COMPUTER ANALYSIS OF THE SPACE STRUCTURE OF LANDSCAPES AND ITS COMPONENTS WITH THE AIM OF MAPPING OF THE NATURAL RESOURCES

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ABSTRACT

Investigation of the landscape structure of natural zones,regions or within the administrational-territorial divisions with the aim of projecting of the complexes of the national economy or for developing the scientific recomendations for renewing the national resources and so on first of all demand the development of the distinct models discribing for itself the qualititive and quantitive characteristics of the state of landscape as a whole and also by components.

INTRODUCTION

At present the parametrization of the state of the space structure of landscapes are mainly conducted by their cartographical materials, methods of cartographical-statistical modelling and so on, and in their turn they need capasitive calculations. Therefore for their abolishing and for composing the graphical-analitical and other mathematical models in more distinct way for destributing the space characteristics of the structural elements of the landscapes the complex of applicational program "PRICLAND" on the algorythmic language "FORTRAN-ST" had been developed by us.

The development of the complex of the program has been conducted at the calculation Centre on US-1035 type in the operational system US OS 6.1 version.The complex program "PRICLAND" is functionating with bases of data "LAND.DATA" worked out by us by means of the language of the managing of the tusks in the system of OS US and by the terminal informational-research system,which functionaltes in SCU "FOCUS" where the models of organization of data are relational.

The structure of over-loaded information in the base of data has a folloving view: -geometrical characteristics of the regions of the conturs,landscape conturs according to ranks of morphological units maximal lenth and width of conturs lenth of the boundary (the general one and according to neighbours),maximal and minimal and also the average hight of situation of conturs on the relief; geomorphological characteristics-intenesity(degree) of distruction of the relief,types of morphostructures and morphosculpheres and so on; signs of soil cover structure,mechanical composition and others; signs of plant cover,climatic data and hydrological data and etc. On the basis of the developed system 22 structural-analitical maps of the states of the natural resources of the Caucasis-Minor (within the boundaries of the Azerbaijan Republic) had been composed. Maps are built on the grapho-builder of the planset type 7053 and on the personal computer IBM PCC AT.

RESEARCH EXAMPLE

MATHEMATICAL-CARTOGRAPHICAL MODELLING OF THE STRUCTURE OF THE NATURAL-TERRITORIAL COMPLEXES OF THE CAUCASIS MINOR AND NEAR-LYING PLAINTS (WITHIN THE TERRITORY OF THE AZERBAIJAN REPUBLIC)

Investigation of the landscape structure (LS) of the natural-territorial complexes (NTC) is of the vrather greater impartance in the territory in organization the base of the mass health resort and turizm,in meliorative measures and others.Mathematical-cartographical modelling of LS NTC gives the possibility for correct recognition of the natural organization of the landscapes in the space, quantitatively defines the geographical distribution of the morphological parts of LS NTC and so on,which enables to give the distinct diagnosis of the natural conditions of the investigated territory. With this aim following mathematical-statistical characteristics of LS on the basis of the squares of the conturs of the individual and genetical groups of landscape types according to physical-geographical regions are defined by us using the landscape map(composed by prof.M.A.Myseibov and M.A.Suleimanov in 1981,1:200000): I.Fore Araksian, II.Agdam-Naftalanian,III. Ganja-Kasakhian,IV.Dashkasan-Kedabecian, V.Karabakhian,VI.Akera,VII.Girchgizian, VIII.Karabakhian high mountainian-volcanic highlan,IX.Gyamish-Shahdagian ones:

1.Middle arithmetical: $\bar{S}_{a2}=\sum_{i=1}^{N} S_i$

where $\sum_{i=1}^{N} S_i$ -sum of square of the individual and genetical groups of landscape types in square km., N -is the number of conturs;

2.Middle square variation:

