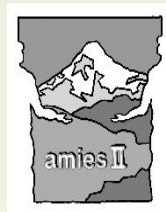


AMIES II - Midterm Meeting

Giessen, Rauischholzhausen in May 2016



Scenario Development for Sustainable Land Use
in the Greater Caucasus, Georgia

GEORGIA-OPEN AIR MUSEUM OF SOILS



Center for
International
Development and
Environmental
Research



Ivane
Javakhishvili
Tbilisi State
University



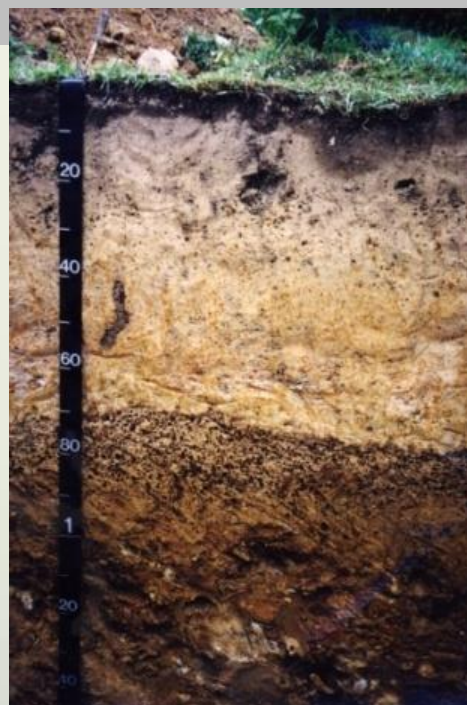
Ilia State
University



Agricultural
University
of Georgia



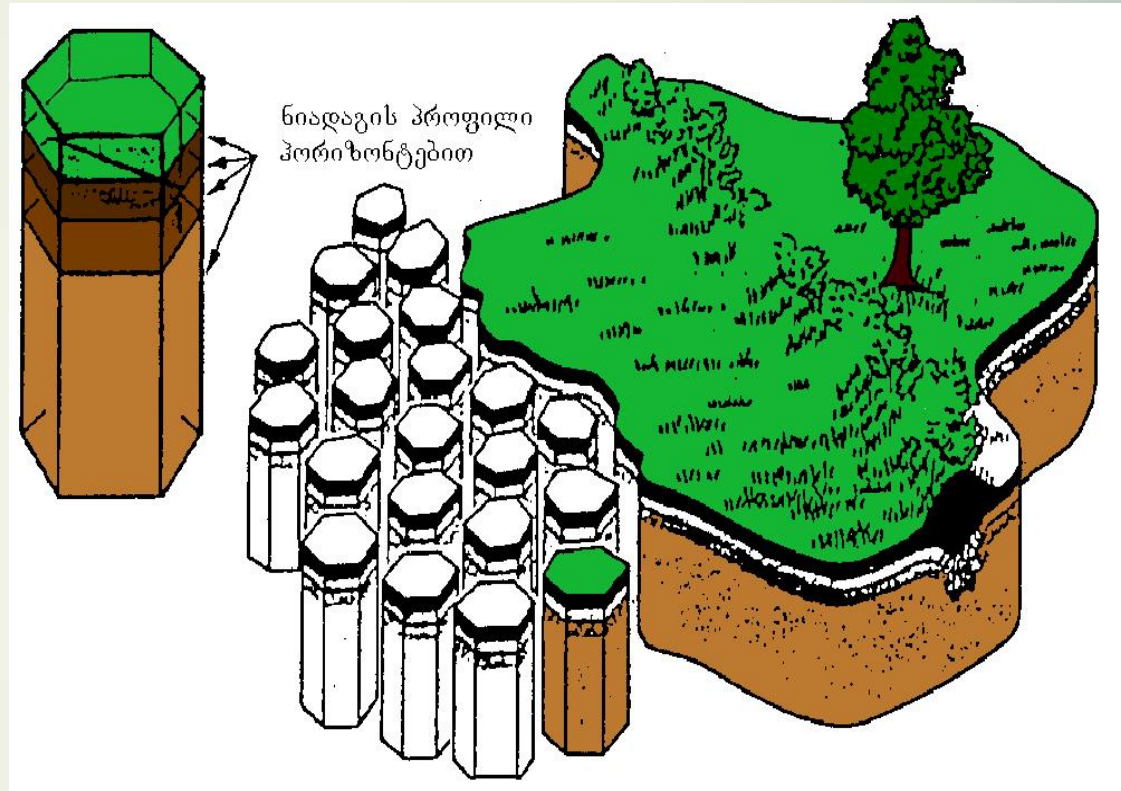
GEORGIA-OPEN AIR MUSEUM OF SOILS



- AUTHORS OF PHOTOS – OTAR ABDALADZE, ARNOLD GEGECHKORI, BESO GELASHVILI,
- BADRI VADACHKORIA, ZURAB MANVELIDZE, STEPHAN MANTEL (HOLLAND), IZOLDA MACHUTADZE, MAKO NOSELIDZE, WWF

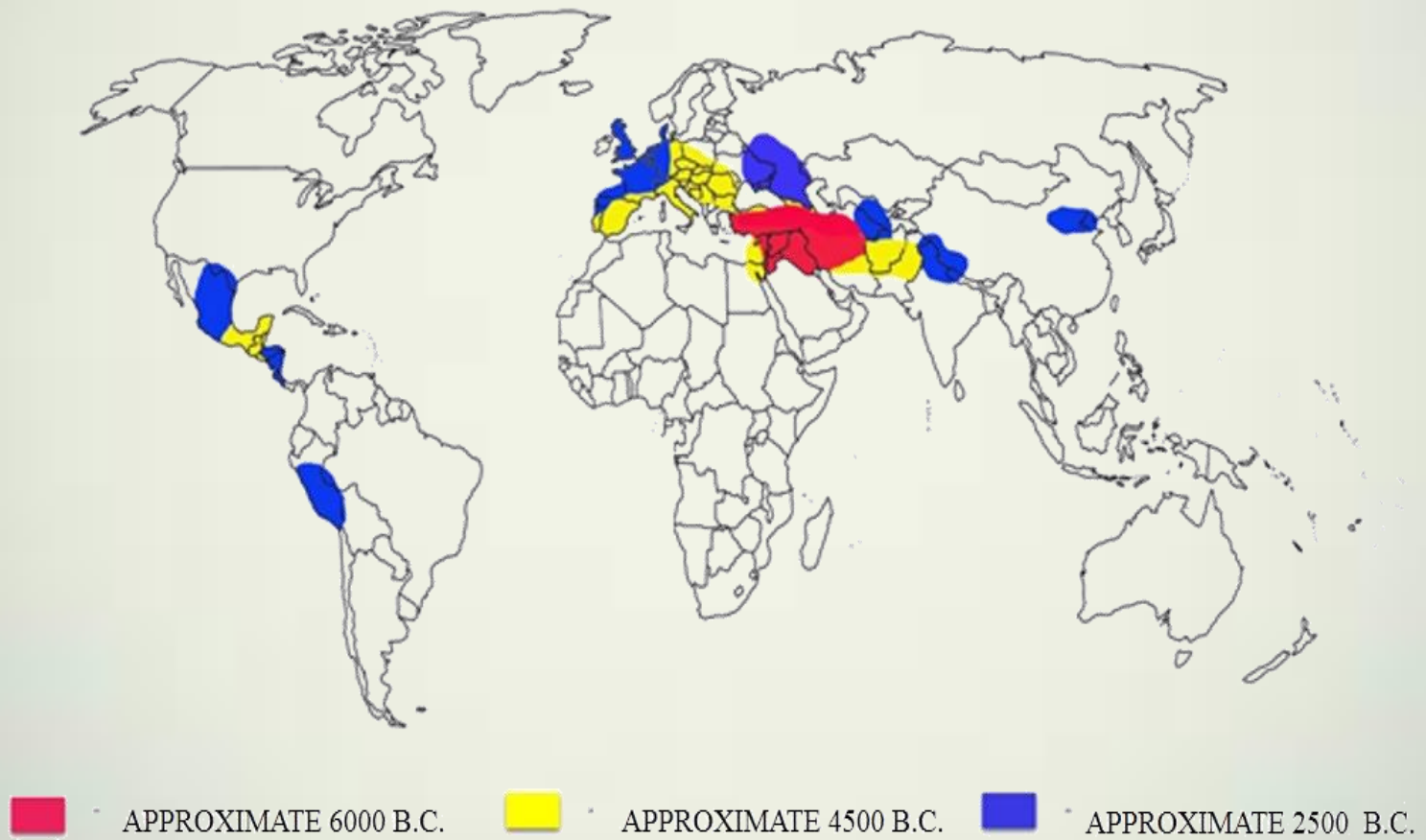
„PRECIOUS RUST OF EARTH”

