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GIS and Remote Sensing based Environmental Management of the Shirvan National Park in Azerbaijan

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STUDY AREA (Shirvan National Park)

RESEARCH OBJECTIVES

1.Determination of the vegetation cover peak season over the Shirvan National Park.

2. Monitoring and assessment of the vegetation cover status in the period of 2000 - 2010.

3. Prediction of the erosion prone areas in the Shirvan National Park.

This research provides the basis for the quantitative assessment of the achieved environmental restoration progress focused on the improvement of vegetation and soil cover in the Shirvan National Park.

DATA PROCESSING (Determination of Vegetation Peak Season in the Shirvan National Park and development of NDVI from Landsat-5(TM) satellite images)

MODIS 16-day composite NDVI for 12 months of 2010

Extraction of NDVI for two positions inside of SNP and determination of vegetation peak season for the selection of optimal LANDSAT-5(TM) satellite images.

LANDSAT-5(TM) Satellite Images

Conversion of LANDSAT-5(TM) Digital Numbers to Top of Atmosphere Reflectance (TOA)

LANDSAT-5(TM) Reflectance Images

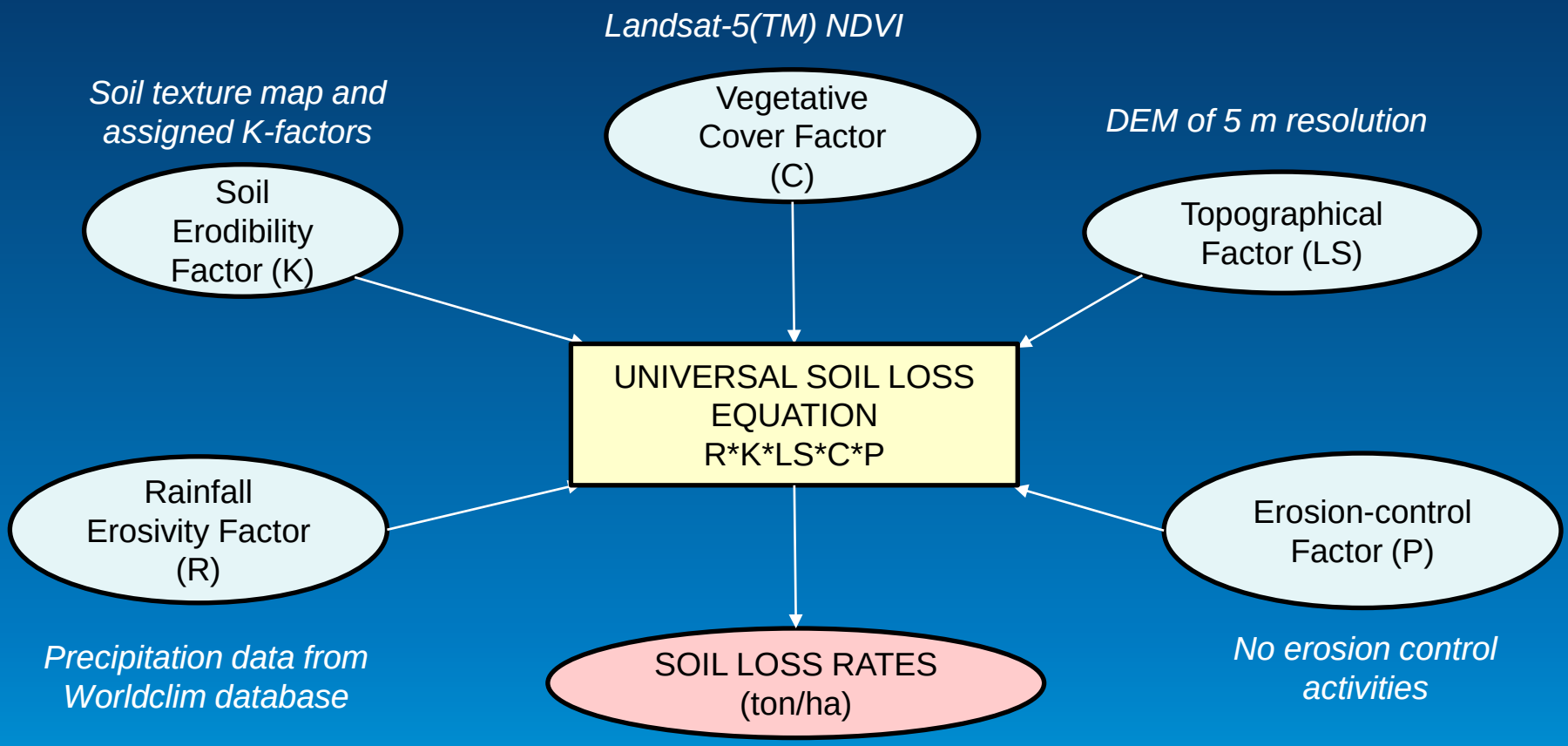
Development of NDVI for comparative analysis of vegetation cover

