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3.NarimanAmirgaliyev, ChristianOpp, MaulkenAskarova, Laura Ismukhanova, AzamatMadibekov, andAskhatZhadiThe article: Long-Term Dynamics of Persistent Organic Pollutants in Water Bodies of the Aral Sea-Syrdarya Basin-2023.

4. TovassarovAdylkhanDadebaevich,General Director, Candidate of Chemical Sciences

Central Asian Institute for Ecological Research LLP.STUDY OF THE CONDITION OF SURFACE WATER IN SHU-TALAS BASIN IN THE TERRITORY OF KAZAKHSTAN

5. Hydrochemical indicators of the environment: reference materials: textbook for students of higher educational institutions / edited by T.V. Guseva. - Moscow: Forum: Infra-M, 2007.- 190 c.

UDC 551.579.2

DETERMINATION OF THE R COEFFICIENT IN THE KURCHUM RIVER BASIN BASED ON THE ARCGIS PROGRAM (USING THE RUSLE FORMULA)

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The RUSLE is a revision of the Universal Soil Loss Equation (USLE) which was originally developed to predict erosion on croplands in the US. Following the revision, the equation can be employed in a variety of environments including, agricultural site, rangeland, mine sites, construction sites, etc.which is greatly accepted and has wide use, is simple and easy to parameterize and requires less data and time to run than most other models dealing with water erosion. GIS on the other hand facilitates efficient manipulation and display of a large amount of georeferenced data. There are various methods that consider soil erosion in watersheds, these methods vary from simple to more complex and differ in their need for data input and their ability to predict erosion. The revised universal soil loss equation (RUSLE) is an upgraded version of USLE, which was proposed by Wischmeier and Smith in (1978), with higher accuracy. RUSLE was the most widely used model in predicting the loss of soil. It is described by the following Equation (1),:

$$A = R \times K \times L \times S \times C \times P \qquad (1)$$

where A is the estimated average soil loss in ton/ha/year, R is the erosivity of rainfall in mj mm/ha/h/year, K is the soil erodibility factor in ton ha h/ha mj mm, LS is the topographic factor integrating slope length and steepness (LS) dimensionless, C is the cover-management factor, dimensionless, and P is the support practice factor, dimensionless.

The Kurchum is a right tributary of the Irtysh. Its length is bounded on the left by the Kurchum Ridge, and on the right by the Sarymsakty ridges, separating the Kurchum basin from the Bukhtarma river basin. The sources of the river are located near Lake Markakol in the zone of sparsely wooded taiga, where the Kurchum is a winding, fast, mountain-taiga river with a width of up to 25 meters and a speed of up to 10 km/h, channels and islands in the channel are frequent. The average annual water consumption (Voznesenskoye village) is 60 cubic meters / s (in May - 212 cubic meters /s), the length of the river is 210 kilometers, width is 10-150 meters, depth is up to 3 meters. The Kurchum flows into the Bukhtarma reservoir (Lake Zaisan).

First, you need to create the Kurchum River basin in the ArcGIS program. A river basin is an area of the earth's surface from which all surface and groundwater flows into a given river, including its various tributaries.

The river basin is being built on the basis of DEM (SRTM v4) using standard and specialized ArcGIS tools.

The standard tools include the Hydrology module from the Spatial Analyst group of tools, and the specialized tools of the Arc Hydrology module.

The Hydrology tools are used to model the flow of water across a surface.

Information about the shape of the earth's surface is useful for many fields, such as regional planning, agriculture, and forestry. These fields require an understanding of how water flows across an area and how changes in that area may affect that flow.

A digital elevation model (DEM) free of sinks a depressionless DEM is the desired input to the flow direction process. The presence of sinks may result in an erroneous flow-direction raster. In some cases, there may be legitimate sinks in the data. It is important to understand the morphology of the area well enough to know what features may truly be sinks on the surface of the earth and which are merely errors in the data. The tools in the Hydrology toolset of the ArcGIS Spatial Analyst extension are useful in preparing a depressionless elevation surface.

