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Rainfall erosivity effect on Iraqi and Polish soils.

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Abstract: The study aim to study the rainfall erosivity from (1980-20100 in Iraq and Polish soils in relationships withIraqi and Polish soil textures and show the highest rainfall erosivity is in forest area and mountain in Iraqi forest area and mountain(Zakho and Kirkuk (510.2- 232.95 MJ mm ha-1 year-1)respectively, and the less in Najaf and Karbala(28.46- 30.21 MJ mm ha-1 year-1) ,While in Polish soils , In forest area and mountain in (Zakupany and more than urban area Bielsko-Biala (692.2 ;557.5 MJ mm ha-1 year-1) respectively ,while the less in Poznan and Warsaw (168.39-170.8 MJ mm ha-1 year-1) respectively .The high sand and silty content and low clay content increased the likelihood of erosion.

Keywords: rainfall erosivity, Iraqi soils, Polish soil, texture.

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1 INTRODUCTION

Soils tend to show a strong geographical correlation with climate, especially at the global scale. Energy and precipitation strongly influence physical and chemical reactions on parent material. Climate also determines vegetation cover which in turn influences soil development. Precipitation also affects horizon development factors like the translocation of dissolved ions through the soil.As time passes, climate tends to be a prime influence on soil properties while the influence of parent material is less“[1]”. Climate is one of the most important factors affecting the formation of soil.Warmer temperatures and an abundance of water have a tendency to speed up the formation of soil, in some cases rather dramatically.Whereas cooler temperatures and less precipitation slow down soil formation.Temperature directly influences the speed of chemical reactions. The warmer the temperature,the faster reactions occur. Fluctuations in temperature increase physical weathering of rocks “[2]”.The factors associated with climate that most influence soil formation are precipitation ,temperature ,basically no chemical weathering occurs while the ground is frozen during the winter. The warmer the climate, the faster the rate of weathering, the warmer the climate, the faster the rate of evaporation, lowering the effects of precipitation ,weathering which cause breakdown of rocks and minerals into soils. Rocks are broken into three major groups: sedimentary, igneous, and metamorphic.

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Iraq climate of is desert in the center and the south, with mild winters and extremely hot summers, it's semi-desert in the north, with relatively cold winters, while in the northern mountains, the climate is cold and rainy or snowy in winter, warm and sunny in summer . Rainfall rates have decreased with abnormal high-temperature degrees, recurrence of dust storms has been increasing and many agricultural areas have turned into barren land “[3]”.The rain caused water erosion and loss soil until 1960 reached 1.6 million ha and 2.4 million ha by wind erosion”[4]”,also soil degree damage caused by erosion can also be assessed from land proportion that cover by forests and proportion of cultivated soil in Iraq0.8%” [5]”,while wind erosion in Iraq due to wide spread of desert reached 18.16 t/ha for the land with poor soil structure and non-slight vegetation cover, and 0.04-0.28 t/ha in land with excellent to good soil structure and plant cover and the mean values of wind erosion with medium conditions of soil and plant cover1.41-9.22t/ha”[6]”. Iraq temperature is hight almost seasons,that will effect on soil transport of and nitrate ions “[7,8]”,soil moisture, plant growth and minerlization of organic residues[12] the effects of warming temperatures on soil loss are more complex“[9]”. The soils generally had alkaline reaction and the pH values ranged from 7.25 to 7.98 which were consistent with carbonate content”[10]”.Neutral chloride-sulfate soils are mostly of marine origin, but can be enriched by deposited sedimentary gypsum by river “[11]”. The most soils in Iraq related to silty loam is dominant in the surface soil, whereas the subsurface are characterized by clay, sandy loam and sandy clay loam types (Fig1) “[12]”.

Poland climate is continental, with very cold winters, often below freezing , and warm summers temperature varies from 6.0 to 8.5°C and “[13,14]” an increase in summer maximum air temperature of about 0.4 ◦C per 10 years

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"[15]", with average long-term precipitation sum oscillates around (600mm) from (1971-2000) "[16]" .Poland soils were covered with deluvial, alluvial and eolian deposits from interglacial periods butalso with periglacial, organic and, locally, alluvial Holocene deposits.