LANDSAT-5(TM) NDVI

$$NDVI = \frac{(nearIR - R)}{(nearIR + R)}$$

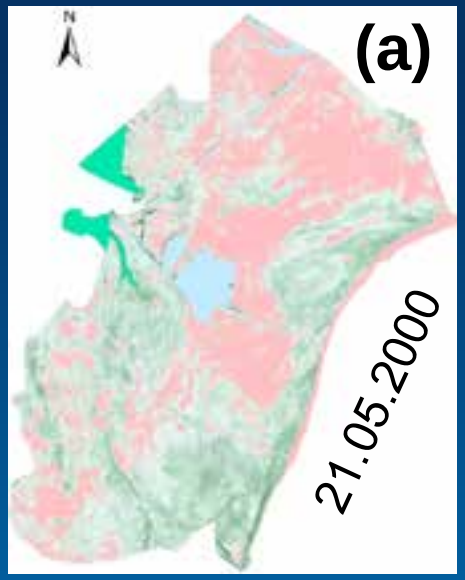
NDVI is based on the fact that chlorophyll absorbs RED whereas mesophyll leaf structure scatters NIR (Pettorelli *et al.* 2005)

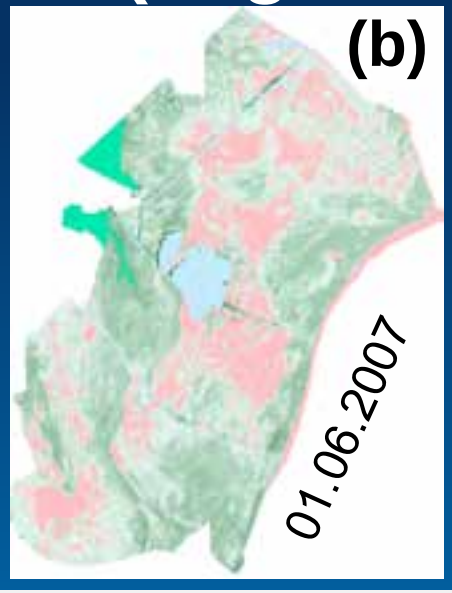
DATA PROCESSING (USLE for the Prediction of Erosion Prone Areas in SNP)

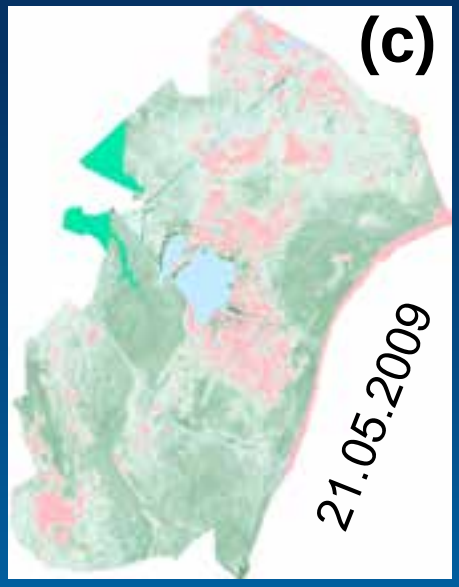


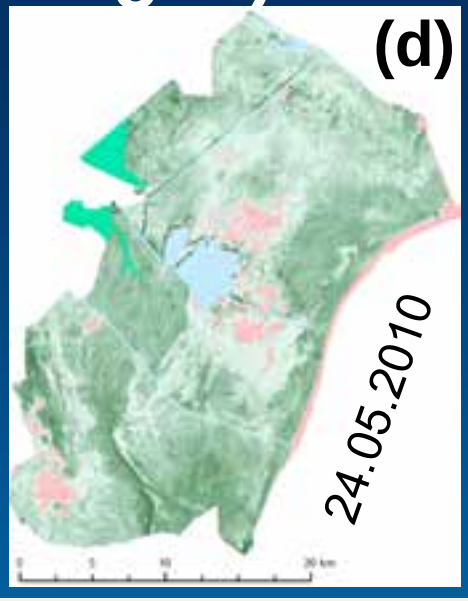
USLE was developed by Wischmeier & Smith (1978)

