MATHEMATICAL-CARTOGRAPHICAL MODELLING OF THE VERTICAL STRUCTURE OF THE MOUNTAINIOUS LANDSCAPE ON THE COMPUTER (ON THE EXAMPLE OF EASTERN PART OF THE CAUCASIS MINOR)

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The investigation of the vertical structure of the landscapes of mountainious contries wan the subjeckt of the research of R.A.Elinevsky (1968), I.S.Shukin and O.E. Shukina (1959), B.I.Alekseev and E.N.Lukashov (1969), G.P.Miller (1974) and others. With the aim of the defining the regularities distribution of (quantitative) data of the landscape structure on the gypsometrical levels of the relief the gypsometric map of the territory of the Caucasis Minor and the large-scale landscape map of the Caucasis Minor composed by prof.M.A.Myseibov and M.A.Suleymanov (1975, 1981) had been used by us applied quantitive data the landscape structure were as following:

1. Areas of the individual uruchish in square km. where - Si

2. The average arithmetical numbers of conturs: $\bar{S}_{a2}=\sum_{i=1}^{N} S_i/N$

3. The general entropy: $H_g=-\sum_{i=1}^{N}\frac{S_i}{\sum S_i}\log_2\frac{S_i}{\sum S_i}$ where N -number of individual conturs of

4. Maximal entropy: $H_m=\log_2 N$ where N -number of individual conturs;

5. Relative entropy: $H_2=(H_m-H_g)/H_m$

6. Average square declination:

$$\sigma=\left\{\sum_{i=1}^{N}(S_i-\bar{S}_{a2})^2/(N-1)\right\}^{\frac{1}{2}}$$

7. Coefficient of variation:

$$C_V=\sigma/\bar{S}_{a2}$$

8. Limits of the squares of the individual contures of landscape group in square km.

9. The number of individual conturs - N

10. Coefficient of landscapic unhomogenic:

$$K_{LU}=\sum_{i=1}^{i=N-1}\sum_{j=i+1}^{j=N} m_i\cdot m_j/C_n^2$$

where $1\leq i<j\leq N,\ m=S_j/100\%/N$

S_j' -is the square of several genetical groups of landscapes (urochish) in the local zones; n -number of genetical group of landscapes (urochish); $C_n^2=\frac{n-1}{2}$ -number of addition from the quantity of pairs. On the basis of above-mentioned data the fortran-program on the computer US-1035 was composed catalogizing on the packet of discos 5261 with the serial number "GEO LAN" had been done and for output data on the packet the continuous complex of data "BSLAN" was created. For conducting the calculation of the data the task in US of UC of 6.1 version had been composed by us. Results of calculations had been given in the table 1.

Table 1.

Gypsometrical levels H(m)	The quantitive data of the landscape structure				
	1	2	3	4	5
1. Till 200	1769	19.45	5.30	6.52	0.18
2. 200 -400	3766	19.71	6.60	7.58	0.13
3. 400 - 600	2346	9.65	7.17	7.93	0.10
4. 600 -1000	2858	8.69	7.63	8.36	0.09
5. 1000-1400	2400	6.08	8.02	8.63	0.07
6. 1400-1800	2416	5.82	8.16	8.70	0.06
7. 1800-2200	1543	5.53	7.53	8.13	0.07
8. 2200-2600	928	5.69	6.70	7.35	0.09
9. 2600-3000	771	5.59	6.60	7.11	0.07
10. 3000-3400	431	5.13	5.82	6.39	0.09
11. 3400-ebav	6	3.00	0.92	1.00	0.09

On the basis of the received results one may come to the following results: 1. With encrease of the hight of the place the average amount of the squares of the individual group of landscapes;

2. The change hage of the general entropy according to the relief is similar to the change of the square of the hypsometrical level as the both data in the middle mountain recieve maximal amount; 3. Maximal entropy also gets its maximum in the middle mountain. 4. The amount of the middle square declination gradually decreases with the increase of the hight of the place; 5. In the distribution of the coefficient of the variation the decrease on the hight of the relief is also abserved. 6. Limits of the squares of conturs are characterised by the accidental variation 7. Distribution of the quantities of conturs are similar to the distribution of the the amount of the squares of the conturs and the general entropy. 8. Coefficients of the landscape unhomogeniosity are not regulary distributed according to the hight of the relief.