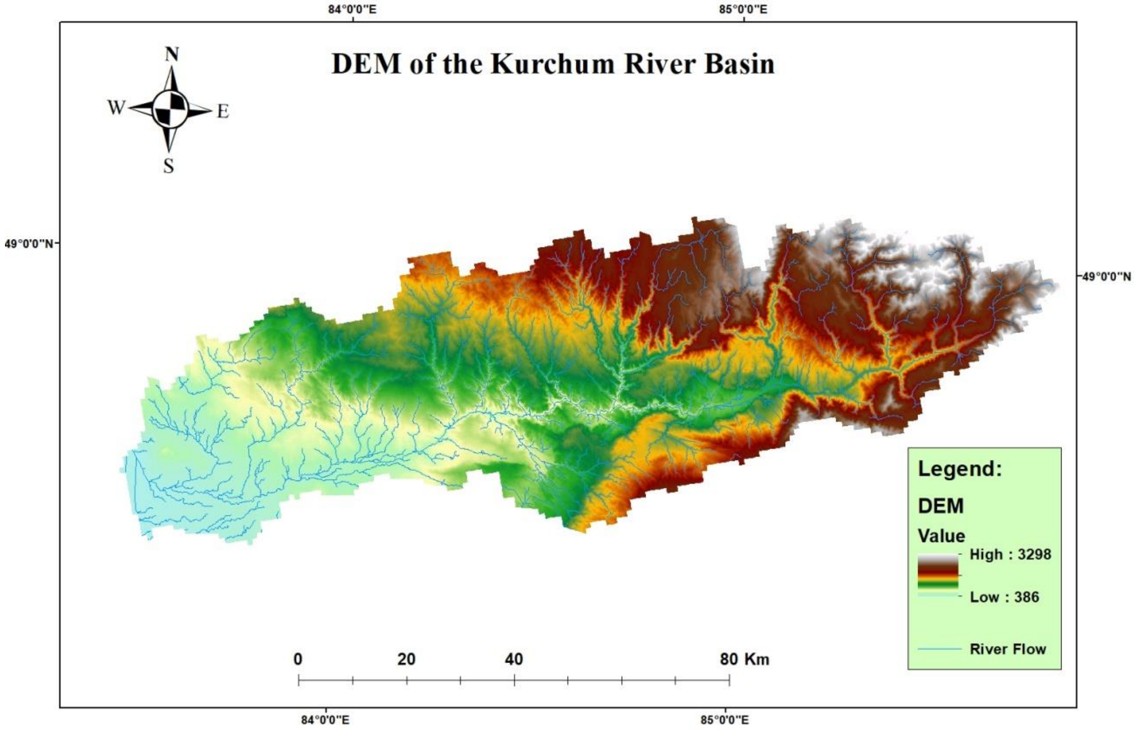

Figure 1 DEM of the Kurchum River Basin in the Arcgis program

Next, we need to find the R-factor in the Kurchum River basin . R is a measure of erosivity of rainfall which is the product of storm kinetic energy .Most of the time rainfall intensity and storm kinetic energy data are not available at national meteorological stations. Based on the lack of data on precipitation intensity and kinetic energy of storms for this study area, monthly precipitation data were used to estimate the R coefficient for 2023

Monthly and annual precipitation totals in Kurchum in 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
23	25	34	20	14	10	6	57	45	37	29	15	316

Monthly and annual precipitation totals in Katon-Karagai in 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
29	7	31	50	31	28	38	100	96	63	42	31	544

Monthly and annual amounts of precipitation Markakol in 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
72	29	79	61	34	40	49	182	106	142	43	71	907

Monthly and annual amounts of precipitation Kokpekty in 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
61	37	36	27	7	12	12	48	54	58	28	40	419

Monthly and annual precipitation totals in Ulken-Naryn in 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
32	17	46	45	25	13	18	69	99	80	37	18	500