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

3.Coefficient of variation:

$$C_v=\sigma/\bar{S}_{a2}.$$

4.Coefficient assimmetry:

$$K_A=N\cdot\sum_{i=1}^{N}(S_i-\bar{S}_{a2})^3/N\cdot\sigma^3$$

5.Coefficient excess:

$$K_E=\sum_{i=1}^{N}(S_i-\bar{S}_{a2})^4/N\cdot\sigma^4$$

6.Representativity coefficient excess:

$$P_E=\left\{24\cdot N(N-2)(N-3)/(N-1)^2(N+3)(N+5)\right\}^{\frac{1}{2}}$$

7.Representativity coefficient assimmetry

$$P_A=\left\{6\cdot(N-1)/(N+1)(N+3)\right\}^{\frac{1}{2}}$$

8.The a value of true the of assimmetry:

$$t_A=K_A/P_A$$

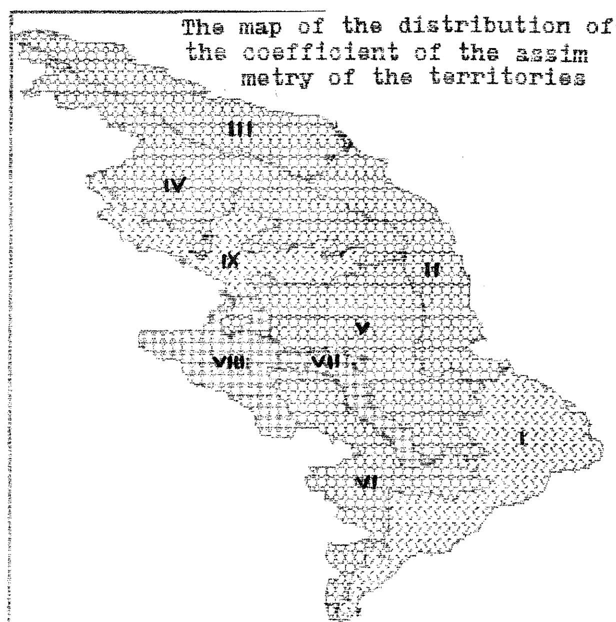
9.The value of truth of excess:

$$t_E=K_E/P_E$$

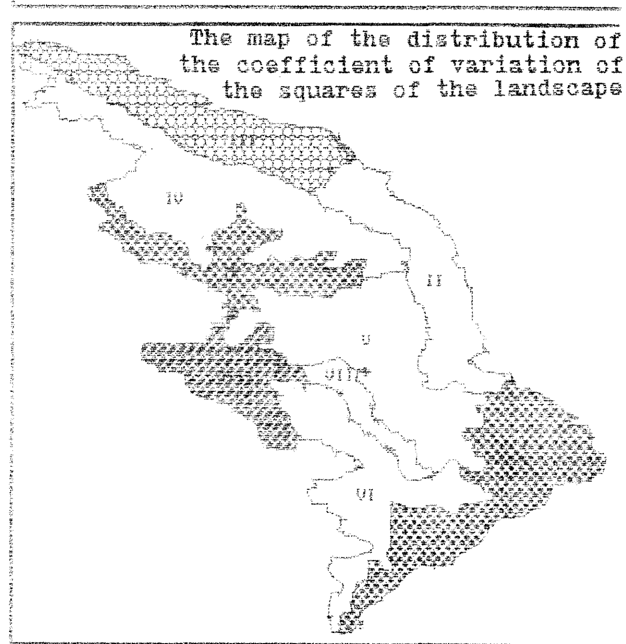
Received amounts of the above mentioned characteristics on physico-geographical regions are given in the folloving table. In the table each first line of coefficients concerns to genetic groups of types of landscapes and the second line to individual ones.