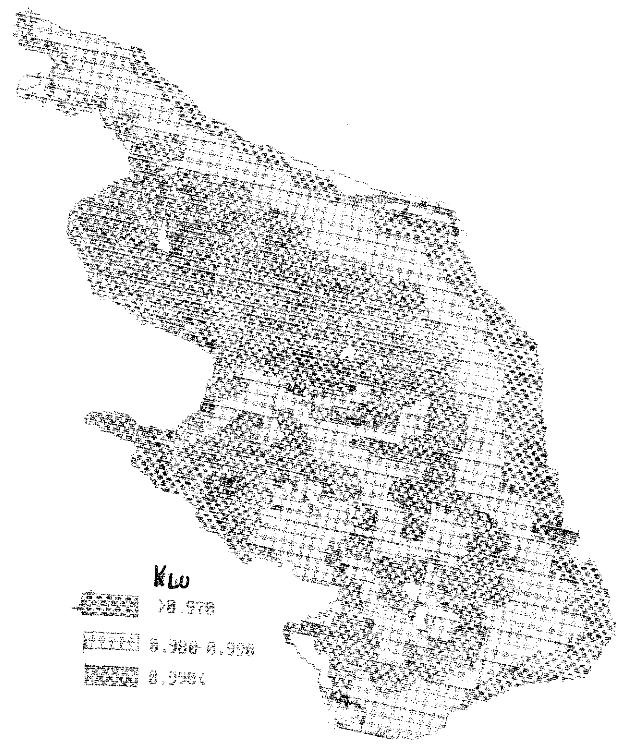
Results of the conducted investigations can be used while doing the meliorative works in the mountainian and pre-mountainian condictions,while working out scemes of the regional planning while doing the erectional works in the mountainian conditions,while recreational evaluation of the territory with the aim of rest and turism.Besides these,the developed method might be applied in the course of analysis of the vertical structure of the soil -plant cover,types of relief,types of quantiniary lauers and in the process of analysis of the other elements of the geographical landscapes.

In the final stage of the investigation one can come in to the following results on the basis of recieved results:maps of landscape structures of gypsometrical levels of the researched territories had been composed on the printer of the personal computer IBM PC AT.

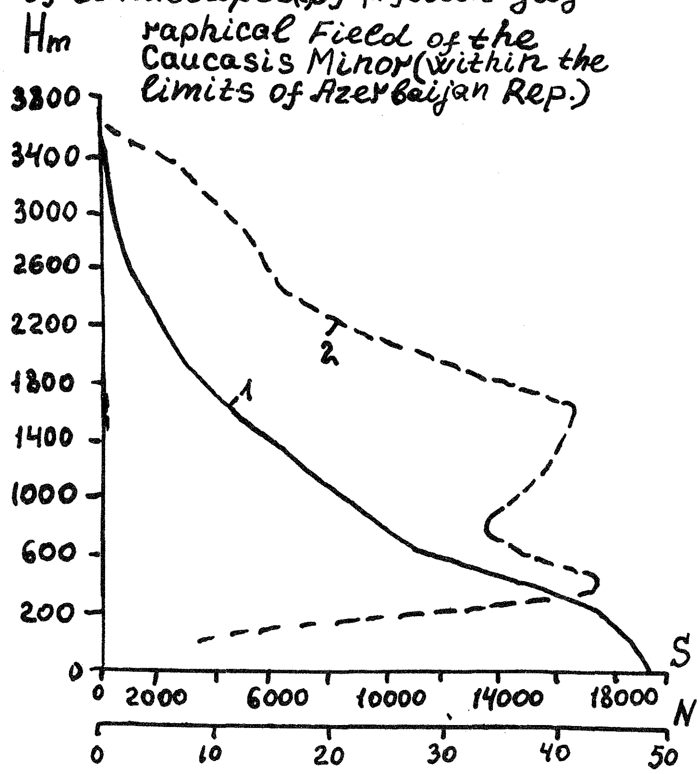
RESEARCH EXAMPLE

Hypsographical map of Physical-Geographical Field of The Caucasis Minor (within the limits of Azerbaijan Repablic)