„PRECIOUS” AS HAVE
FERTILITY
„RUST“- SOIL COVER –
PRODUCT OF THE
ROCKS PROCESSING



-
- IN AGRUCULTURE HAVE HUGE PROPERTY: WHEAT, BARLEY, WOOD MILLET, ETC
-
- IN WORLD ARE 27 SPECIES OF WHEAT, IN GEORGIA 14 (52%), 5-ENDEMIC (19%).
- TUSHETI AND IMERETI SHEEP, CHEVSURETIAN AND MINGREL COW, KAKHETI PIG, GEORGIAN BEE ETC
- ZELKOVA CARPINIFOLIA AND PTEROCARYA PTEROCARPA
-
- FOUNDATION – SOIL, OUR EARTH, TREASURE OF NATURE

MAP OF THE ANCIENT AGRICULTURE REGIONS



- HOLOTCEAN 10 000 – 12 000
- BYZANTINE PERIOD V1-V111 NEW
- ANCIENT PERIOD V11 OLD -V NEW
- NEOLIT (6000-10 000) CERAMICS, DOMESTIC ANIMALS, EARLY AGRICULTURE EPOCH
- “NEOLIT REVOLUTION” –CHARLI –ENGLISH ARCHEOLOGIST 30 YEARS of XX THE CENTURE



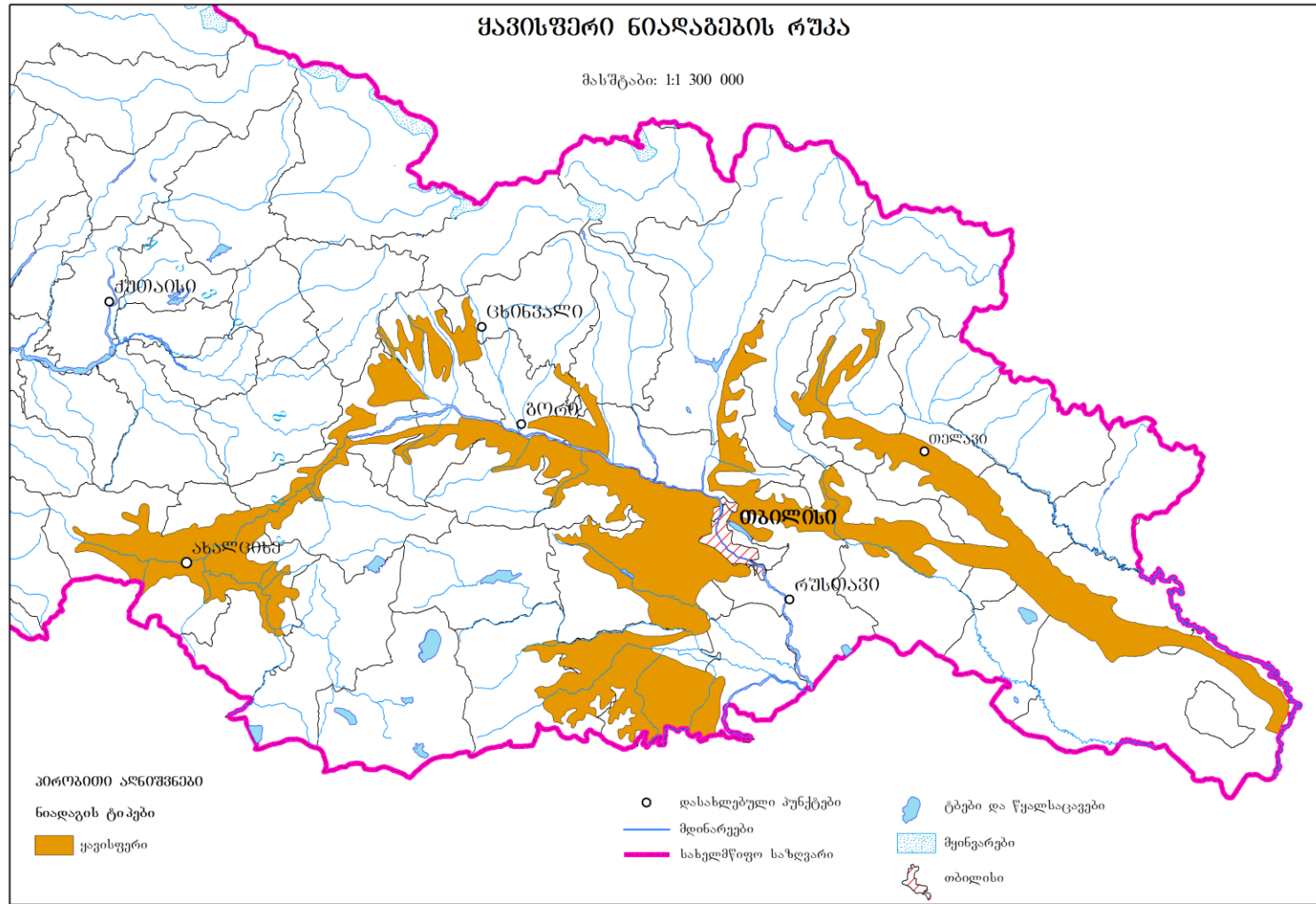
IMERETI (PAINTER KAKABADZE)

-

- IN COUNTRY ARE DISTRIBUTE MANY SOILS OF WORLD AND ALL SOILS OF EUROPE
- IN THE END OF XIX CENTURE OUR COUNTRY WAS RECOGNIZED AS “OPEN AIR MUSEUM OF SOILS”

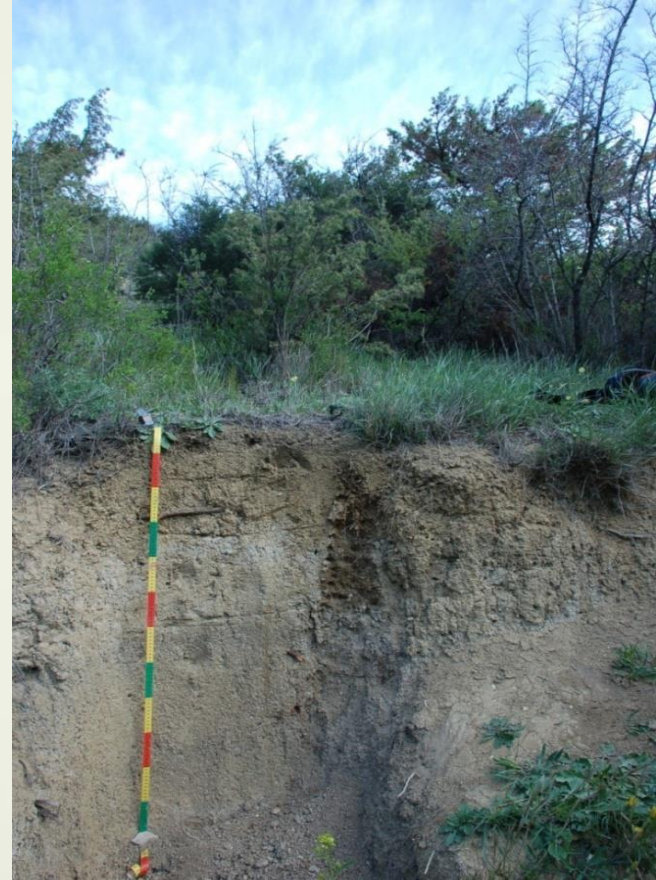
- SOME SOILS WERE DESCRIBED AND ACKNOWLEDGED IN COUNTRY
- CINNAMONIC – in 1904 YEAR BY PROFESSOR S. ZAKHAROV IN ENVIRONS OF MTZKHETA
- MEADOW-CINNAMONIC-in 1956 YEAR BY PROFESSOR V.FRIDLAND IN MUKHRANI
- YELLOW-BROWN FOREST – in 1968 BY ACADEMICIAN T.URUSHADZE ON THE MOUNTAIN MTIRALA IN ENVIRONS BATUMI.
- THE RICH SOIL COVER OF COUNTRY MAY BE EXPLAIN BY CHANGE OF SOIL-FORMING FACTORS COMBINATION ON SUFFICIENT SHORT DISTANCE