Number of character. mat.stat.	Physical-Geographical Regions			
	I	II	III	IV
1	2	3	4	5
1.	84.15	77.96	87.76	55.14
2.	39.24	28.92	19.52	13.34
2.	134.30	100.41	104.89	67.14
	71.77	34.40	23.60	14.19
3.	1.60	1.29	1.19	1.24
	1.83	1.19	1.21	1.06
4.	3.08	2.69	1.68	1.62
	5.61	2.38	3.48	2.87
5.	8.49	6.94	0.98	2.15
	33.63	6.05	16.55	13.29
6.	0.41	0.43	0.48	0.39
	0.28	0.27	0.24	0.15
7.	0.80	0.85	0.94	0.65
	0.56	0.54	0.48	0.30
8.	7.52	6.20	3.48	2.23
	19.82	8.72	14.40	19.23
9.	10.62	8.30	1.05	9.12

N	V	VI	VII	VIII	IX
1	6	7	8	9	10
1.	54.14	40.05	35.38	44.36	78.05
	16.42	18.33	8.84	11.89	20.67
2.	78.31	50.37	31.34	36.76	119.65
	19.22	16.14	8.90	13.06	41.04
3.	1.45	1.26	0.89	0.83	1.53
	1.17	1.02	1.01	1.09	1.99
4.	3.16	2.09	0.84	1.58	2.34
	2.71	2.15	2.25	1.90	5.97
5.	11.58	3.43	-1.19	2.00	3.27
	8.96	7.56	3.95	3.21	36.02
6.	0.32	0.32	0.72	0.41	0.54
	0.17	0.25	0.39	0.22	0.29
7.	0.62	0.63	1.40	0.81	1.04
	0.34	0.40	0.77	0.44	0.57
8.	9.91	6.48	1.17	3.81	4.37
	15.71	10.50	5.74	8.54	20.52
9.	18.43	5.42	0.85	2.47	3.15



The map of the distribution of the coefficient of the assim metry of the territories



The map of the distribution of the coefficient of variation of the squares of the landscape

EXAMPLE PROGRAM "PRICLAND-2"

```
      DIMENSION ABSVAR(300),SVVAR(300),
     *CUBX(300),TRENX(300),TT(77),X(300)
C     DO 44 KK=1,50
      READ(5,20)N,TT
   20 FORMAT(I3,77A1)
      PRINT 20,N,TT
      READ 200,(X(I),I=1,N)
      PRINT 200,(X(I),I=1,N)
  200 FORMAT(16F5.0)
      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
      WRITE(6,71)
      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(6,71)
      WRITE(6,400)SYM,SR
  400FORMAT(1H,,'SYM=',F11.4,'MIDDLE ',
     *'ARITHMETICAL  SR= ',F11.4)
      AVAR=0.
      AKVAR=0.
      AINFOR=0.
      CUBSUM=0.
      TREND=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)**2
      SVVAR(I)=ABSVAR**22
      CUBX(I)=ABSVAR**3
      TRENX(I)=ABSVAR**4
      CUBSUM=CUBSUM+CUBX(I)
      TREND=TREND+TRENX(I)
      AKVAR=AKVAR+SVVAR(I)
   23 CONTINUE
      DOTK=SQRT(AKVAR/(AN-1.0))
      ASIM=AN*CUBSUM/(AN-1.0)*(AN-2.)*
     *DOTK**3
      EXES=TREND/AN*DOTK**4 -3.
      HDA=SQRT(6.*(AN-1.)/(AN+1.)*(AN+3.))
      HDE=SQRT(24.*AN*(AN-2.)*(AN-3.)/
     *((AN-1.)**2)*(AN+3.)*(AN+5.))
      TA=ASIM/HDA
      TE=EXES/HDE
      AMAXIN=3.3222*ALOG10(AN)
      OTINF=(AMAXIN-ABS(AINFOR))/AMAXIN
      PRINT 75,AINFOR,AMAXIN,OTINF
   75 FORMAT(1H ,'GENERAL ENTROPY =',F10.
     *F10.4,10x,'MAXIMAL ENTROPY =',
     *F10.4,5X,'RELATIVE ENTROPY =',F10.4)
      CV=DOTK/SR
      WRITE(6,888)ASIM,EXES,HDA,HDE,DOTK,
     *CV
  888 FORMAT(1H ,'COEFFICIENT ASIMMETRY',
     *' KA=',F10.4/1H ,'COEFFICIENT ',
     *'EXCESS KE=',F10.4/1H ,'REPRESEN',
     *'TATIVITY COEFFICIENT ASSIMMETRY ',
     *' HDA=',F10.4/1H ,'REPRESENTATI',
     *'VITY COEFFICIENT EXCESS HDE=',
     F F10.4/1H ,'MIDDLE SQUARE VARIA',
     * 'TION DOTK=',F15.4/1H ,'COEFFI',
     *'CIENT OF VARIATION CV=',F10.4)
       END
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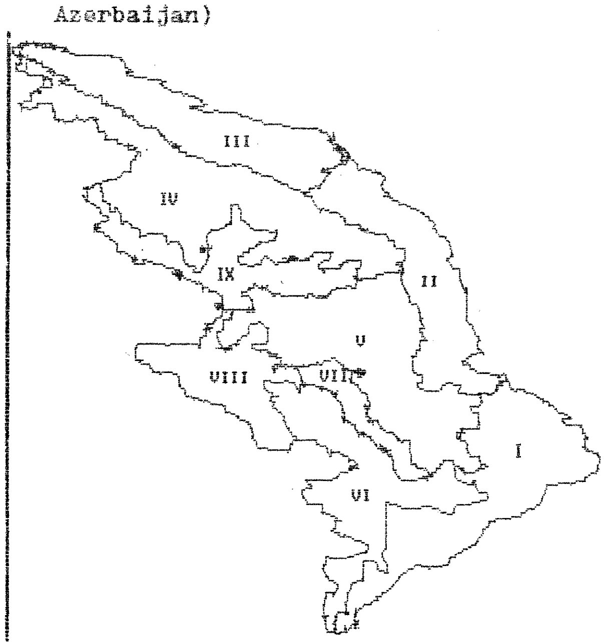
EXAMPLE PROGRAM "PRICLAN -3"