. Bedrocks of the vast majority of Poland's soils are various types of Pleistocene post-glacial deposits (of which the most importantare glacial till, fluvioglacial and eolian formations), characterised by high variation of basic features: mineralogical composition, grain size distribution and arrangement of horizons. An important part is played by alluvial formations from contemporary rivers and bog and post-bog soils built from organogenic formations"[17]", an interesting aspect is the resistance of rocks to weathering, which contributes to the diversification of soil cover in the mountain areas. High mountains are built from solid magmatic and metamorphic formations, whereas low mountains were formed from deposit structures called flysch (clastic rocks from the Cretaceous and Tertiary periods, mostly schists, sandstones, siltstones and conglomerates.Taking into account the criterion of granulometric composition of bedrocks, the soil resources of Poland belong to sandy and silty soils. Only a small percentage of the soils are clayey soils "[18]",(Fig2),massive rocks of various origins (about 6%) "[19]". The precipitation in Poland associated with cyclones moving from the Mediterranean Sea to East-Central Europe (Mediterranean Cyclonal Precipitation – MCP). Average daily sum of MCP constitutes approximately 150% of daily amount of all precipitation in Poland.In the years1958–2008,the mean annual MCP was characterized by a signifcant decreasing trend - the MCP sum reduced by 29 mm,42% of its multiannual value "[20]".

The cold climate in Poland and snow caused snow thaw soil erosion due to freezing soil in cold period, in which water is extracted from soil aggregates to form small crystals around them, in addition, a considerable quantity of water rises from lower horizons in to the freezing zone. The ice crystals as they form partially destroy the soil aggregation that when thaw come a mass of fine soil particles is released. Disaggregation and oversaturation increase water on soil surface, also freezing increase the erodibility of the soil during the spring is the greatly reduced infiltration rate of snow water into the deeper layers and erosion losses caused by snow water generally show losses increase with soil permeability, while rainfall and its downpour is less damage than snow-water depend on its total quantity and its intensity and snow thaw to produce runoff "[21]". In Poland, three levels of urgency of anti-erosion prevention are in use "[22]":

a. Very urgent erosion control—occurs when over 25 % of the arable land of the administrative unit faces an average or higher erosion risk,
b. Urgent erosion control—occurs when 10–25 % of the arable land of the administrative unit faces an average or higher erosion risk,
c. Less urgent erosion control—occurs when up to 10 % of the arable land of the administrative unit faces an average or higher erosion risk.

The aim of study to calculate the Rainfall erosivity between(1980-2010) in Iraq and Poland and compare between each places erosion to understand cause of acidification and degradation soil ration.

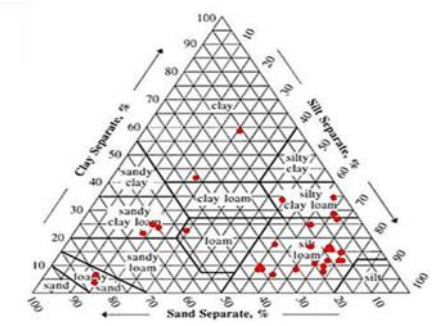

Fig. 1. Texture of Iraqi soils.

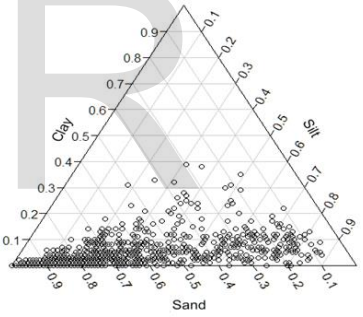

Fig 2: Texture of Polish soils

2 Materials and Methods

Statistical data between (1980-2010), were used to analyze rainfall, using 9 meteorological stations elements in Iraq "[23]"

In Poland. Mean monthly, seasonally and annually values of rainfall collected from Institute of Meteorology and Water Management, National Research Institute "[24]" to study strongly erosion precipitation by equation (1) of rainfall erosion,

$$\mathbf{R} = \sum_{i=}^{12} \mathbf{1.735x10}^{[1.5\ x\ \log 10\left(\frac{Pi2}{p}\right)-0.08188\ ]} \quad (1)$$

R is the rainfall erosivity (MJ mm ha^{-1} h^{-1} yr^{-1}),
P_i is the monthly rainfall (mm),
P is the annual rainfall totals (mm)"[25]" .

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3 Results and Discussion

The higher R-factor(Fig3) is between (1980-2010)In Iraq , is in Zakho and Kirkuk (510.2-232.95 MJ mm ha-1 year-1); the less in Najaf and Karbala (28.46-30.21 MJ mm ha-1 year-1) respectively. The increasing in mean annual precipitation was linked to changes in the soil properties with indicators of soil degradation increasing with lower levels of rainfall. The status of the soil was better in wet areas and worse in drier areas, while the highest R-factor(Fig4) is in Poland between (1980-2010) in Zakupany and Bielsko-Biala (692.2-557.595 MJ mm ha-1 year-1) respectively and the less in Poznan and Warsaw (168.39- 170.8 MJ mm ha-1 year-1) respectively.