MAP OF CINNAMONIC SOILS



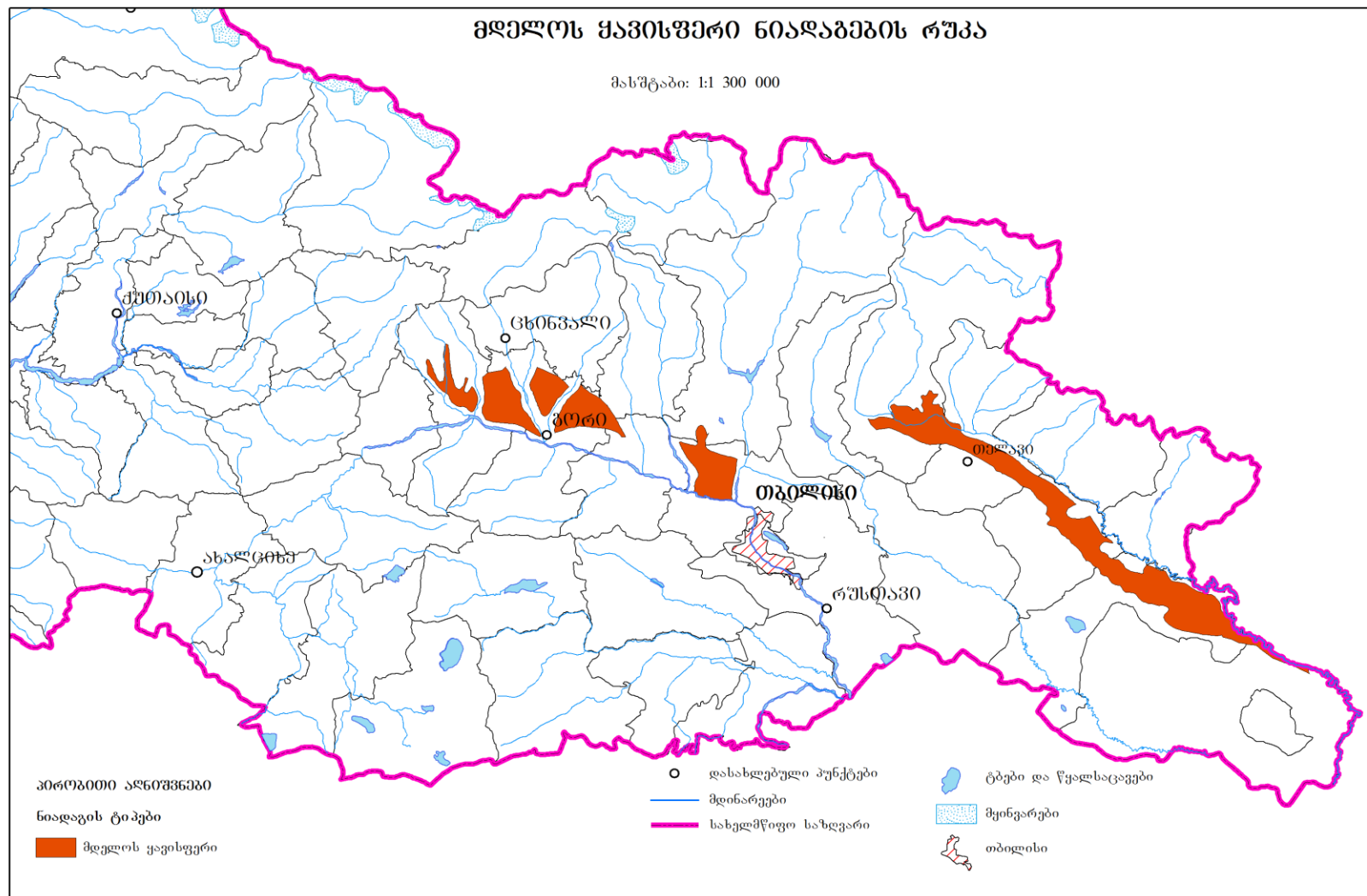


VASHLOVANI RESERVE



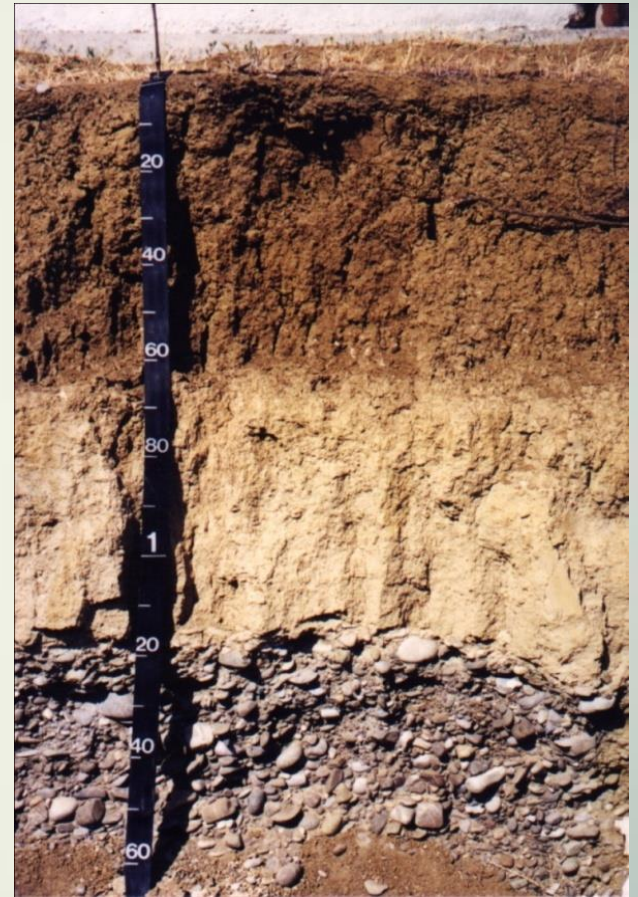
CINNAMONIC SOIL

MAP OF MEADOW-CINNAMONIC SOILS



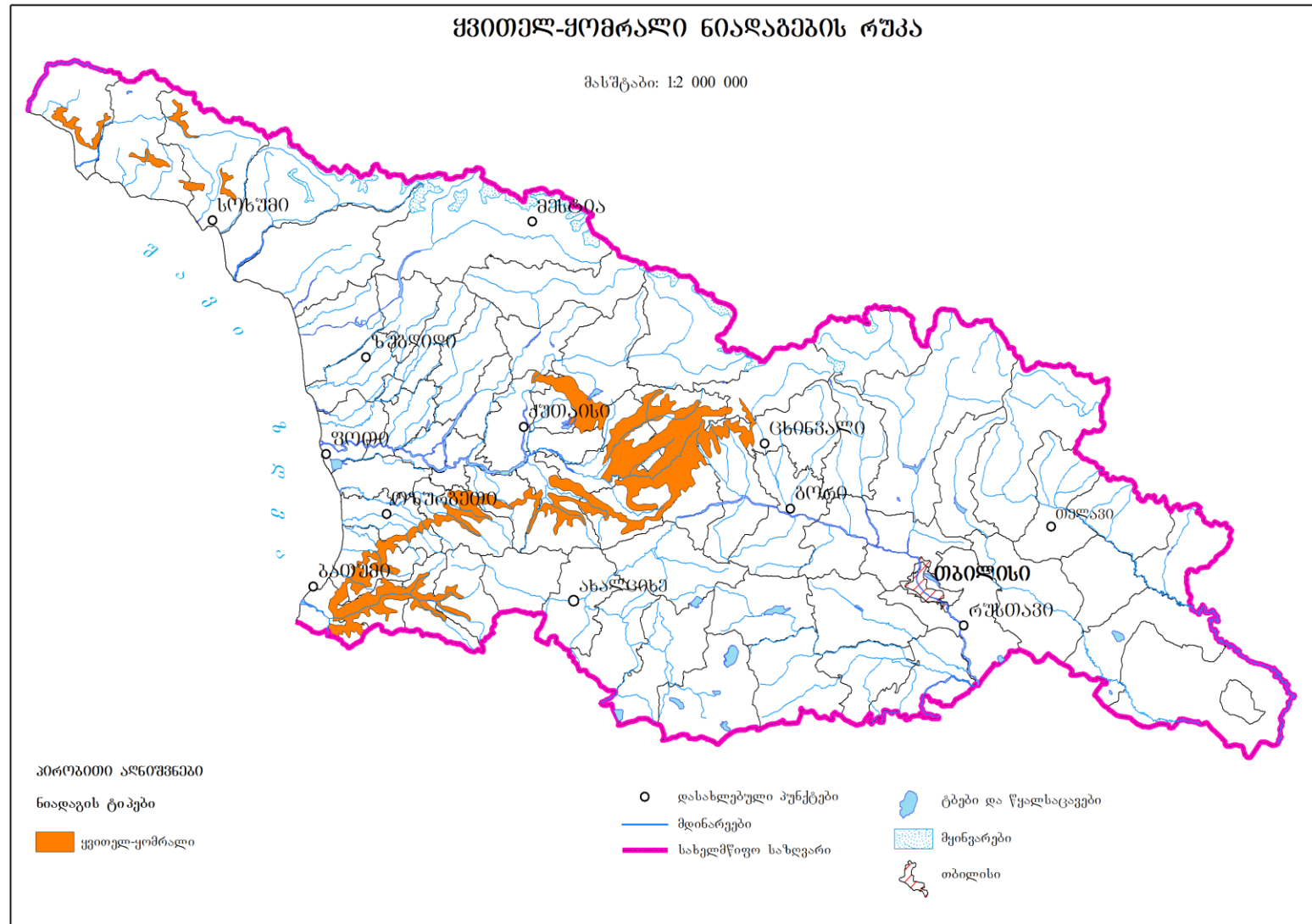


SHIDA KARTLI



