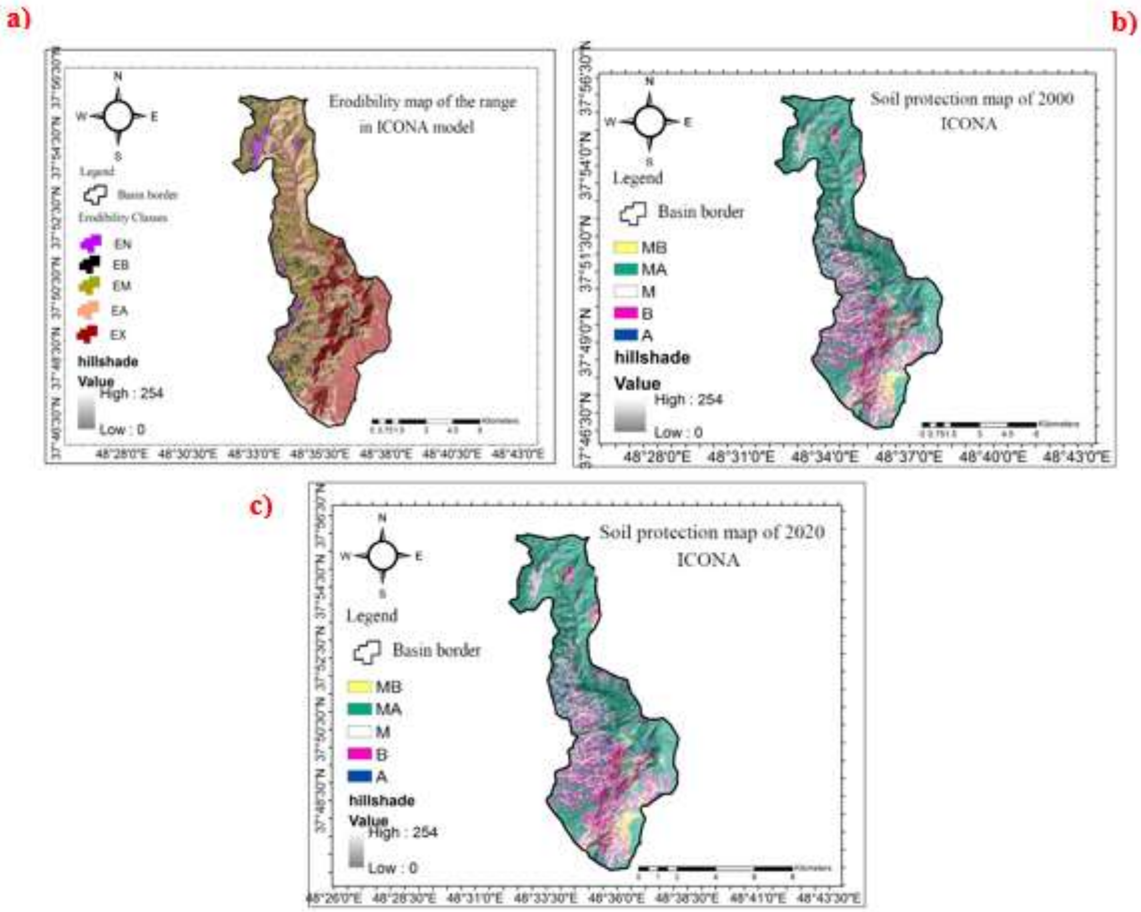


**Figure 12.** a) Erodibility map of the study area according to the ICONA model b) Soil protection map of 2000 ICONA study area c) Soil protection map of 2020 ICONA study area