Monthly and annual amounts of precipitation in Samara in 2023

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	year
33	23	35	35	19	2	28	68	85	78	30	37	473

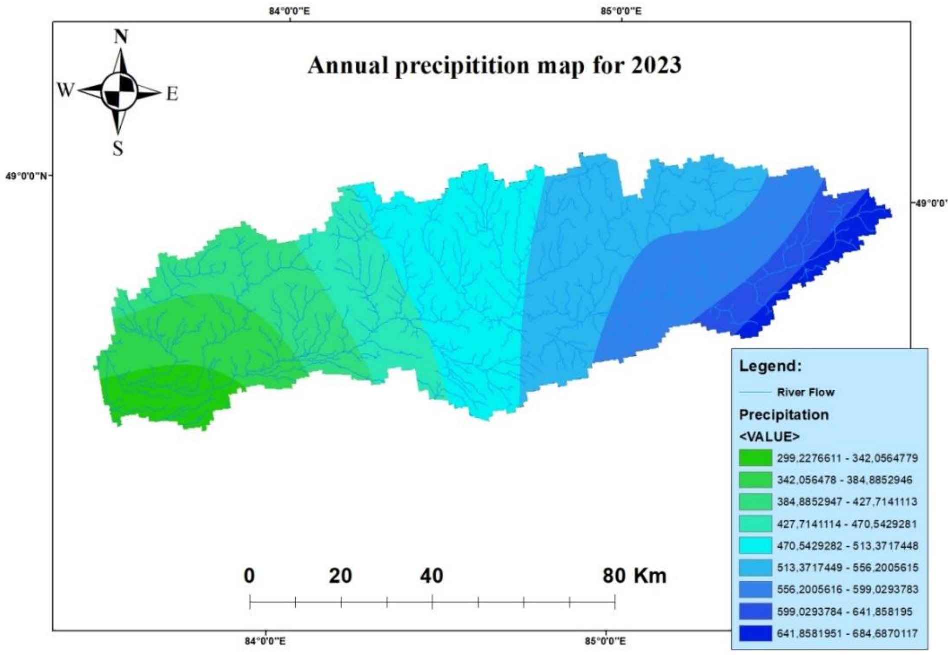

Figure 2 Annual precipitition map for 2023

Based on Figure 2, we can see in which part of the basin precipitation prevails.Precipitation is formed on the Kurchum River due to atmospheric phenomena such as condensation of water vapor and cloud formation. The amount of precipitation on the Kurchum River depends on many factors, including climatic conditions, air temperature, humidity and wind direction.The terrain, the presence of mountains and forests can contribute to the formation of clouds and precipitation.

To determine the factor R - coefficient of precipitation and runoff, the calculation formula was applied

$$R=0,58*P-59,8 \quad (2)$$

P- precipitation for the year

Kurashim	R	123,4
Katon-Karagai	R	255,7

Markakol	R	466,2
Cockpits	R	183,22
Ulken-Naryn	R	235,2
Samara	R	219,2
Aksuate	R	63,5

Precipitation erosivity coefficient (R) Precipitation abrasiveness coefficient (R) is a value that indicates the cumulative ability of the soil to peel off as a result of heavy rains during the year. To calculate the coefficient R, data on continuous precipitation is needed, and it reflects the effect of precipitation intensity on the process of water erosion. The two most important characteristics of a storm that determine its erosiveness are the amount of precipitation and peak intensity, which persists for a long period. The coefficient of erosion of precipitation can be easily determined if you find data on the intensity of precipitation in a suitable form. Here, the R coefficient was calculated based on annual precipitation data from 7 weather stations in and around the study area. P is the annual precipitation (mm). After calculating the R coefficients for individual rain measuring stations, kriging, an interpolation method, is then used to determine the spatial distribution of the R coefficient over the study area

The R factor in the RUSLE equation (Revised Universal SoilLoss Equation) is an index of soil erosion resistance. This factor takes into account the effect of precipitation on soil erosion and depends on climatic conditions such as the intensity of rainfall, the duration of rains and their distribution over time.In rivers, the R factor can play a key role in assessing soil losses due to water erosion. Rainfall falling on the soil surface can cause the formation of streams and streams, which can lead to soil erosion and the transfer of its particles into the river system.