MEADOW-CINNAMONIC SOIL

MAP OF YELLOW-BROWN FOREST SOILS

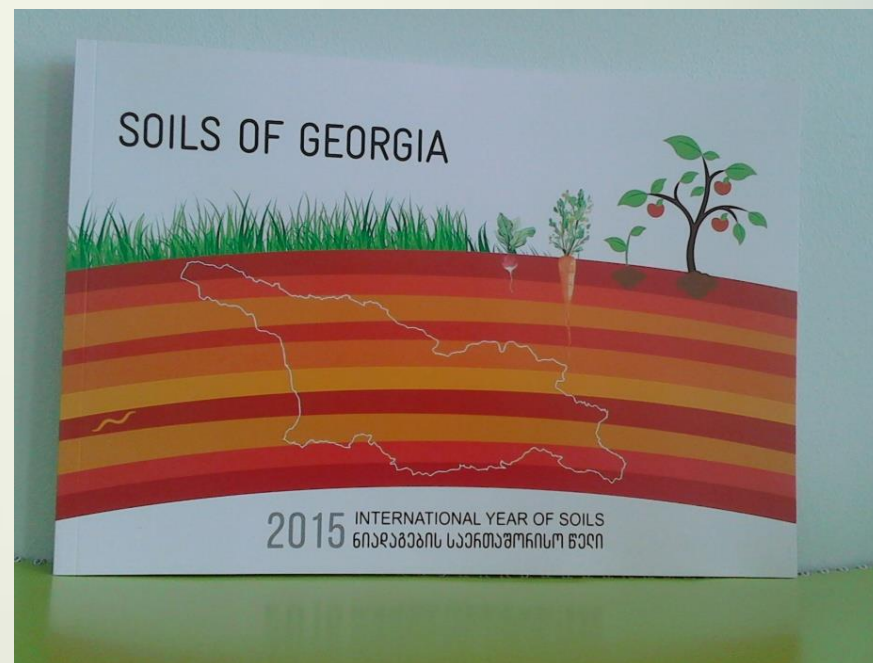
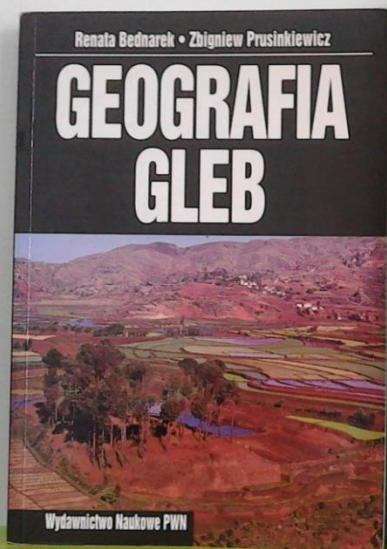
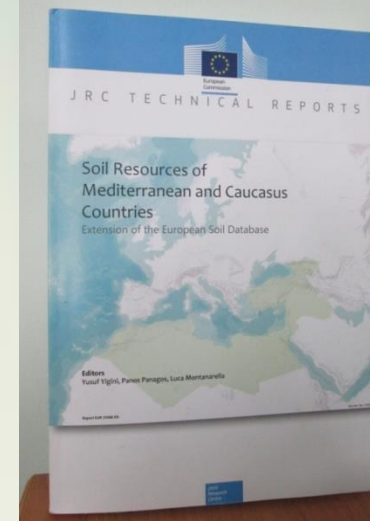
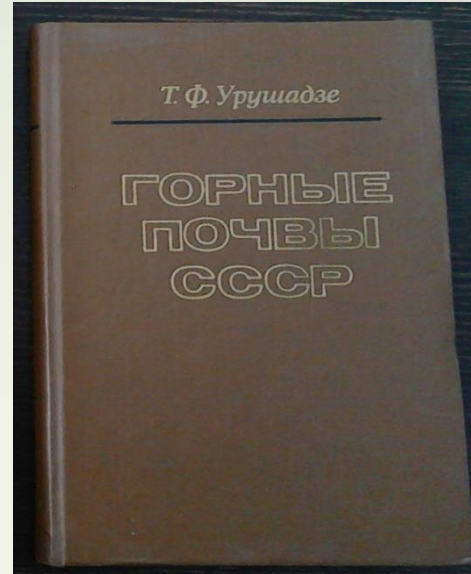
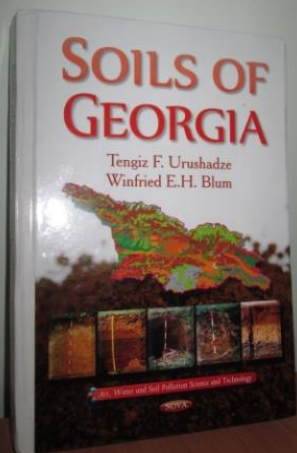