In the period 2000 to 2020, the soil protection class has been greatly reduced from 4156.42 in 2000 to 3491.37 hectares in 2020. That is, in total, from 62.45% of the study area to 52.47%, a reduction was observed. Also, medium and low protection classes have increased from 902.82, 873.91 and 323.52 hectares to 1268.85, 1268.73 and 458.51 hectares. Therefore, in general, soil protection of Hassan Dirmani study area has decreased in this period, which is due to unauthorized changes in forest land use and conversion of pastures to orchards and rainfed agriculture and changes in the quality of vegetation in the study area. It directly affects the amount of organic matter and physical properties of the soil and reduces its protection and increases its sensitivity. Finally, the erodibility and soil protection maps of the study areas in 2000 and 2020 were combined. It is necessary to explain that in the map, the erodibility of the classes shows the sensitivity of the study area to erosion. In contrast, the soil protection map is the resistance of the basin to erosion. The final erosion map of the basin is shown in Figures 13a and b, and its changes are shown in Table 7.

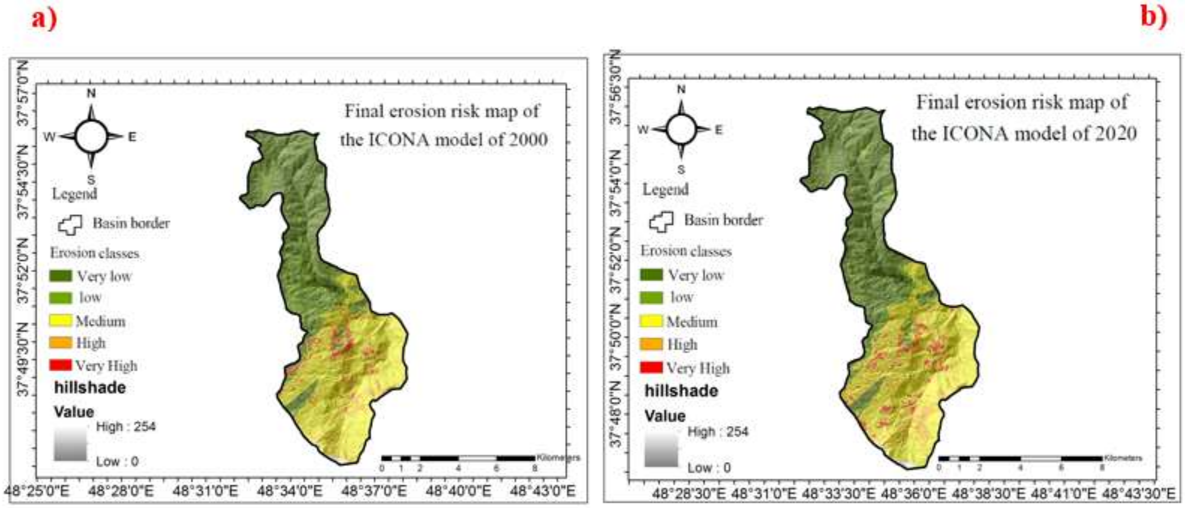


**Figure 13.** a) Final erosion risk map of the study area based on the ICONA model of 2000 b) Final erosion risk map of the study area based on the ICONA model of 2020

**Table 7.** Distribution of levels of water erosion classes in 2000 and 2020

| Erosion risk changes | | 2020 image | | 2000 image | | Erosion risk classes |
|---|---|---|---|---|---|---|
| Area (percentage) | Area (hectares) | Area (percentage) | Area (hectares) | Area (percentage) | Area (hectares) | |
| 5.67 | 372.71 | 38.79 | 2548.73 | 33.12 | 2176.02 | Very low |
| -5.20 | -341.9 | 9.84 | 646.95 | 15.05 | 988.85 | low |
| -2.39 | -157.53 | 39.1 | 2569.21 | 41.5 | 2726.74 | medium |
| 0.79 | 51.98 | 8.8 | 578.43 | 8.01 | 526.44 | High |
| 1.13 | 74.55 | 3.44 | 226.38 | 2.31 | 151.83 | Very High |

The results obtained in the period 2000 to 2020 show that the amount of erosion risk related to low and medium risk classes is reduced and the amount of areas with very low, high and very high erosion risk is increased. Has been. The high and very high risk classes in 2000 were 8.01 and 2.31 percent, respectively, while in 2020 these figures reached 8.80 and 3.44 percent.

