USLE modeli kullanılarak bir havzada toprak kayıplarının GIS ortamında hesaplanması

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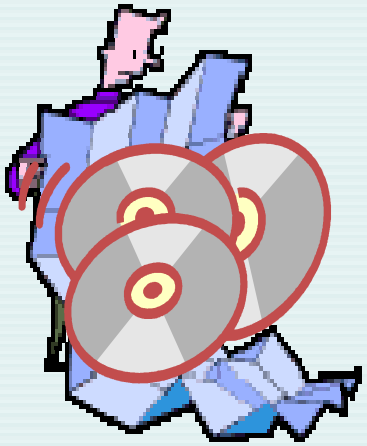
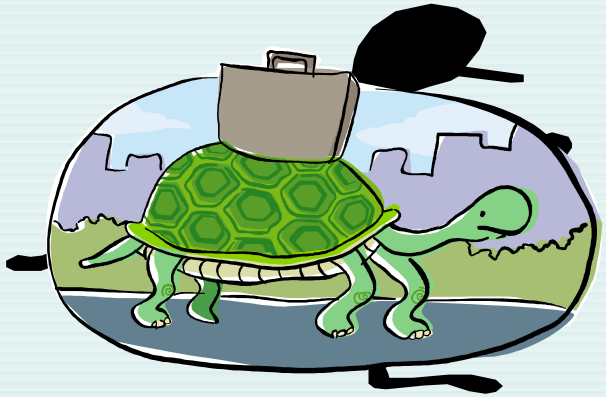
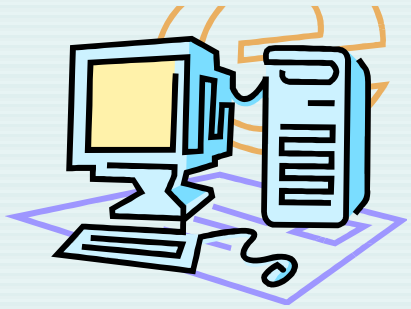
Ankara Üniversitesi, Ziraat Fakültesi, Toprak Bölümü

Neden GIS ?





GIS bileşenleri



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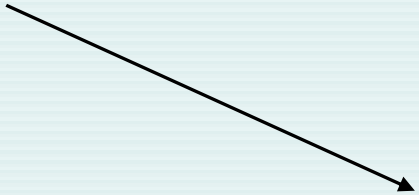
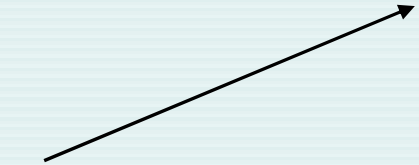
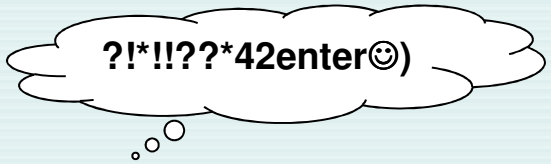
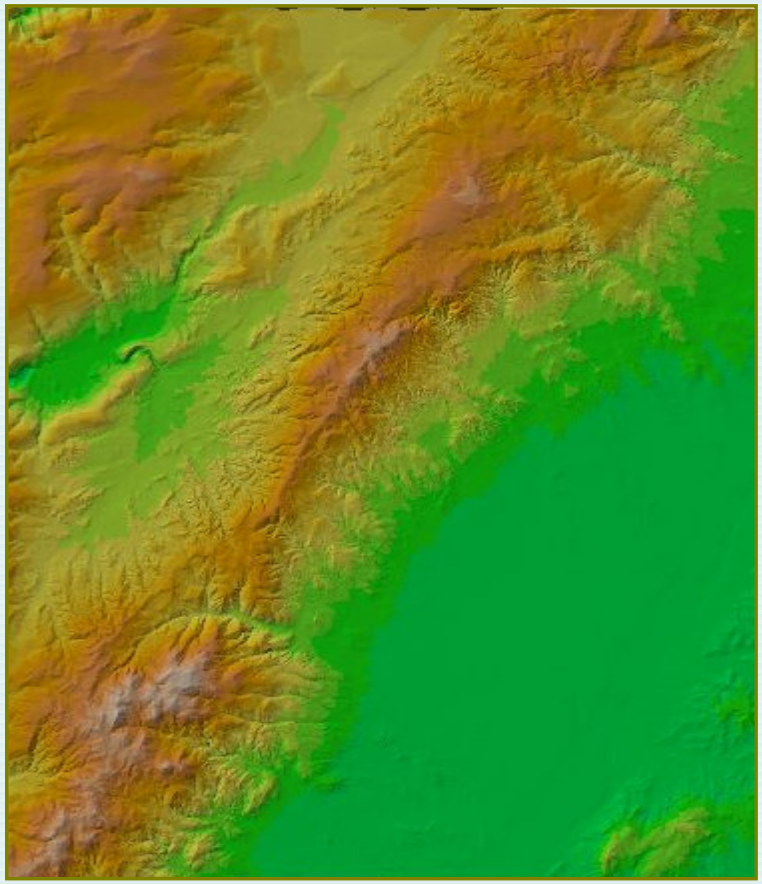