FAGETUM AZALEAZUM



YELLOW-BROWN FOREST SOIL





SOIL FORMING FACTORS


PARENT ROCKS

MAP OF MAIN SOIL FORMING ROCKS


SCALE 1: 2 000 000

Legend


- **MAGMA ROCKS**

 GRANITE


- **METAMORPIC ROCKS**


 CLAY SLITE

- **SEDIMENTARY ROCKS**

 LIMESTONE


 LOESS


 SANDSTONE


 RED WEATHERING MANTLE


 Settlement

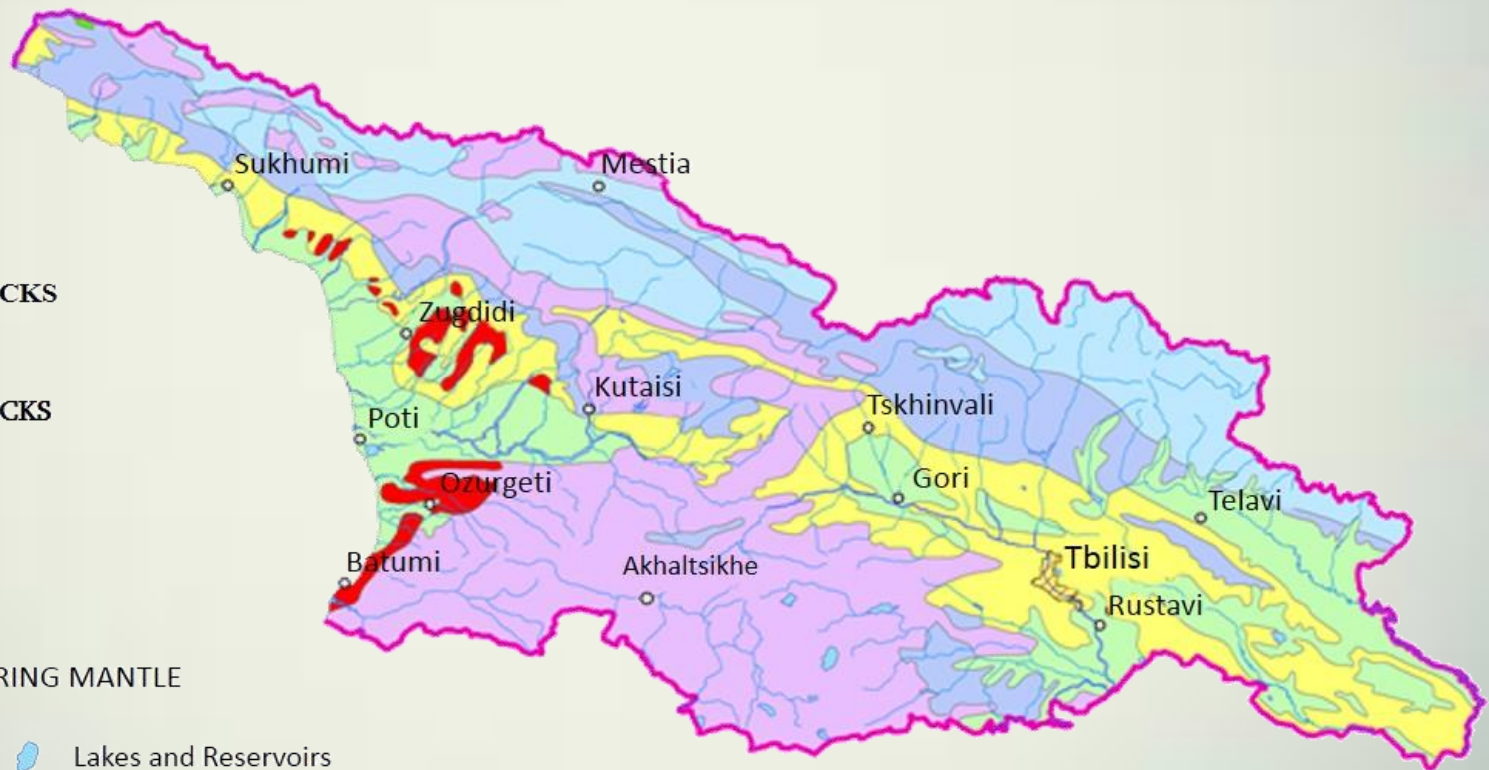
 Rivers

 State Border

 Lakes and Reservoirs

 Glaciers

 Tbilisi



MAGMA ROCKS



BASALT



GABRO





GRANITE



GRANITOIDE WITH DIABAZ DAIK

METAMORPHIC ROCKS



MARBLE



CLAY SLITE

SEDIMENTARY ROCKS



LIMESTONE



SANDSTONE



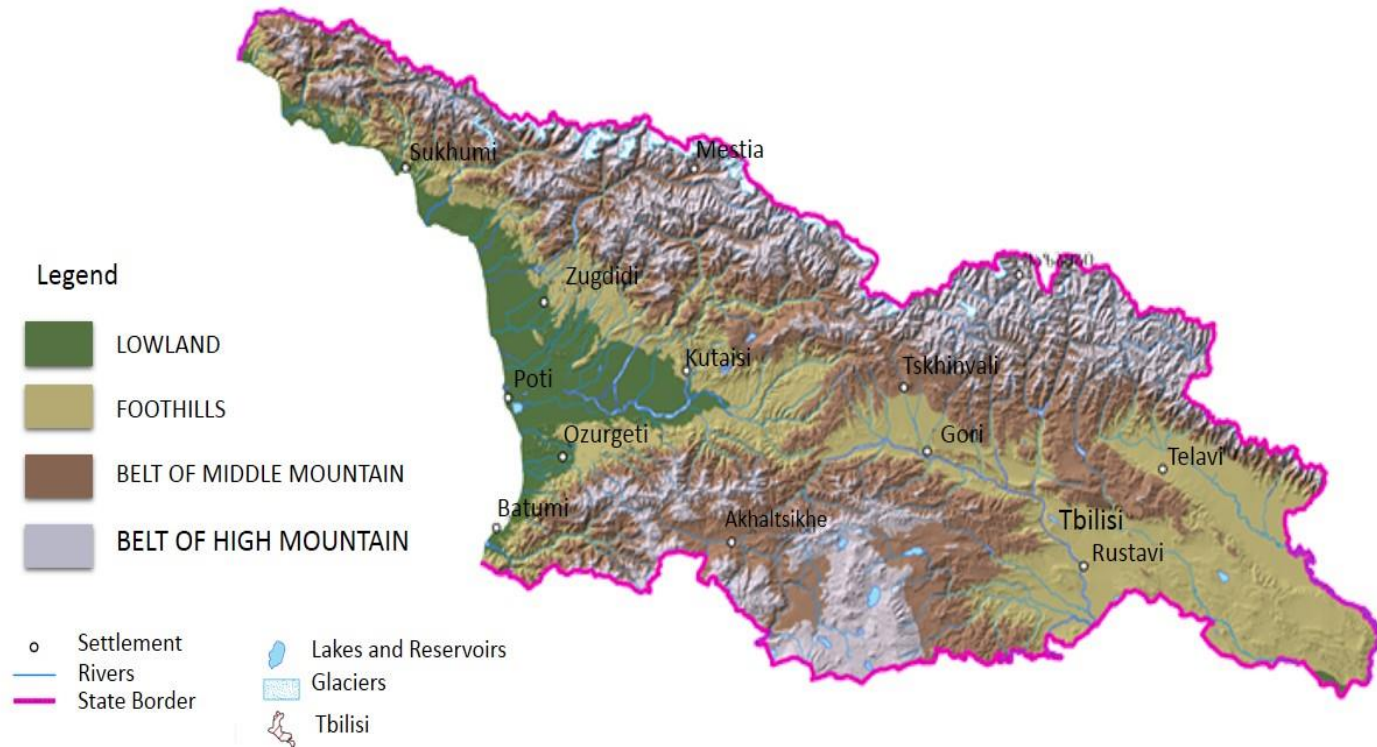
STALACTITE AND STALAGMIT E



GORGE OF RIVER RIONI
LIMESTONE OF LOW CHALK
AGE

MAP OF RELIEF

SCALE 1 : 2 000 000



IN COUNTRY ARE GOOD EXPRESSED THREE GROUPS OF RELIEF:
MACRO- , MEZO- and MICRO RELIEF



MACRO RELIEF
BIG CAUCASUS

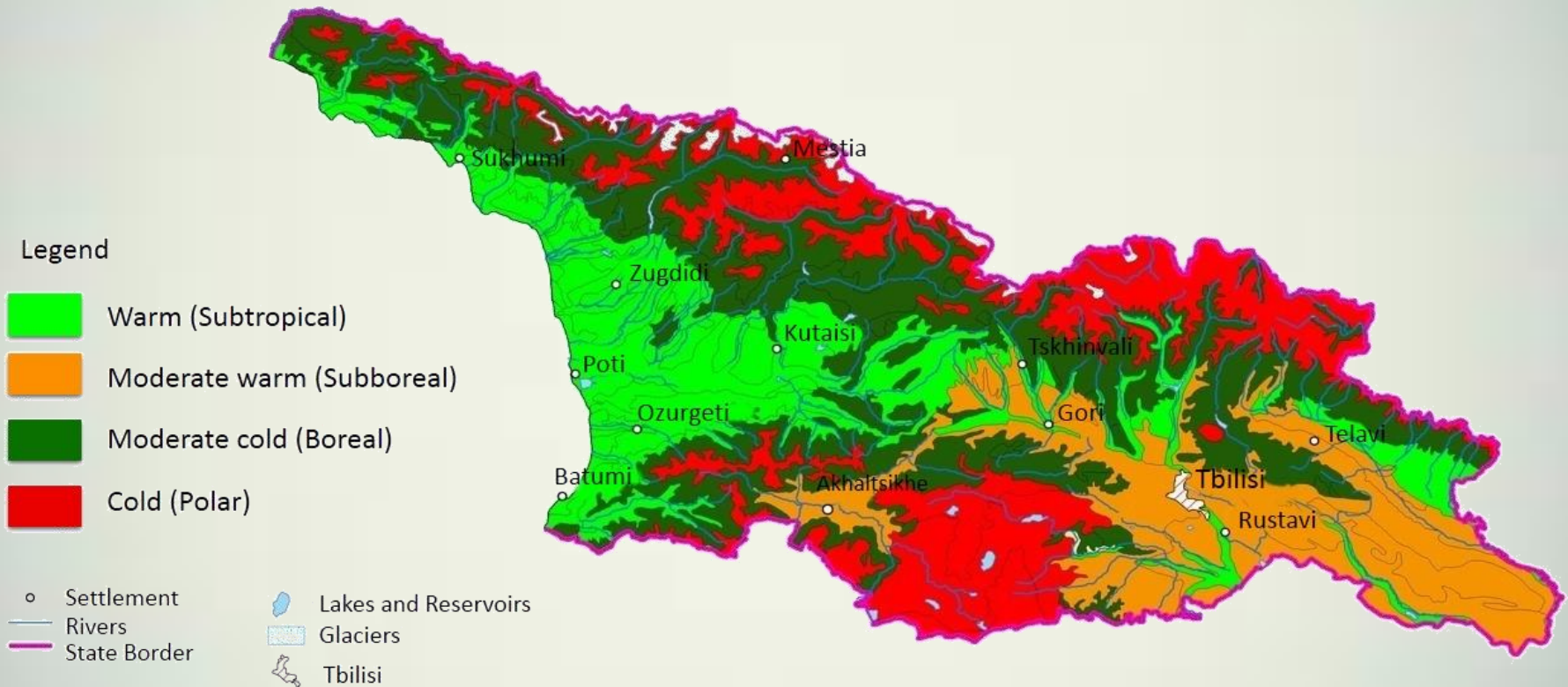


MACRO RELIEF
SMALL CAUCASUS

CLIMATE

Major thermal groups of Georgian climate
(Sum of active temperature - $\Sigma > 10^{\circ}\text{C}$)