### 4.3. Validation of the Results of CORINE and ICONA Models with Ground Points

After ground control, the study area of erosion-prone areas and the areas in which erosion was observed were determined using GPS to collect and distribute erodible points on Figure 14. The results of field surveys were compared with the zoning map of ICONA and CORINE models and the results were obtained in Tables (7) and (8).

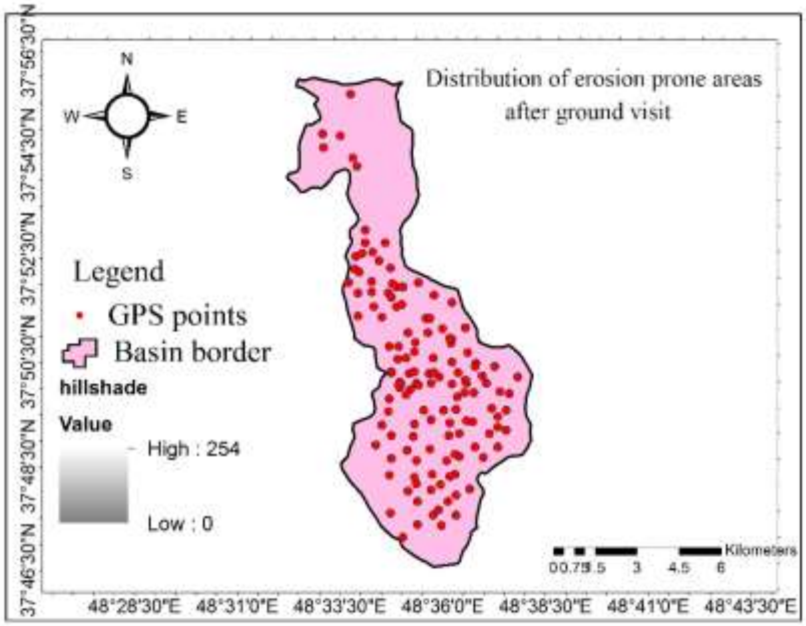


**Figure 14.** Distribution of erosion prone areas after ground visit

**Table 7.** Kappa coefficient and overall accuracy of erosion zoning maps in CORINE model

| Overall accuracy | Kappa coefficient | Zoning |
|---|---|---|
| 0.9082 | 0.9058 | 2000 |
| 0.9405 | 0.9359 | 2020 |

**Table 8.** Kappa coefficient and overall accuracy of erosion zoning maps in ICONA model

| Overall accuracy | Kappa coefficient | Zoning |
|---|---|---|
| 0.8672 | 0.8222 | 2000 |
| 0.9646 | 0.9512 | 2020 |

## 5. Conclusion

The result of this process showed that in the CORINE model of 2000, 42.54% of the area was in high protection class and 57.45% of the area was in unprotected class. Also, soil protection classes in 2020, this CORINE model showed that 67.02% of the area was in high protection class, 32.97% of the area was in unprotected class. In the ICONA soil conservation map for the period 2000 to 2020, the soil protection class has been greatly reduced from 4156.42 in 2000 to 3491.37 hectares in 2020. That is, a total reduction of 62.45% of the study area to 52.47% was observed. Also, medium and low protection classes have increased from 902.82, 873.91 and 323.52 hectares to 1268.85, 1268.73 and 458.51 hectares. The final map of erosion risk in 2000 and 2020 showed that the risk of water erosion in 2000 of ICONA model in very low, low, medium, high and very high classes were 2176.02, 988.85, 2726.74, 526.44 and 151.83%, respectively. 2020 This value for very low, low, medium, high and very high classes was 2548.73, 646.95, 2569.21, 578.43, 226.38 percent, respectively. Therefore, the area of low and medium classes has decreased by 341.9 and 157.53 and the area of very low, high and very high classes has increased by 372.71, 51.98 and 74.55%, respectively, and it can be said that in the whole range of studies in this period, the rate of erosion It has increased. In the final real erosion risk map, the CORINE model, the area of low, medium and high classes in 2000, was changed from 1109.55, 4195.33, 1330.36 to 667.94, 2936.73 and 3030.57 hectares, respectively. (Rezaei & Gilkes, 2004), the effect of slope, height and vegetation on the spatial distribution of soil properties and found that the slope significantly increased many physical properties of soil surface, including degree of agglomeration, percentage of coarse gravel, effective thickness of soil profile, Water holding capacity and depth affect the static surface of the water, which introduces the model with high accuracy and a new algorithm for erosion. The role of land use and vegetation in erosion is quite clear and this model uses these parameters with high accuracy in its abdomen.