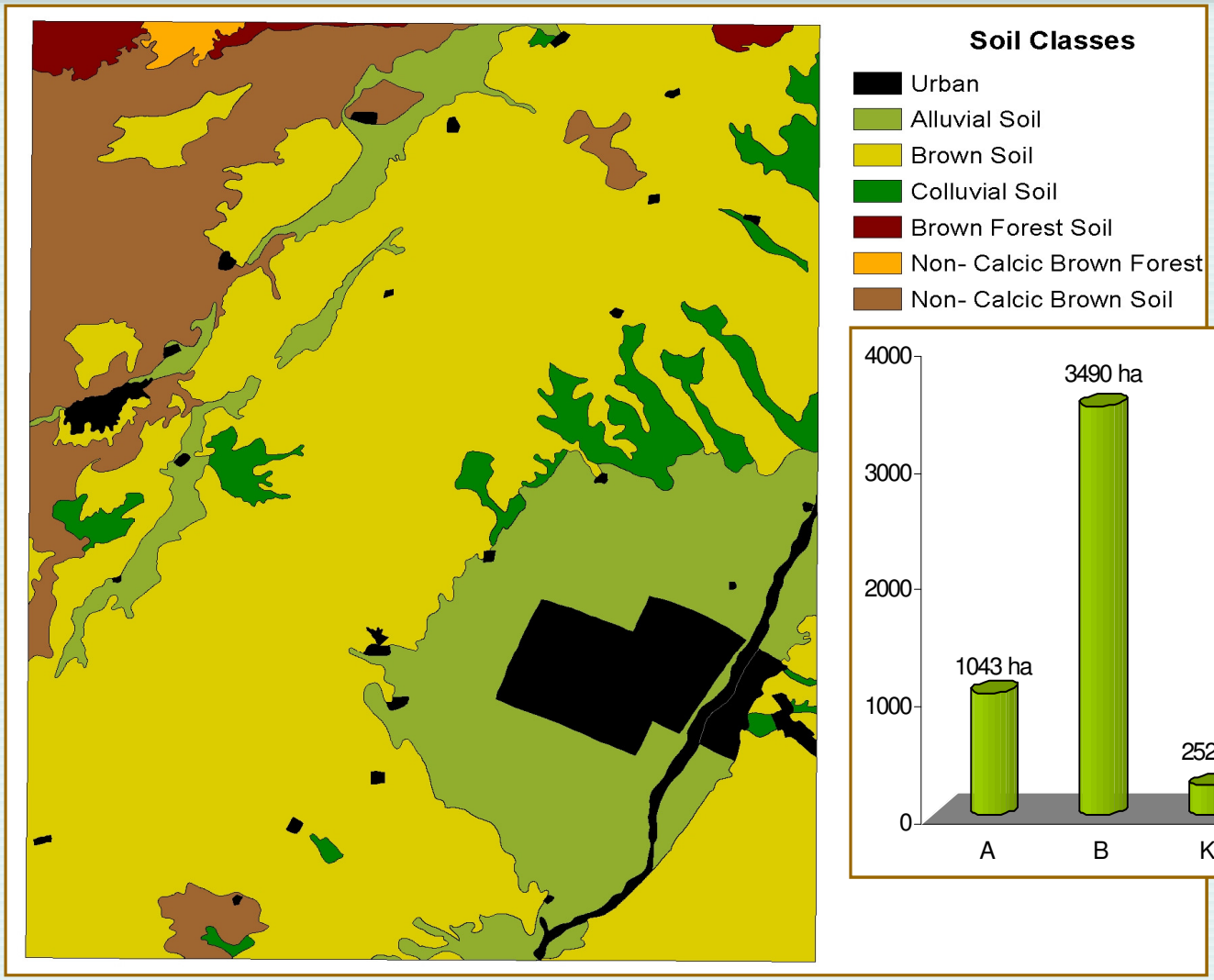


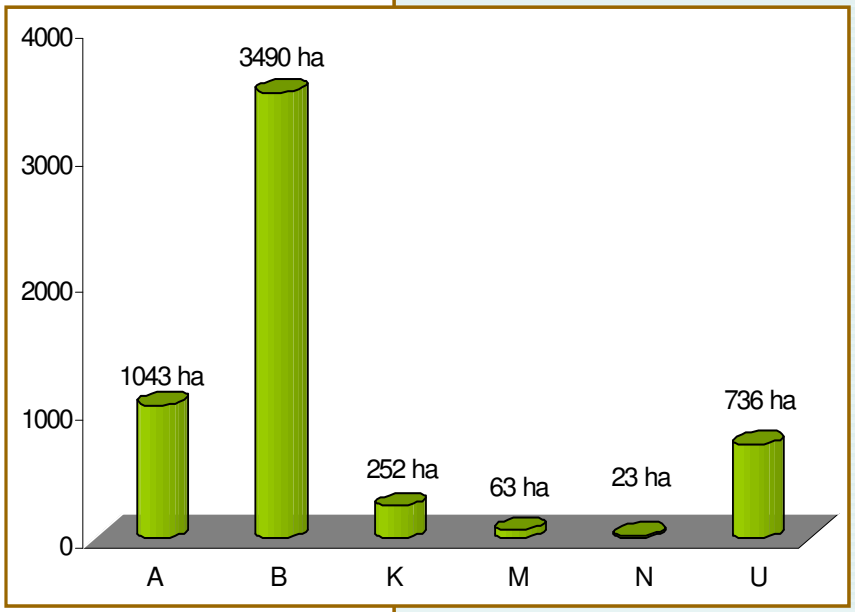


Örnek Çalışma



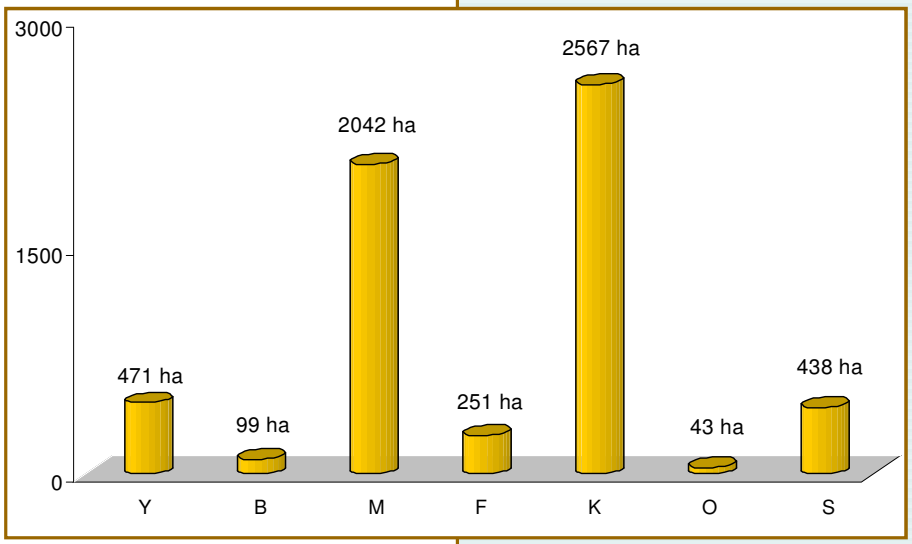
- ✓ 6000 ha
- ✓ Yıllık ortalama yağış 350 mm


Soil Classes
Urban
Alluvial Soil
Brown Soil
Colluvial Soil
Brown Forest Soil
Non- Calcic Brown Forest
Non- Calcic Brown Soil


4000
3000
2000
1000
0
1043 ha
3490 ha
252 ha
63 ha
23 ha
736 ha
A
B
K
M
N
U