The increasing in mean annual precipitation was linked to changes in the soil properties with indicators of soil degradation increasing with lower levels of rainfall. The status of the soil was better in wet areas and worse in drier areas. In wet environments, with 950-1100 mm of annual rain, biotic factors, such as the amount of vegetation and organic matter, play the greatest role in maintaining good soil status and preventing erosion. In sub-humid environments, with 650-950 mm of annual rain, biotic factors were also important but so too was the soil texture (high sand content and low clay content increased the likelihood of erosion). In dry soils, with 450-550 mm per year, there was less vegetation and more unprotected soil so condition was mediated by soil moisture and also by soil texture with again the sand content increasing the likelihood of erosion. Finally, in the semi-arid and arid regions, where rainfall is between 250-350 mm per year, vegetation is of a specific type that needs little water, such as strawflower and cottonweed. This vegetation produces low levels of organic matter in the soil and the soil condition is more closely linked to abiotic properties. High levels of sand content increase the likelihood of erosion but so do high levels of clay since, due to lack of vegetation, there will be a crusting of the clay surface which increases erosion "[26]".In other hands, high intensity rainfall events especially in the dry areas, which will increase runoff and soil erosion "[27]".Beside that if the rain is acidic, Soils containing calcium and limestone are more able to neutralize sulphuric and nitric acid depositions than a thin layer of sand or gravel with a granite base. If the soil is rich in limestone or if the underlying bedrock is either composed of limestone or marble, then the acid rain may be neutralized. This is because limestone and marble are more alkaline (basic) and produce a higher pH when dissolved in water. The higher pH of these materials dissolved in water offsets or buffers the acidity of the rainwater producing a more neutral pH. The emission of acidic gazes Sox and NOx lead to acid rainfall and cause new problem, Acid deposition.

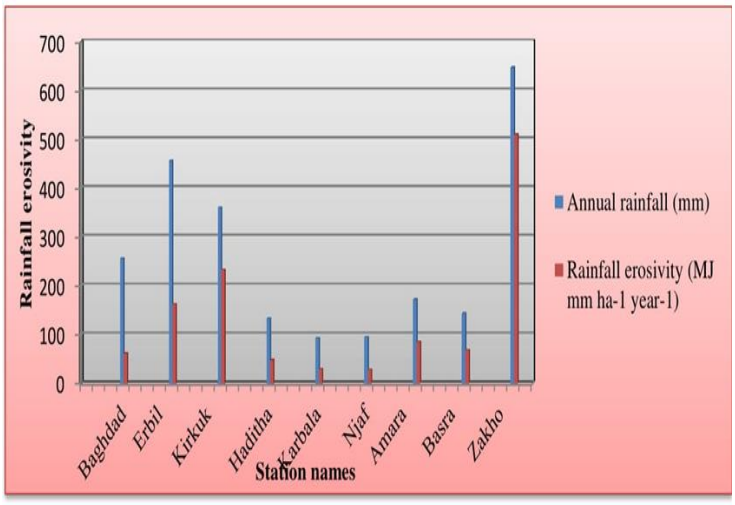

Fig3.Rainfall erosivity 9 stations in Iraq.

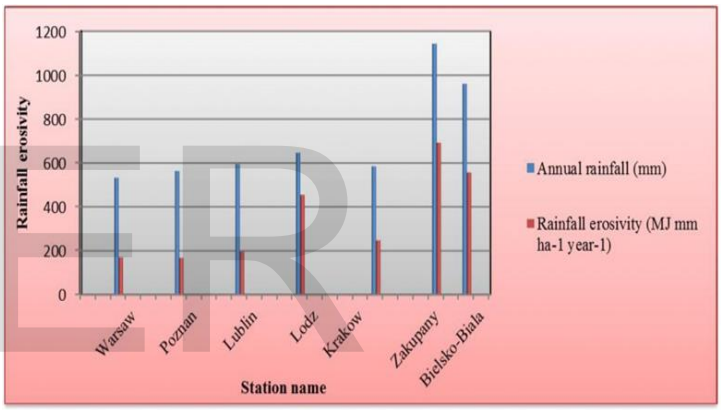

Fig 4: Rainfall erosivity 8 stations in Poland.

4 Conclusion

The highest Rainfall erosivity is in Zakupany and Bielsko-Biala (692.2-557.5 MJ mm ha-1 year-1) high sand content and low clay content increased the likelihood of erosion; the less in Poznan and Warsaw (168.39 - (170.8 MJ mm ha-1 year-1) between (1980-2010).The rainfall effect more on polish soil due to continue mainly sand and silty texture with small percentages of clay.

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