Scale 1 : 1 200 000

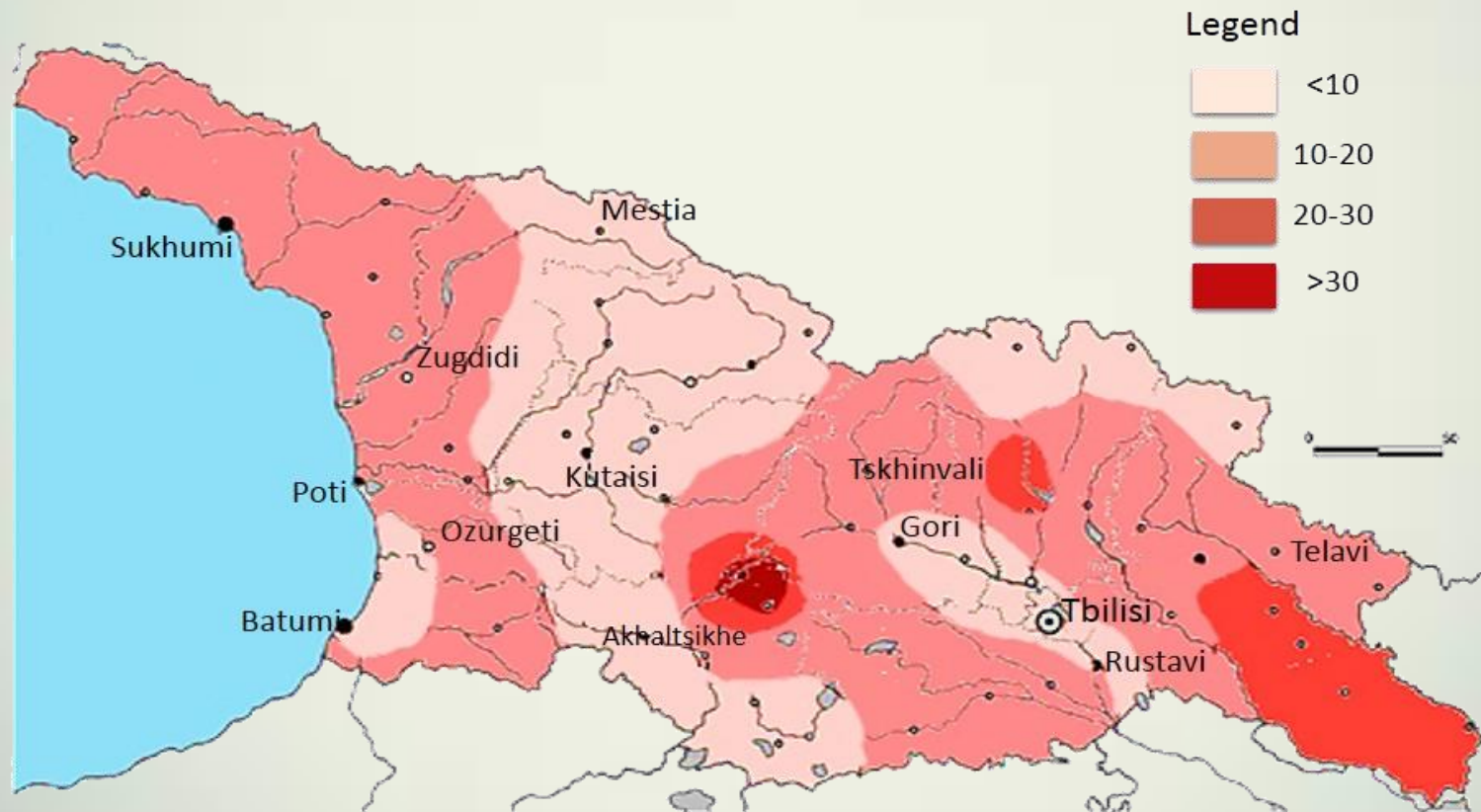


AMONG FIVE MAIN TYPE OF CLIMATE (POLAR, BOREAL, SUBBOREAL, SUBTROPIC, TROPIC) HAVE FOUR (EXCEPT TROPIC)

AVERAGE DATA OF 1999-2010 YEARS WAS COMPARED WITH PRECEDING MANY YEARS (SOMETIMES CENTURIES) DATA

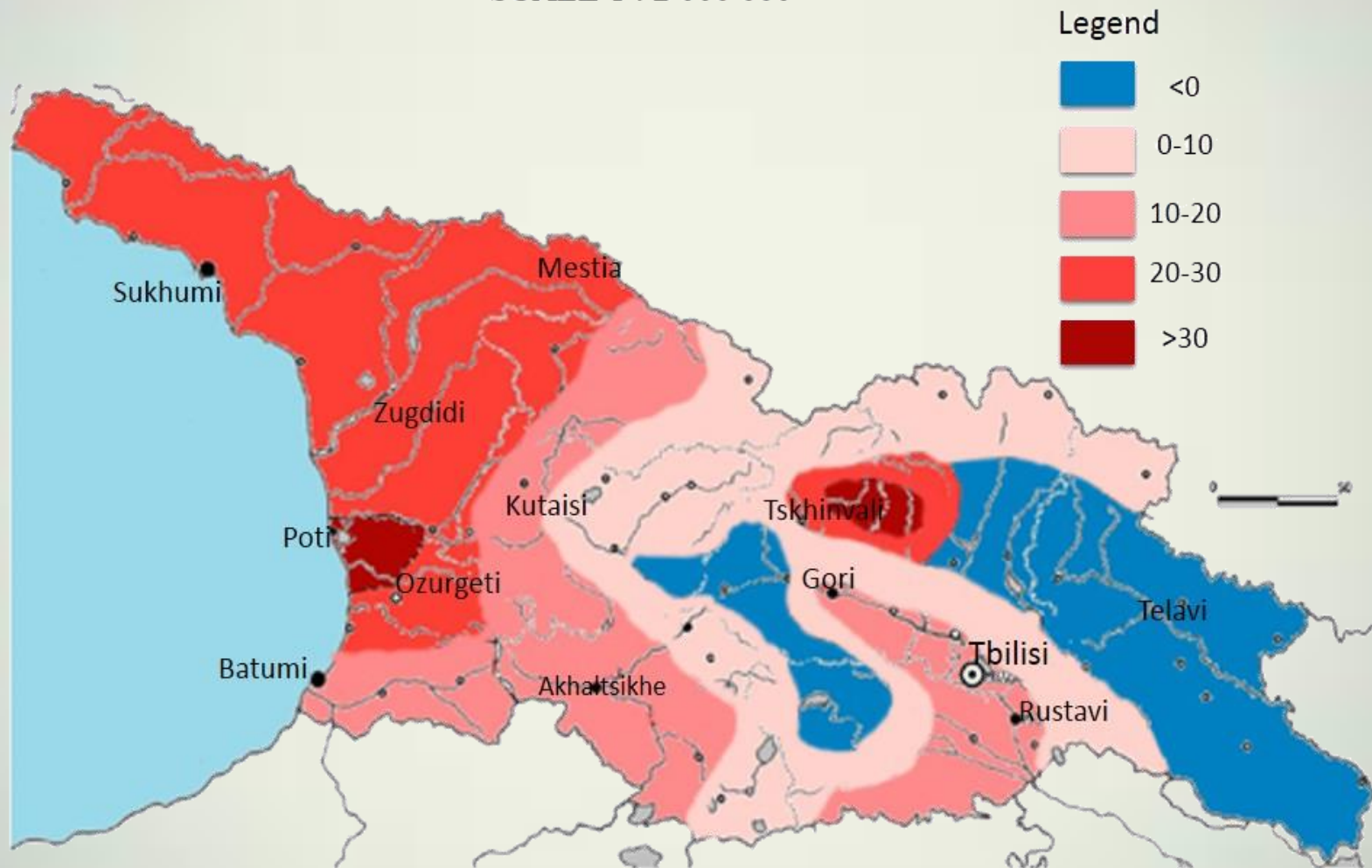
AVERAGE TEMPERATURE ($^{\circ}\text{C}$), %