The map of the distribution of the coefficient of unhomogenity the landscape (according to squares)



Hypsographical currature(1)and the currature of the distribution of the quantity of types of landscapes(2)of physical-geographical Field of the Caucasis Minor(within the limits of Azerbaijan Rep.)



EXAMPLE FORTRAN PROGRAM PRICLAN

```
      DIMENSION ABSVAR(990),SVVAR(990),
     *W(990),V(990),TT(80),AKORRX(990),
     *VKORRV(990),X(990),AEN(990),
     *UZUN(990),NK(990),NN(990),
     *GRANIA(1000,10),SUMGR(1000)
      DO 44 KK=1,1
      READ(5,20)TT
   20 FORMAT(80,A1)
      PRINT 20,TT
      READ(5,102)N
  102 FORMAT(I3)
   71 FORMAT(1H ,60('-'))
      DO 3875 I=1,N
      READ 200,NN(I),NK(I),X(I),AEN(I),
     *UZUN(I),(GRANIA(I,J),J=1,10)
      PRINT 200,NN(I),NK(I),X(I),AEN(I),
     *UZUN(I),(GRANIA(I,J),J=1,10))
 3875 CONTINUE
  200 FORMAT(I3,I2,F5.1,F5.1,10F5.1)
      DO 623 I=1,N
      SUMGR(I)=0.0
      DO 571 J=1,10
      SUMGR(I)=SUMGR(I)+GRANIA(I,J)
  571 CONTINUE
  623 CONTINUE
      CALL FORMA(NN,NK,X,AEN,UZUN,
     *SUMGR,N)
      DO 66 L1=1,3
      IF(L1.EQ.1)GO TO 985
      IF(L1.EQ.2)GO TO 986
      IF(L1.EQ.3)GO TO 987
  986 DO 456 L2=1,N
      X(L2)=AEN(L2)
  456 CONTINUE
      GO TO 985
  987 DO 867 L2=1,N
      X(L2)=UZUN(L2)
  867 CONTINUE
  985 SYM=0.
      XMIN=X(1)
      XMAX=XMIN
      DO 77 I=1,N
      IF(X(I).LT.XMIN)XMIN=X(I)
      IF(X(I).GT.XMAX)XMAX=X(I)
   77 CONTINUE
      PRINT 88,XMIN,XMAX
   88 FORMAT(1H ,'XMIN=',F10.2,'XMAX=',
     *F10.2)
      DO 4 I=1,N
      SYM=SYM+X(I)
    4 CONTINUE
      AN=N
      SR=SYM/AN
      WRITE(6,400)SYM,SR
  400 FORMAT('SYM= ',F11.2,'MIDDLE',
     *'ARITHMETICAL','SR=',F11.2)
      AVAR=0.
      AKVAR=0.
      AINFOR=0.
      DO 23 I=1,N
      DOLJA=X(I)/SYM
      AINFOR=AINFOR+3.3222*ALOG10(DOLJA)*
     *DOLJA
      ABSVAR(I)=X(I)-SR
      AVAR=AVAR+ABSVAR(I)
      SVVAR(I)=ABSVAR(I)**2
      AKVAR=AKVAR+SVVAR(I)
   23 CONTINUE
      AINFOR=ABS(AINFOR)
      DOTK=SQRT(AKVAR/(AN-1.0))
      AMAXIN=3.3222*ALOG10(AN)
      OTINF=(AMAXIN-AINFOR)/AMAXIN
      HDOLI=AMAXIN-AINFOR