```
      DIMENSION K3(25),K4(25),IXA(900,24),
     *IE(900),IX(900),IR(900),IC(900),
     *IS(900),IC1(900),IC2(900),K1(900),
     *AK2(900,24),K2(900,24)
      READ(5,1)N,M,N2,N3
      PRINT 1,N,M,N2,N3
    1 FORMAT(4I3)
      DO 2 I=1,N
      READ(5,3)IE(I)?(IXA(I,J),J=1,M)
    2 CONTINUE
    3 FORMAT(I4,24I2)
      DO 4 I=1,M
      WRITE(6,3)IE(I),(IXA(I,J),J=1,M)
    4 CONTINUE
      DO 66 J=1,M
      MIN=IXA(1,J)
      MAX=MIN
      DO 67 J=1,M
      IF(IXA(I,J).LT.MIN)MIN=IXA(I,J)
      IF(IXA(I,J).GT.MAX)MAX=IXA(I,J)
   67 CONTINUE
      K3(J)=MIN
      K4(J)=MAX
   66 CONTINUE
      WRITE(6,42)
      WRITE(6,667)
      WRITE(6,96)(K3(J),J=1,M)
      WRITE(6,42)
      WRITE(6,666)
      WRITE(6,96)(K4(J),J=1,M)
      WRITE(6,42)
      WRITE(6,777)
 1000 DO 5 J=1,M
      DO 6 I=1,N
      IX(I)=IXA(I,J)
    6 CONTINUE
      DT2=N2
      DO 8 I=1,N
      IR(I)=LT2
    8 CONTINUE
      ISWA=ISWA+IR(I)
      IS(I)=ISWA
      IF(I.GT.1)GO TO 62
      IC(I)=K3(J)
      GO TO 9
   62 I1=I-1
      IC(I)=K3(J)*IS(I1)
    9 CONTINUE
      DO 60 I=1,N
      IC1(I)=IC(I)
      IC2(I)=IC(I+1)
   60 CONTINUE
      DO 220 I=1,N3
      KT=0
      DO 55 K=1,N
      IF(IX(K).GE.IC1(I).AND.IX(K).LT.
     *IC2(I))GO TO 50
      NX=0
      GO TO 10
   50 NX=1
   10 K1(K)=NX
      KT=KT+K1(K)
   55 CONTINUE
      K1(I)=KT
      K2(I,J)=K1(I)
  220 CONTINUE
    5 CONTINUE
      DO 116 J=1,M
      K2(1,J)=K2(1,J)-1
  116 CONTINUE
      DO 40 I=1,N3
      WRITE(6,402)IC1(I),(K2(I,J),J=1,M),
     *IC(I)
   40 CONTINUE
      WRITE(6,777)
```