The results of the evaluation of the final zoning of the erosion risk map of the study area with terrestrial realities showed that in the best case, the overall accuracy of the zoning of the image of 2000 and Landsat 8 of 2020 CORINE model are equal to 0.87 and 0.91 and kappa coefficient, respectively. 0.86 and 0.89 were estimated to be acceptable. In ICONA model, kappa coefficient and overall accuracy in 2000 were 0.85 and 0.86, and for 2020, 0.87 and 0.88, which were acceptable. Research results with research results (Bayramin et al., 2003), which using the ICONA model showed that all these factors can be analyzed and easily evaluated with new technologies such as RS and GIS. According to the results of kappa coefficient and overall accuracy, which was done to evaluate the classification accuracy, kappa coefficient and overall accuracy in CORINE method in 2000 and 2020 were 0.905 and 0.908 for 2000 and 0.935 and 0.940 for year, respectively. 2020 was obtained. In ICONA model, kappa coefficient and overall accuracy for 2000 were 0.822 and 0.867 and for 2020, 0.951 and 0.964. Therefore, the CORINE method was more accurate than the ICONA method in assessing the risk of erosion and the first hypothesis was accepted. Among the many effective ways to predict erosion using GIS and RS, the simulation results of these models are widely accepted. Many studies have been done on soil erosion modeling using GIS and RS techniques. These models have also made good use of remote sensing capabilities and GIS in estimating parameters and zoning of erosion risk. Producing accurate maps to manage the watershed, including soil erosion maps can be accompanied by the process of forming a spatial database and using the GIS, and Landsat images and GIS analysis techniques can be used to prepare demolition maps. And land erosion should be used and the first hypothesis of the research is accepted and the second hypothesis was accepted. The ICONA erosion model is very useful for erosion risk assessment studies in large areas. And with the results of Chatersimab et al. (2017), who researched the risk of water erosion using the ICONA model in the Salaj Anbar watershed. And showed that about 74% of the area has a low and very low risk of erosion and 26% of the area is at risk of severe erosion. Their study showed that GIS and RS techniques play an important role in preparing the soil erosion risk map. Gupta & Uniyal (2012) also assessed the risk of soil erosion using the CORINE method in the Ramgad watershed, Ninital. The results of the study showed that 24.9%, 52.2% and 22.76% of Ramgad watershed are at risk of real, low, medium and high erosion, respectively. With the results of et al Reis (2016), they performed the erosion risk map using the CORINE method for the catchment area in Kahramanmaras region of Turkey and found that the most important factors of erosion risks in the watershed are slope (average 38%) and lack of cover. It was plant (11.67). In addition, the results showed that the preparation of a hazardous erosion map by the CORINE method was a highly efficient and cost-effective approach. According to the research results, to ensure the accuracy and validity of basic data before modeling, such as topographic and geological maps and repeat this research with satellite images with high ground resolution (High resolution) such as Ikonos satellite images and Or Quick bird is recommended.

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