SCALE 1 : 2 000 000



PRECIPITATION OF VEGETATION PERIOD (1V-X) (MM), %

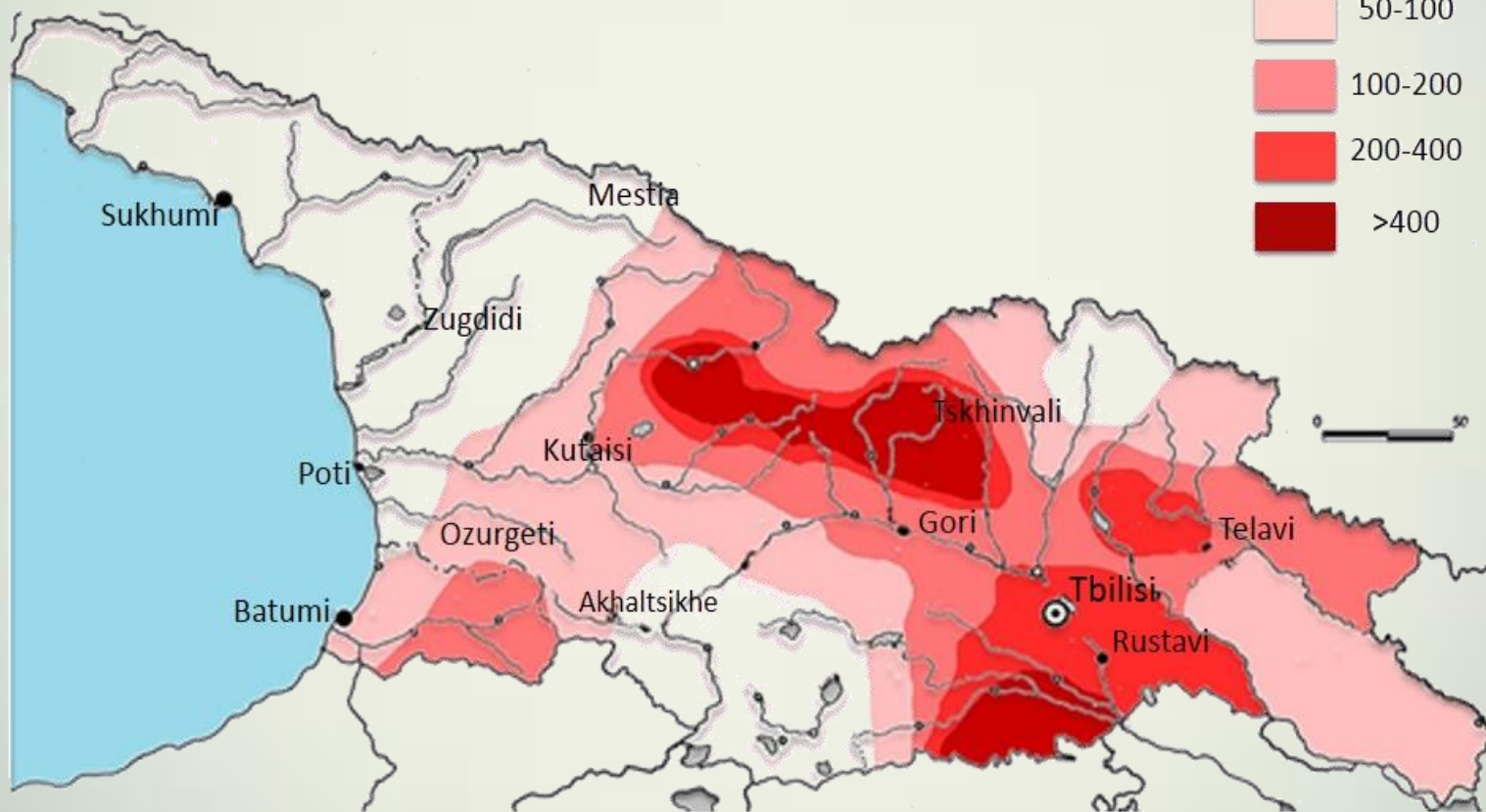
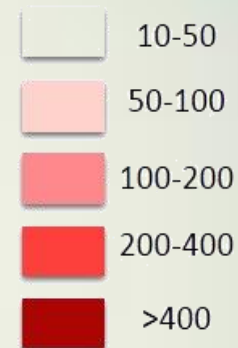
SCALE 1 : 2 000 000



AVERAGE TEMPERATURE OF JANUARY (0C), %

SCALE 1 : 2 000 000

Legend



- SHAMPIAN – NORTH-EAST OF FRANCE
- BORDO – SOUTH-WEST OF FRANCE
- BURGUND – EAST

- KAKHETI – RKATSITELI, SAPERAVI
- KARTLI - CHINURI, GORULI MTSVANE
- IMERETI – TSITSKA, TSOLIKAURI
- RACHA, LECHKHUMI – ALEKSANDREULI, MUJULETULI
- GURIA, SAMEGRELO – CHKHAVERI, OJALESHI
- ABKHAZETI – KACHICHI, AVASIRXVA

ORGANISMS

GREEN VEGETATION, MICROORGANISMS, ANIMALS

GREEN VEGETATION UNIT VEGETATION FORMATION:

- WOOD FORMATION – HUMID SUBTROPIC,
BROADLY LEAF, CONIFEROUS WOOD;
- TRANSITION WOOD-GRASS FORMATION – SOUTH TYPE OF FOREST-STEPPE
- GRASS FORMATION – MEADOWS AND STEPPES;
- DESERT and HALF-DESERT FORMATIONS;
- LICHEN-MOSS FORMATIONS (HIGHMOUNTAINS, BOGS)

WOOD FORMATIONS INCLUDED WIDE SPECTRUM



COAST OF PALEOSTOMI LAKE



TEA PLANTATION

MIXT SUBTROPICAL FOREST ZONE
ASSIMILATION AND SUBTROPICAL CULTUREES

NATURE SONE OF CASTANEA FOREST



ZONE OF QUERCUS IBERICA



ZONE OF FAGUS ORIENTALIS



FAGUS WITH EVERYGREEN
UNDERWOOD

ZONE OF PICEA-ABIES



PICEA ORIENTALIS

FOREST ZONE OF PINE AND BIRCH

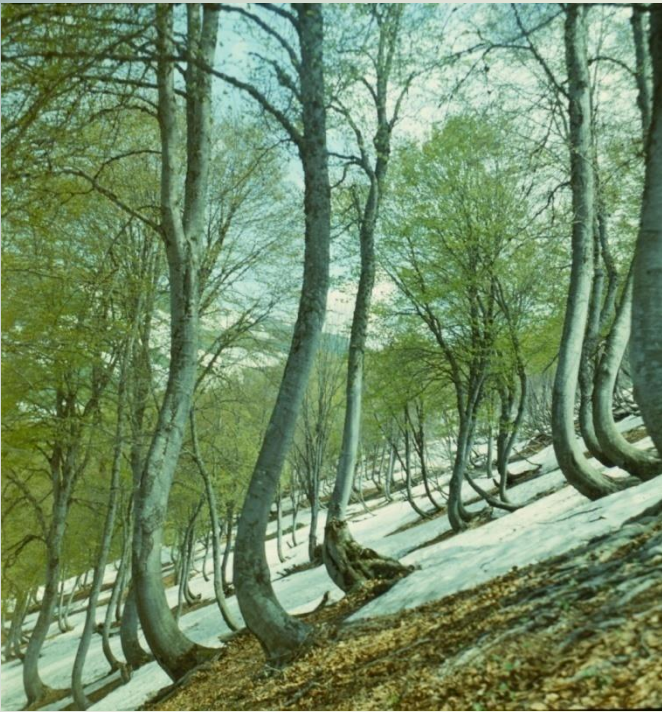


PINE FOREST
(BORJOMI GORGE)



HIGH MOUNTAIN BIRCH FOREST
(KAZBEGI REGION, CENTRAL CAUCASUS)