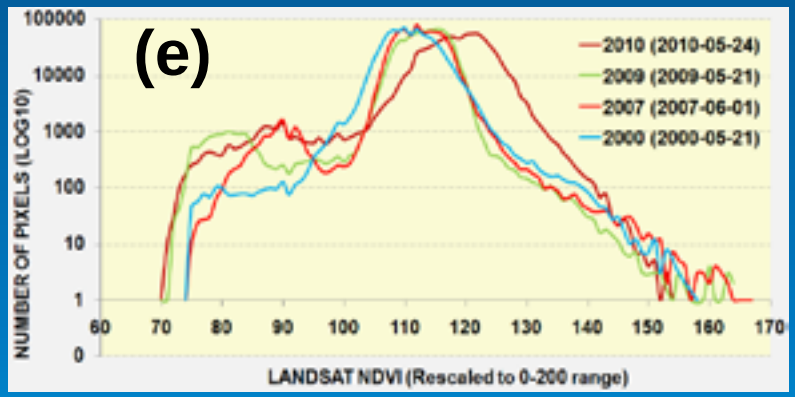
RESULTS (Vegetation Cover Changes)

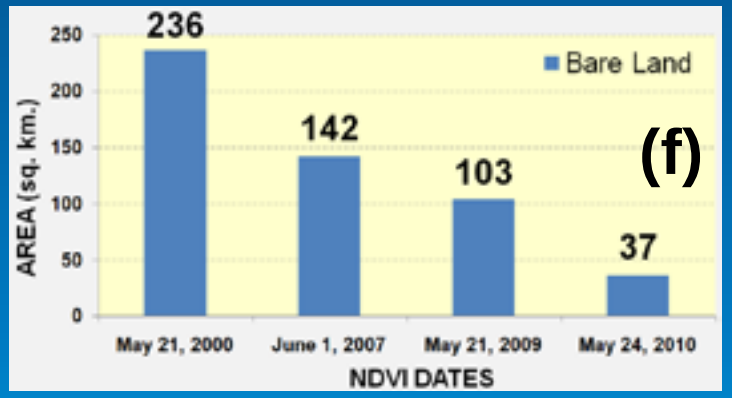






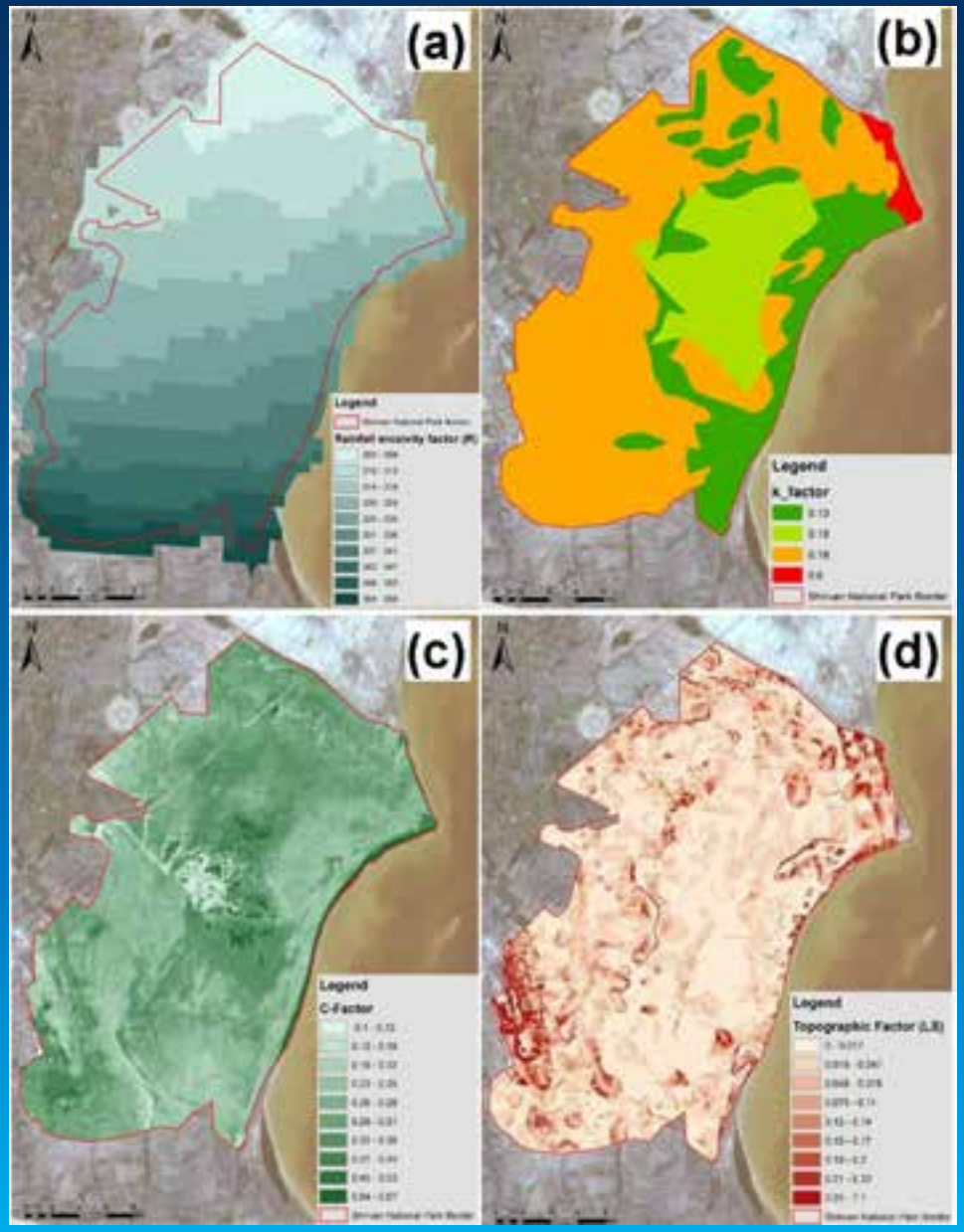






The modeling of NDVI for the Shirvan National Park revealed that the area of bare lands decreased from 2000 till 2010

RESULTS (USLE spatial factors)



(a) Rainfall Erosivity (R)

Input Data: Rainfall (Worldclim Database) ; Recommended Rainfall intensity value by Hudson (1995) and (Wischmeier & Smith 1978)

$$R = P_{eros}(0.119 + 0.0873 \log_{10} I) * I_{30}$$

(b) Soil Erodibility (K)

Input Data: The recommended soil erodibility factor (K) recommended by Morgan (2005) assigned to the map of soil texture types developed by Schmidt (2005)

(c) Vegetative cover factor (C)

Input Data: Landsat-5(TM) NDVI for 2010

$$C = \exp\left(-\alpha \frac{NDVI}{\beta - NDVI}\right)$$

(d) Topographic Factor (LS)