      HDELTA=AMAXIN/AINFOR
      WRITE(6,50)HDOLI,HDELTA
   50 FORMAT(1H ,'HDOLI= ',F10.3,
     *' HDELTA= ',F10.3)
      PRINT 75,AINFOR,AMAXIN,OTINF
   75 FORMAT(1H ,'GENERAL ENTROPY HO=',
     *F10.4/'MAXIMAL ENTROPY HMAX=',
     *F10.4/'RELATIVE ENTROPY HOT=',
     *F10.4)
      CV=DOTK/SR
      WRITE(6,24)AVAR,AKVAR,DOTK,CV
   24 FORMAT(1H ,'AVAR=',F10.2,
     *AKVAR=',F10.2,'DOTK=',F10.2,
     *'CV=',F6.2)
      WRITE(6,71)
      NM=N
      CALL KABKAZ(NM,X)
      WRITE(6,71)
   66 CONTINUE
      WRITE(6,71)
      CALL FORMA(X,AEN,UZUN,SUMGR,NM)
   44 CONTINUE
      STOP
      END
      SUBROUTINE FORMA(NN,NK,PLOSAD,
     *SIRINA,DLINA,GRANIS,N)
      DIMENSION DLINA(1000),SIRINA(1000),
     *GRANIS(1000),PLOSAD(1000),TT(77),
     *S(1000),NN(1000),NK(1000)
      DO 3 I=1,N
      GRANIS(I)=GRANIS(I)*2.0
      SIRINA(I)=SIRINA(I)*2.0
      DLINA(I)=DLINA(I)*2.0
      PLOSAD(I)=PLOSAD(I)*4.0
    3 CONTINUE
      DO 4 I=1,N
      S(I)=DLINA(I)/SIRINA(I)
      SPK(I)=GRANIS(I)/3.54*SQRT(PLOSAD(I))
      XS(I)=1.24*PLOSAD(I)/DLINA(I)**2
    4 CONTINUE
      WRITE(6,5)(S(I),I=1,N)/
     *(SPK(I),I=1,N)/(XS(I),I=1,N)
    5 FORMAT(12F10.4/'',12F10.4/12F10.4)
      SUBROUTINE KABKAZ(N,SQ)
     *DIMENSION SQ(990),WWA(80),QSQ(990),
     *S(990),AM(990)
      WN=0.
      AN=N
      DO 3 I=1,N
    3 WN=WN+SQ(I)
      DO 33 I=1,N
      S(I)=(SQ(I)/WN)*100.0
      AM(I)=S(I)/(100.0/AN)
   33 CONTINUE
      SUM=0.
      N1=N-1
      DO 7 I=1,N1
      I1=I+1
      DO 4 J= I1,N
      QSQ(I)=AM(I)*AM(J)
      SUM=SUM+QSQ(I)
    4 CONTINUE
    7 CONTINUE
      ODNOR=SUM/(AN*(AN-1.0)/2.0)
      WRITE(6,5)WN,SUM,ODNOR
    5 FORMAT(3X,'WN=',F10.3,4X,'SUM=',
     *F11.3,4X,'COEFFICIENT LANDSCAPIC ',
     *'UNHOMOGENIC  -ODNOR= ',F10.4)
      RETURN
      END
```

EXAMPLE SYSTEMIC PROCEDUR

```
//PRICLAND JOB MSGLEVEL=(1,1),MSGCLASS=P
//GEOGRAF EXEC FORTGCLG,PARM.FORT=SOURCE
//FORT.SYSPRINT DD SYSOUT=P
//FORT.SYSIN DD UNIT=SYSDA,VOL=SER=GEOLAN,
//              DSN=PROGLAN(PRICLAND)
/*
//GO.SYSIN DD UNIT=SYSDA,VOL=SER=GEOBAS,
//              DSN=LAN.DATA(LAND.BASE)
```