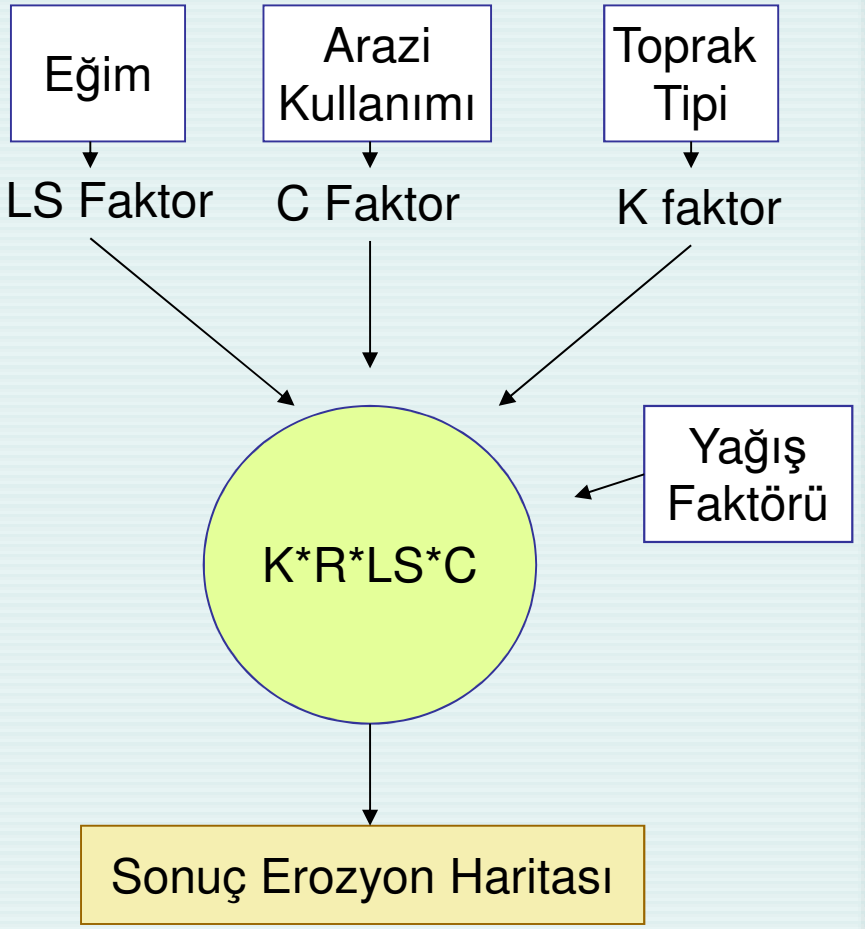
Land Use Type
(GDRS,1986)

- (O) Forest
- (B) Fruits
- (S) Irrigated Agriculture
- (F) Natural Shrubs
- (M) Pasture
- (K) Unirrigated Agriculture
- (Y) Urban



Yöntem

- ✓K ve C faktor verileri digital toprak haritası lejantından türetilmiştir. (1:25000)
- ✓LS faktor değerleri DEM (10m).
- ✓R faktor verileri; erozyon index değerleri (Dogan, 2002).