```
      WRITE(6,42)
      DO 117 J=1,M
      DO 117 I=1,N3
      AK2(I,J)=FLOAT(K2(I,J))
  117 CONTINUE
      AN=N-1
      DO 118 J=1,M
      DO 118 I=1,N3
      AK2(I,J)=(AK2(I,J)/AN)*100
  118 CONTINUE
      WRITE(6,333)
      DO 110 I=1,N3
      WRITE(6,403)IC1(I),(AK2(I,J),J=1,
     *M),IC2(I)
  110 CONTINUE
  333 FORMAT(1H ,'     PER CENT      ')
   96 FORMAT(4H  ,  ,24I4)
  667 FORMAT(1H ,'MINIMAL MEANING ',
     *'CHARACTERISTICS ')
  666 FORMAT(1H , 'MAXIMAL MEANING',
     *'CHARACTERISTICS')
  402 FORMAT(I4,24I4,I4)
  403 FORMAT(I4, 24F4.1,I4)
  777 FORMAT(1H ,'DISTANCE',39X,
     *'PARTS CHARACTERISTICS',39X,
     *'DISTANCE')
   42 FORMAT(1H ,120('- '))
      STOP
      ENB
```

Result example

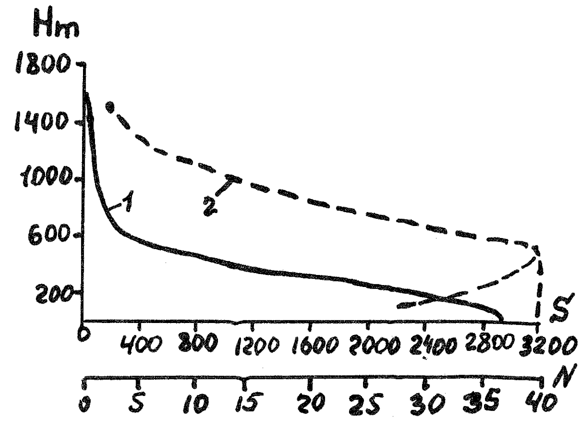
The scheme of physical-geographic regions of the Caucasis Minor (within the boundariies of Azerbaijan)



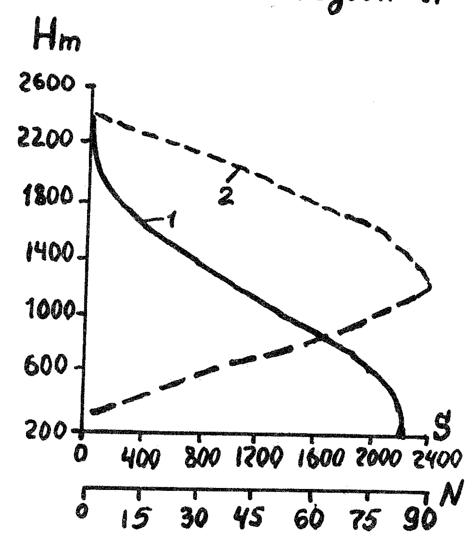
I. Fore Araksian
II. Agdam-Naftalanian
III. Gianja-Kasakhian
IV. Dashkasan-Kedabecian
V. Karabakhian
VI. Akerinian
VII. Girchgizian
VIII. Karabakhian high Mountainian-Volcanic highlan
IX. Gyamish-Shahdagian

Hypsographical currature (1) and the currature of the ditribution of the quantity of types of landscapes (2) of the physico-geographical regions

Fore Araksian region-I



Akerinian region-VI



Karabakhian high Mountainian-Volcanic highlan region-VIII