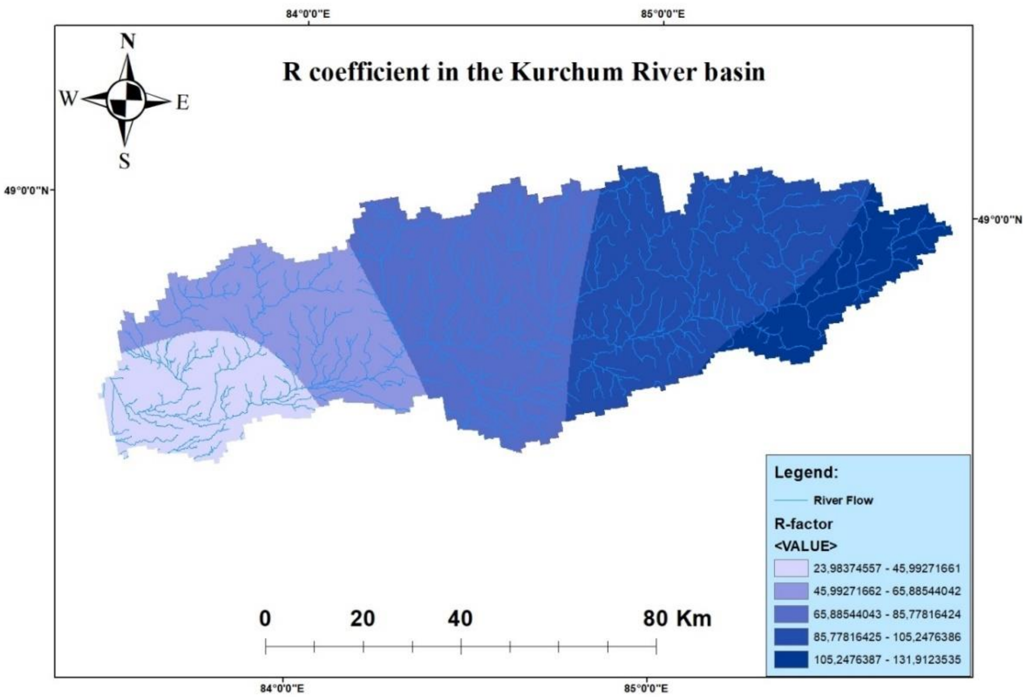

Figure 3 The R coefficient in the Kurchum River basin based on the ArcGis program (using the RUSLE formula)

The analysis of the R coefficient on rivers can be carried out by examining climatic data such as precipitation, its intensity, and distribution over time and space. Hydrological models can also be used to estimate water flow and soil erosion in a river system.Studying the R-factor on rivers will help to better understand the processes of water erosion and develop measures to prevent soil loss and protect water resources.Based on Figure 3, we can see in which part of the basin erosion is more likely and where it can be prevented.Precipitation on the Kurchum River is formed due to atmospheric phenomena and in Figure 2 we can see in which part of the basin precipitation prevails.

References

1. https://core.ac.uk/download/pdf/38039472.pdf
2. https://link.springer.com/article/10.1007/s13201-020-01185-4
3. https://pro.arcgis.com/en/pro-app/3.1/tool-reference/spatial-analyst/creating-a-depressionless-dem.htm
4. https://www.ncei.noaa.gov/access/monitoring/monthly-report/national/202004
5. https://www.linkedin.com/pulse/soil-erosion-modeled-usle-gis-remote-sensing-case-study-le-anh-tin
6. https://ru.wikipedia.org/wiki/Курчум_(Восточно-Казахстанская_область)