BTG	TOK	DTO	ERZ	SAK	AZT	AKK	ATS	BTG_TOK	C_FACTOR	K_FACTO
									0	0
B	19		3	M		VII	es	B_19	0.10	0.8
K	1		1	K		I		K_1	0.35	0.13
K	1	t	1	K		II	s	K_1	0.35	0.13
U	5		2	K		II	e	U_5	0.35	0.25
U	24		4	M		VII	es	U_24	0.10	0.8
B	15		3	M		VI	es	B_15	0.10	0.8
B	10		2	K		III	e	B_10	0.35	0.5
B	15		3	M		VI	es	B_15	0.10	0.8
B	19		3	M		VII	es	B_19	0.10	0.8
B	15		3	M		VI	es	B_15	0.10	0.8
B	24	t	4	M		VII	es	B_24	0.10	0.8
B	15	t	3	K		VI	es	B_15	0.35	0.8
K	14		2	K		II	e	K_14	0.35	0.5
B	15	t	3	M		VI	es	B_15	0.10	0.8
B	9		2	K		III	e	B_9	0.35	0.5
K	1		1	K		I		K_1	0.35	0.13
B	19		3	M		VII	es	B_19	0.10	0.8
B	16	t	3	M		VII	es	B_16	0.10	0.8
B	24		4	M		VII	es	B_24	0.10	0.8
B	16		3	M		VII	es	B_16	0.10	0.8
B	10		2	K		III	e	B_10	0.35	0.5
A	1		1	Sy		I		A_1	0.45	0.13
U	11	t	2	F		IV	se	U_11	0.15	0.7
U	24	t	3	M		VII	es	U_24	0.10	0.8
B	5		1	K		II	e	B_5	0.35	0.25
A	1		1	K		I		A_1	0.35	0.13
B	24		4	M		VII	es	B_24	0.10	0.8
									0	0
U	9		2	O		III	e	U_9	0.10	0.5
U	5		1	S		II	e	U_5	0.40	0.25
B	15		3	K		VI	es	B_15	0.35	0.8
M	24	t	4	M		VII	es	M_24	0.10	0.8
M	24	t	3	F		VII	es	M_24	0.15	0.8
B	15		3	K		VI	es	B_15	0.35	0.8
B	11		2	K		IV	es	B_11	0.35	0.7
B	20		3	M		VII	es	B_20	0.10	0.8
A	1		1	Sy		I		A_1	0.45	0.13

Show: All Selected Records (0 out of 242 Selected.) Options

Eğim	Derinlik (cm)			
	Derin > 90	Orta Derin 50 - 90	Sığ 20 - 50	Çok Sığ 0 - 20
A (%0 – 2)	Çok düşük	Çok düşük	Düşük	Düşük
B (%2 – 6)	Düşük	Düşük	Orta	Orta
C (%6 – 12)	Orta	Orta	Yüksek	Yüksek
D (%12 – 20)	Yüksek	Yüksek	Çok yüksek	Çok yüksek
E (%20 – 30)	Çok yüksek	Çok yüksek	Çok yüksek	Çok yüksek
F (> %30)	Çok yüksek	Çok yüksek	Çok yüksek	Çok yüksek

Erozyon Potansiyeli	K değeri
Çok Yüksek	0.80

Kahverengi Orman Toprakları **(M)**,
Kireçsiz Kahverengi Orman Toprakları **(N)**,
Kahverengi Topraklar **(B)**
Kireçsiz Kahverengi Topraklar **(U)**

BTG_TOK	C_FACTOR	K_FACTO
	0	0
B_19	0.10	0.8
K_1	0.35	0.13
K_1	0.35	0.13
U_5	0.35	0.25
U_24	0.10	0.8
B_15	0.10	0.8
B_10	0.35	0.5
B_15	0.10	0.8
B_19	0.10	0.8
B_15	0.10	0.8
B_24	0.10	0.8
B_15	0.35	0.8
K_14	0.35	0.5
B_15	0.10	0.8
B_9	0.35	0.5
K_1	0.35	0.13
B_19	0.10	0.8
B_16	0.10	0.8
B_24	0.10	0.8
B_16	0.10	0.8
B_10	0.35	0.5
A_1	0.45	0.13
U_11	0.15	0.7
U_24	0.10	0.8
B_5	0.35	0.25
A_1	0.35	0.13
B_24	0.10	0.8
	0	0
U_9	0.10	0.5
U_5	0.40	0.25
B_15	0.35	0.8
M_24	0.10	0.8
M_24	0.15	0.8
B_15	0.35	0.8
B_11	0.35	0.7
B_20	0.10	0.8
A_1	0.45	0.13