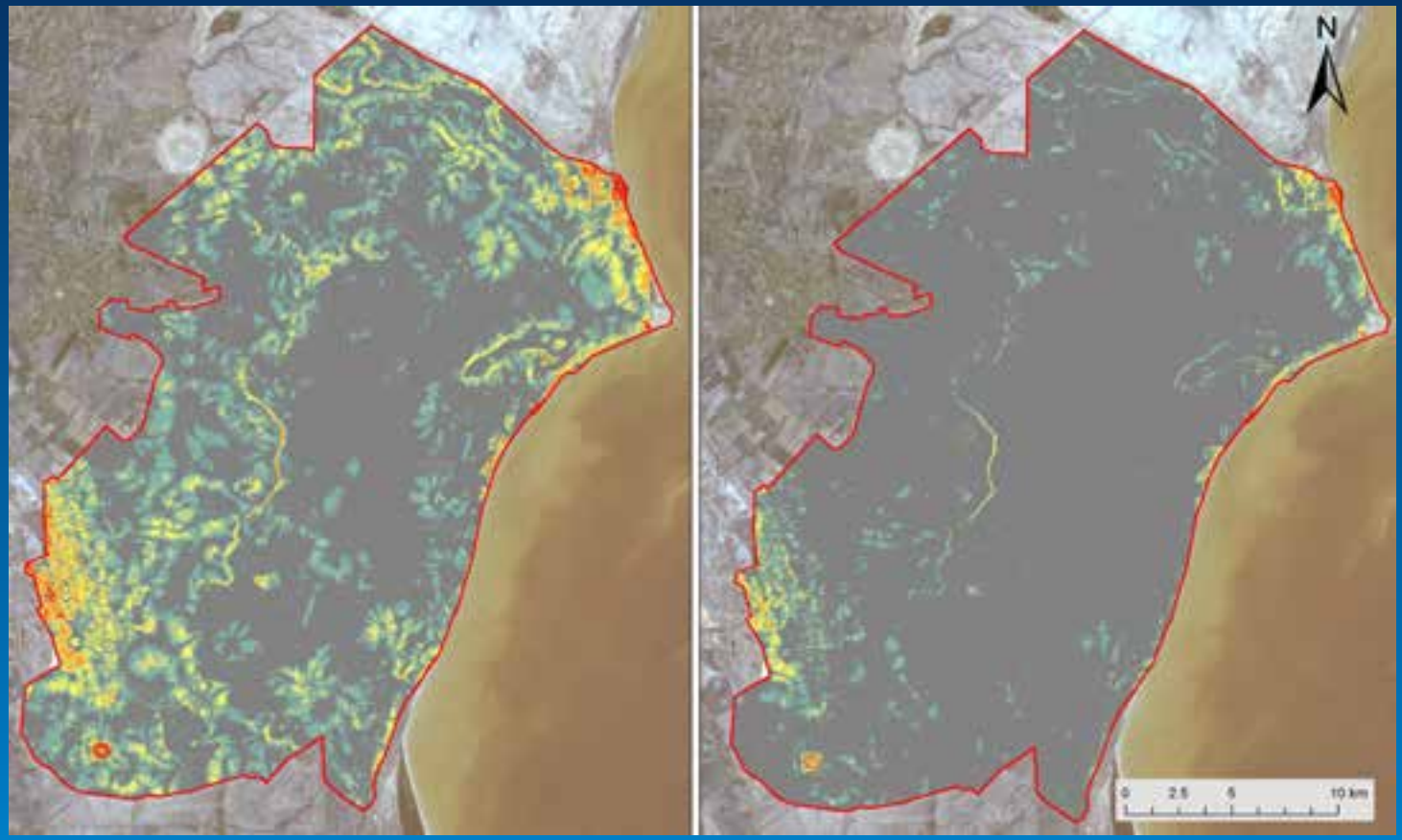
Input Data: DEM from 1:25000 topographic maps with spatial resolution of 5 meter

$$LS = \left(\frac{\text{FlowAccumulation} * \text{CellSize}}{22.13}\right)^{0.6} * \left(\frac{\text{sinSlope} * 0.01745}{0.09}\right)^{1.3}$$

Erosion-control Practice Factor (P)

Since no erosion-control measures were taken in SNP, erosion-control practice factor was assigned to 1

RESULTS (Predicted Erosion Prone Areas using USLE)



Soil Loss > 10ton/ha = 38.92 sq. km. (USLE with C-factor)

Soil Loss > 10ton/ha = 7.8 sq. km. (USLE with C-factor)

CONCLUSSIONS

1.May is the month of the vegetation cover peak season in the Shirvan National Park

2. Areas of bare lands were decreasing in the period of 2000 – 2010, that is a positive spatiotemporal environmental trend related to a number of strategic improvement measures since the establishment of the Shirvan National Park in 2003.

3. The restoration activities should continue around the Flamingo Lake to reduce the soil salinity and the root cause from irrigation collectors should be investigated.

4. Predicted USLE soil loss rates higher than 10 ton/ha was 38.92 sq. km. without the consideration of vegetation cover protection whereas with the consideration of vegetative cover factor was 7.8 sq. km.