Options

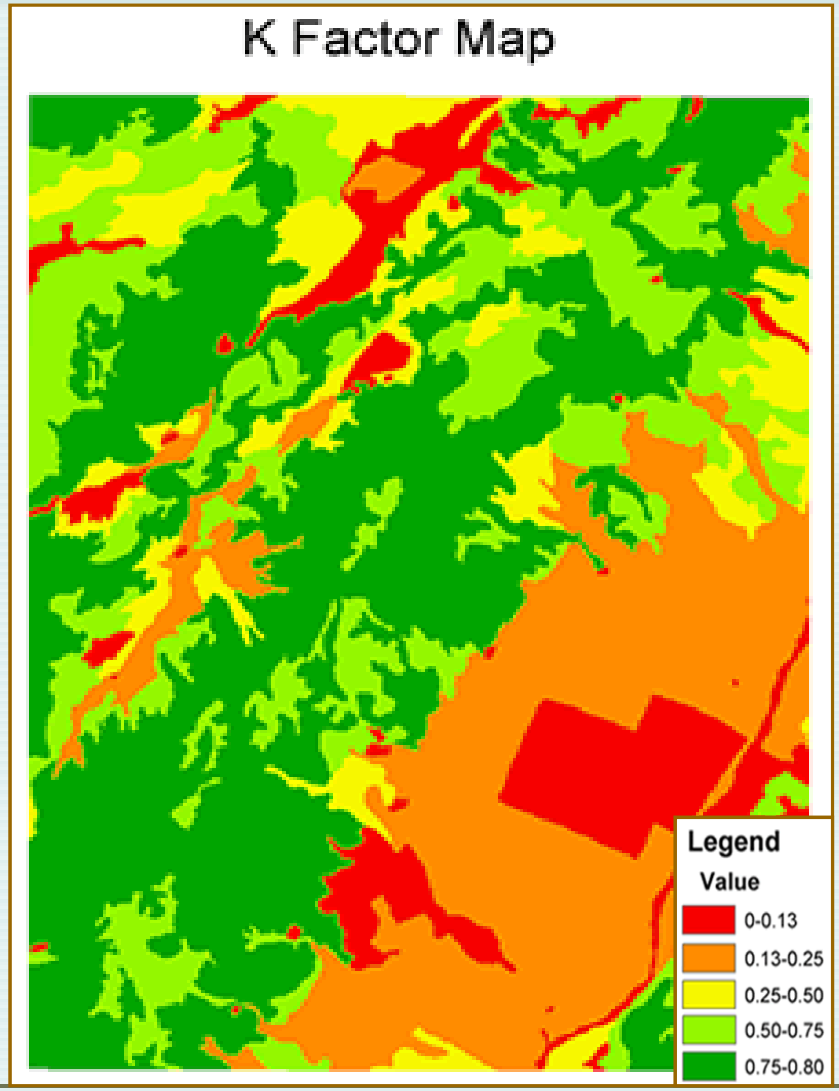
K faktörü

Toprak Özellik kombinasyonları

+

Erozyon Potansiyeli	K değeri
Çok Yüksek	0.80
Yüksek	0.70
Orta	0.50
Düşük	0.25
Çok Düşük	0.13

RECLASS



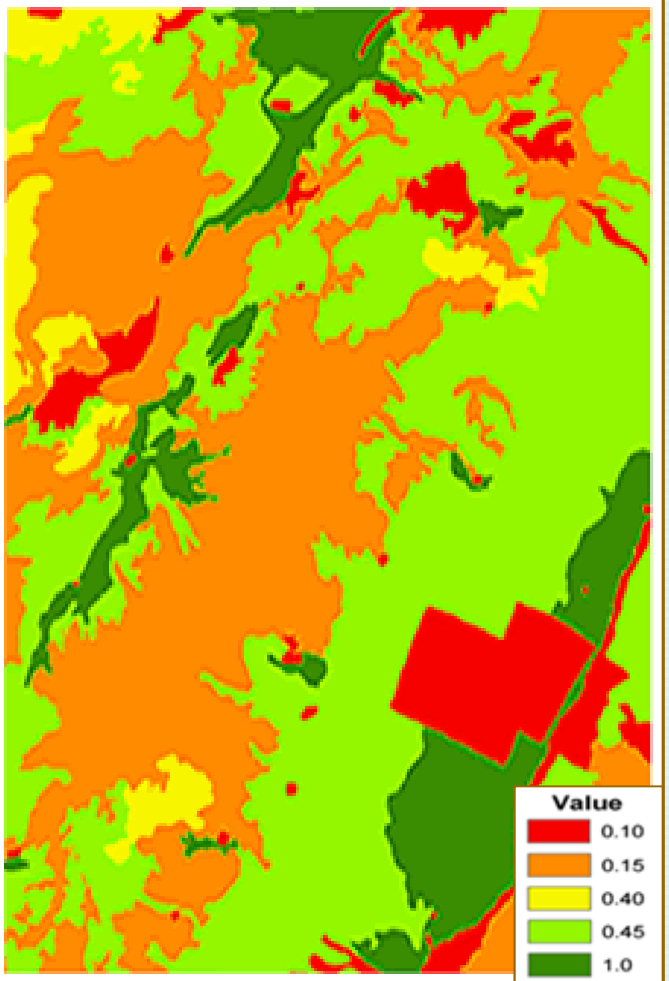
C faktörü

Land Use Map

SAK	Sembol	C değeri
Nadas	N	1.00
Tarım alanı(sulu)	S	0.40
Tarım alanı (susuz)	K	0.45
Mera	M	0.10
Orman	O	0.10
Çayır	Ç	0.15
Bahçe	B	0.40

Reclassification

C Faktor Map



BTG	TOK	DTO	ERZ	SAK	AZT	AKK	ATS	BTG_TOK	C_FACTOR	K_FACTO
									0	0
B	19		3	M		VII	es	B_19	0.10	0.8
K	1		1	K		I		K_1	0.35	0.13
K	1	t	1	K		II	s	K_1	0.35	0.13
U	5		2	K		II	e	U_5	0.35	0.25
U	24		4	M		VII	es	U_24	0.10	0.8
B	15		3	M		VI	es	B_15	0.10	0.8
B	10		2	K		III	e	B_10	0.35	0.5
B	15		3	M		VI	es	B_15	0.10	0.8
B	19		3	M		VII	es	B_19	0.10	0.8
B	15		3	M		VI	es	B_15	0.10	0.8
B	24	t	4	M		VII	es	B_24	0.10	0.8
B	15	t	3	K		VI	es	B_15	0.35	0.8
K	14		2	K		II	e	K_14	0.35	0.5
B	15	t	3	M		VI	es	B_15	0.10	0.8
B	9		2	K		III	e	B_9	0.35	0.5
K	1		1	K		I		K_1	0.35	0.13
B	19		3	M		VII	es	B_19	0.10	0.8
B	16	t	3	M		VII	es	B_16	0.10	0.8
B	24		4	M		VII	es	B_24	0.10	0.8
B	16		3	M		VII	es	B_16	0.10	0.8
B	10		2	K		III	e	B_10	0.35	0.5
A	1		1	Sy		I		A_1	0.45	0.13
U	11	t	2	F		IV	se	U_11	0.15	0.7
U	24	t	3	M		VII	es	U_24	0.10	0.8
B	5		1	K		II	e	B_5	0.35	0.25
A	1		1	K		I		A_1	0.35	0.13
B	24		4	M		VII	es	B_24	0.10	0.8
									0	0
U	9		2	O		III	e	U_9	0.10	0.5
U	5		1	S		II	e	U_5	0.40	0.25
B	15		3	K		VI	es	B_15	0.35	0.8
M	24	t	4	M		VII	es	M_24	0.10	0.8
M	24	t	3	F		VII	es	M_24	0.15	0.8
B	15		3	K		VI	es	B_15	0.35	0.8
B	11		2	K		IV	es	B_11	0.35	0.7
B	20		3	M		VII	es	B_20	0.10	0.8
A	1		1	Sy		I		A_1	0.45	0.13

Show: All Selected Records (0 out of 242 Selected.) Options

R faktörü

Faktörü bilinen referans istasyonun R değeri

Faktörü bilinmeyen ünitenin ortalama yıllık yağışı

$$R_y = R_r \left(\frac{p_y}{p_r} \right)^{1.75}$$

Faktörü bilinmeyen ünite için düzeltilmiş R değeri

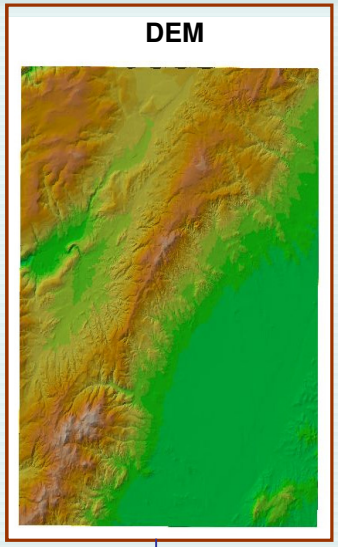
Faktörü bilinen referans istasyonun ortalama yıllık yağışı

- ✓ **Çözüm yapmak istediğimiz haritalama ünitesinin yüksekliği 2500 m olsun.**
- ✓ **Referans istasyonumuzun yüksekliği 1215 m**
- ✓ **Yıllık ortalam yağış 366.5 dir.**
- ✓ **Referans istasyonumuzun R değeri Rr = 15.241**
  - ➢ **Yükseklik farkı *2500 – 1215 = 1285 m*'dir**
  - ➢ **Hesap yapmak istediğimiz ünitedeki ortalama yıllık yağış (p_y) :**

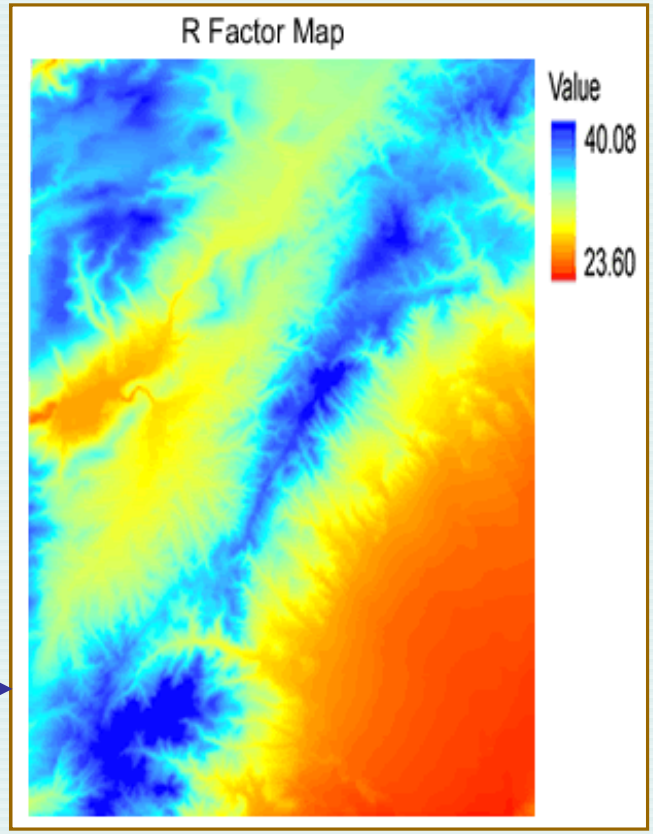
    p_y = *366.5mm +* ((1285*50mm) / 300m) = *569 mm*

$$R_y = 15.241 \left(\frac{569}{366.5} \right)^{1.75} = 32.91 \cdot \frac{MJ \cdot mm}{ha \cdot saat}$$

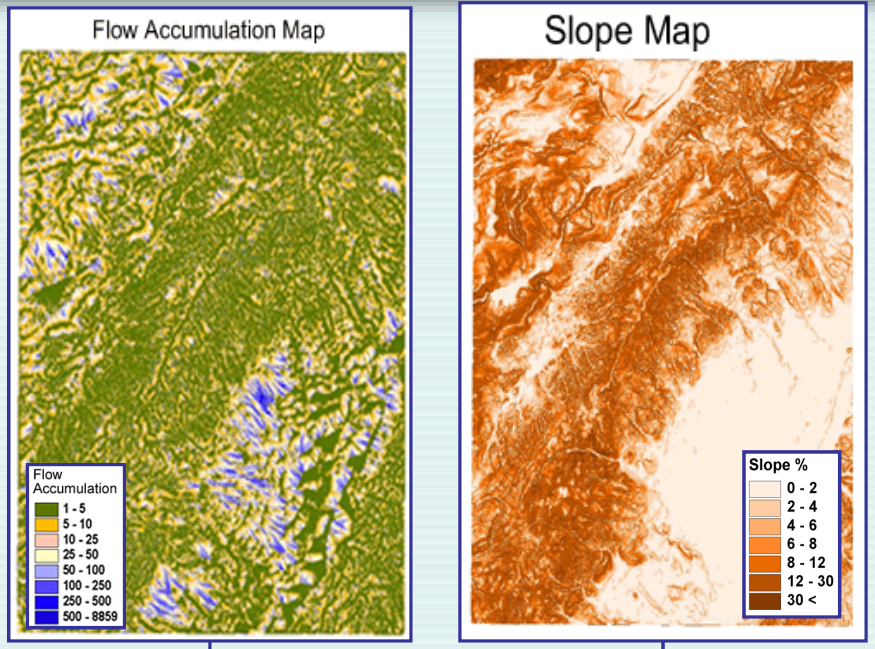
R factor

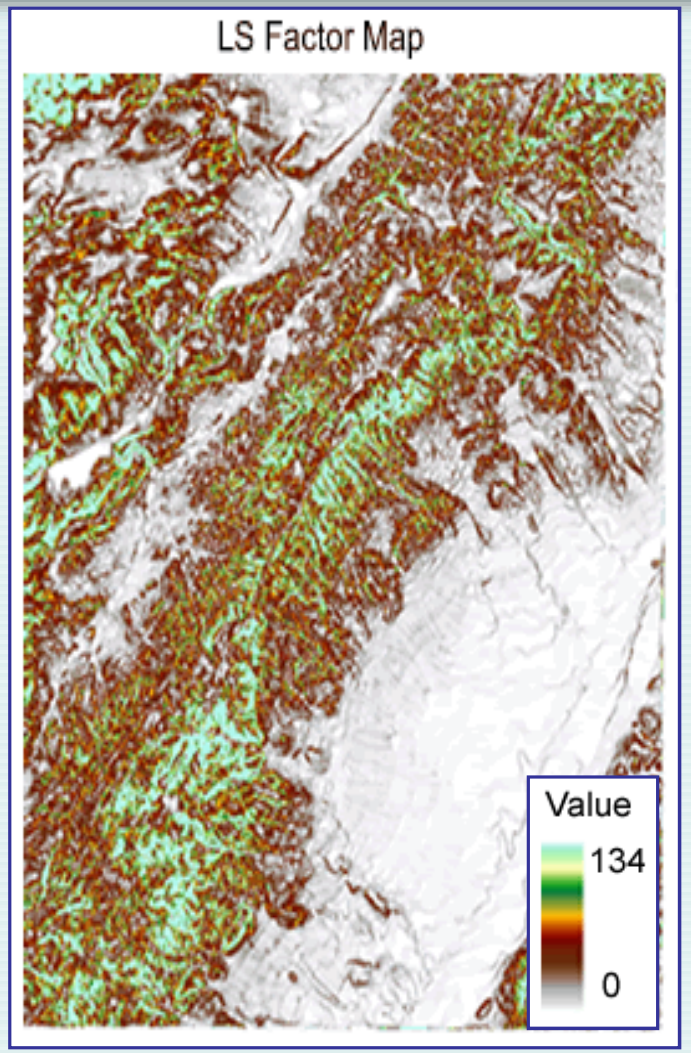


(((([Dem_name] / [Dem_name]) * 366) + (([Dem_name] - 1285) * 50)) / 393).Pow(1.75)) * 15.24



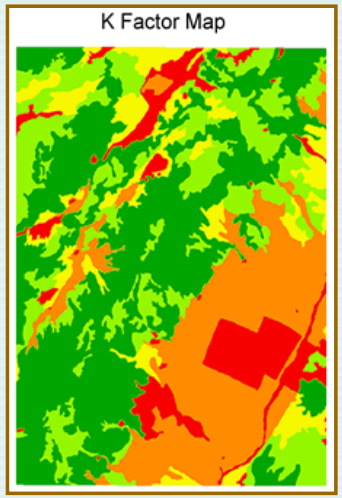
LS Faktörü



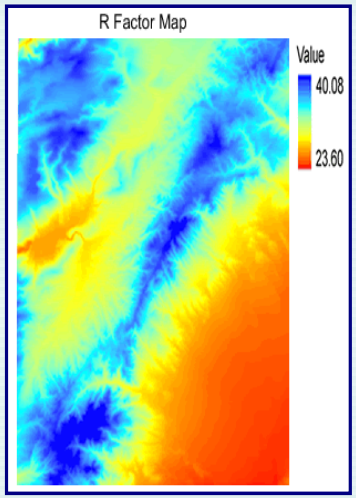


LS = (Flow Accumulation x Cell Size / 22.13)
0.4 x (sin slope / 0.0896)1.3

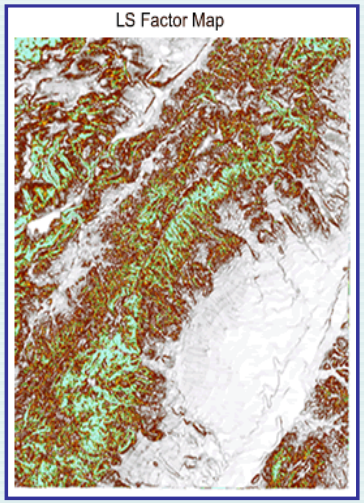
USLE = K * R * LS * C


K Factor Map

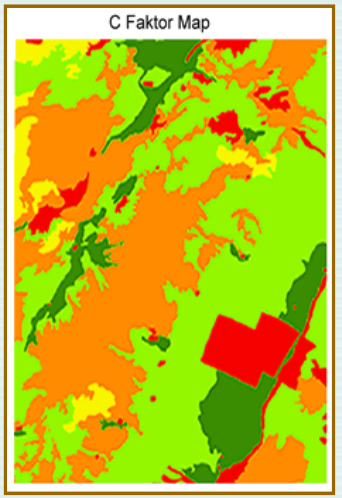
*


R Factor Map
Value
40.08
23.60

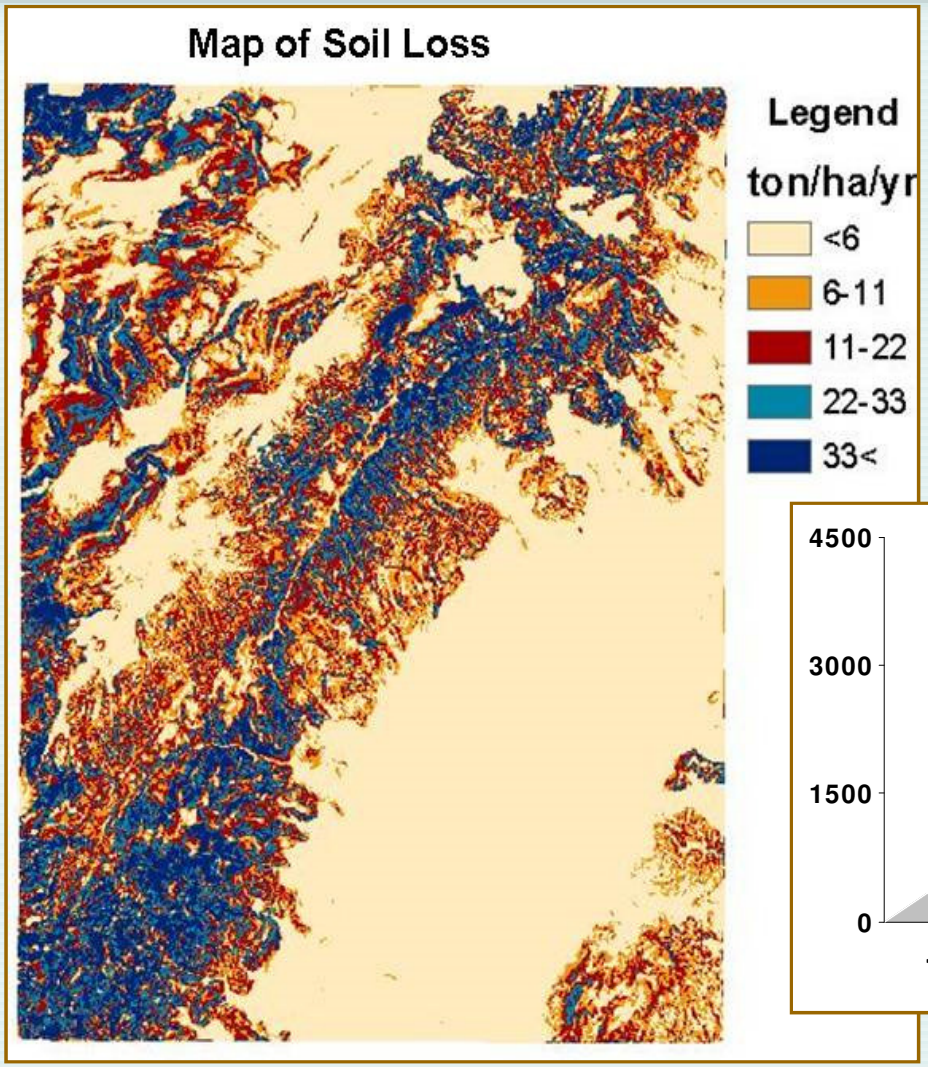
*


LS Factor Map

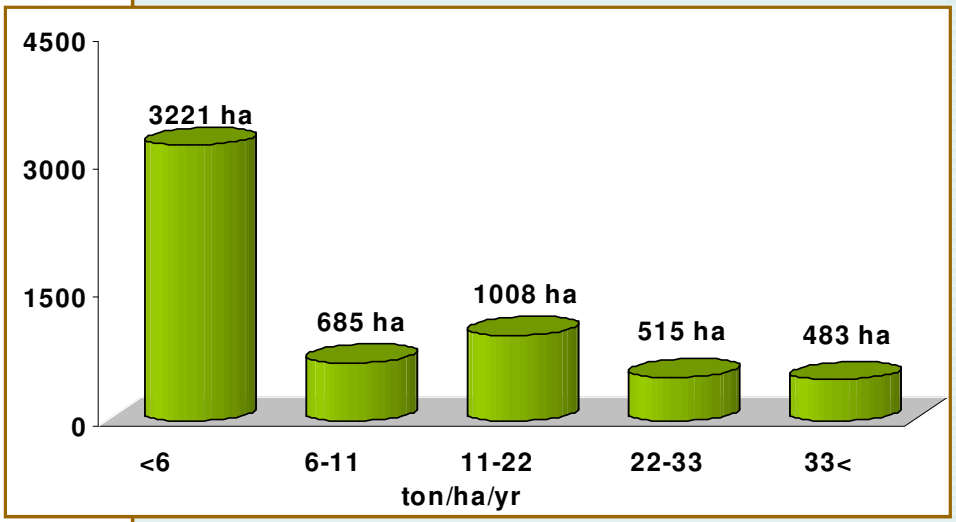
*


C Faktor Map

Sonuç



Toprak Kaybı (ton/ha/yr)	Risk sınıfı
<6	Çok düşük
6-11	Düşük
11-22	Orta
22-33	Yüksek
33<	Çok Yüksek



Teşekkürler