TRANSITION WOOD-GRASS
FORMATIONS
SOUTH TYPE OF FOREST-STEPPE



FAGETUM SUBLPINUM



PALIURUS SPINA-CHRISI

- JVARI MONASTERY



ALEXANDER ZAKHAROV, 1870



ELVI SCHMIDT, 2009

GRASS FORMATION MEADOW AND STEPPE



SHIRAKI



SUBALPINE MEADOW, BIG CAUCASUS

FORMATION OF DESERT AND HALF DESERT



HALF DESERT -ARTEMISIA

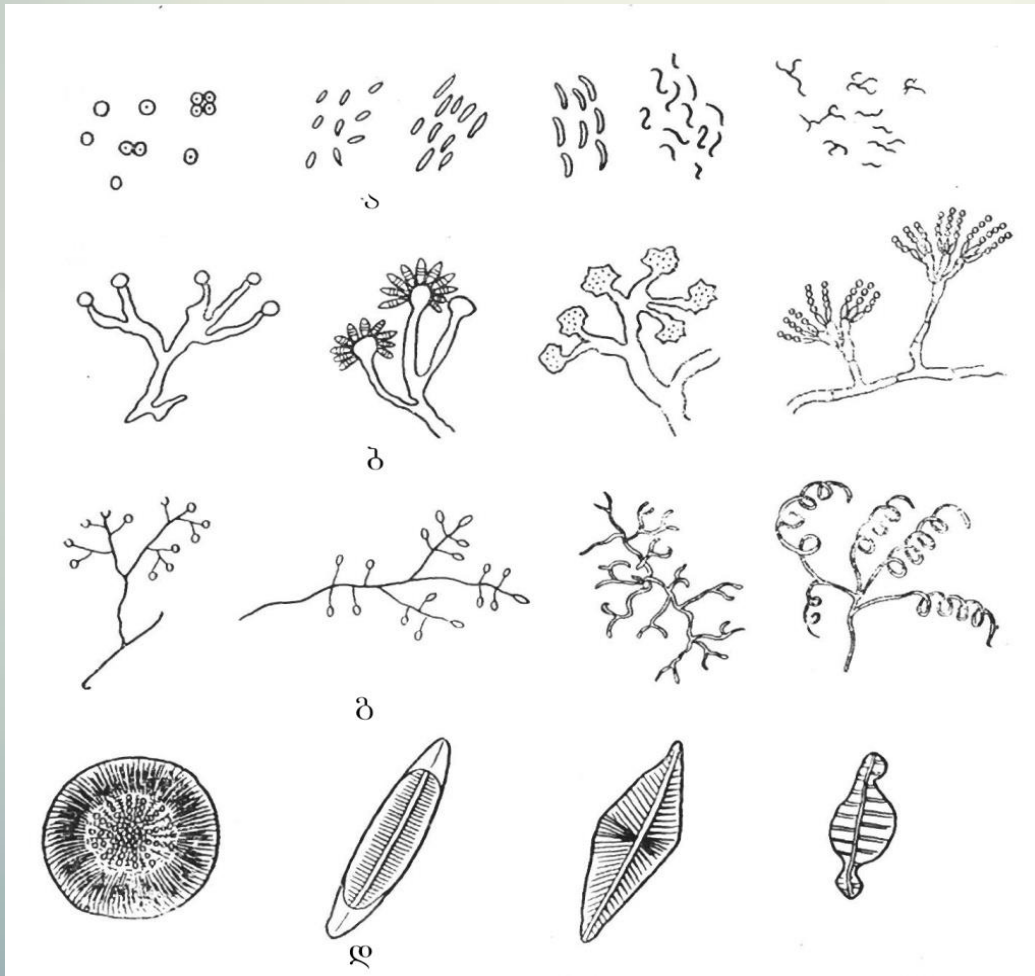


BEDLAND (DAVID GAREJI)



LICHEN-MOSS FORMATIONS

MICROORGANISMS



a - BACTERIUM

b - SOIL MUSHROOM

g - AKTINOMITCET

d - DIATOM SEAWEED

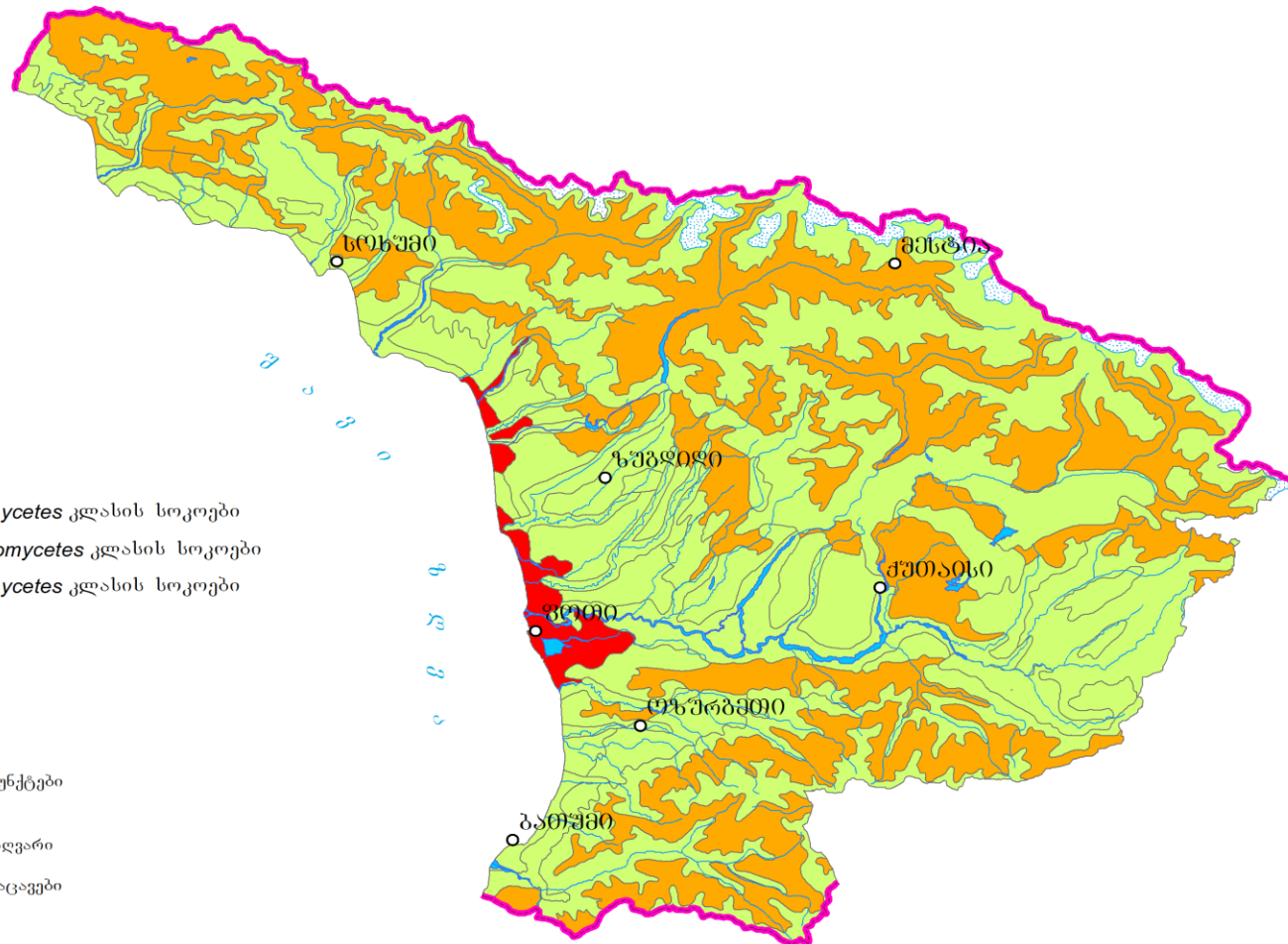
მიკროსკოპული სოკოების რაოდენობა დასავლეთ საქართველოს ნიადაგებში

მასშტაბი: 1:1 500 000

პირობითი აღნიშვნები

- ჭარბობს *Ascomycetes* კლასის სოკოები
- ჭარბობს *Deiteromycetes* კლასის სოკოები
- ჭარბობს *Zygomycetes* კლასის სოკოები

- დასახლებული პუნქტები
- მდინარეები
- სახელმწიფო საზღვარი
- ტბები და წყალსაცავები
- მყინვარები



ბაქტერიები დასავლეთ საქართველოს ნიადაგებში

მასშტაბი: 1:1 500 000



ANIMALS



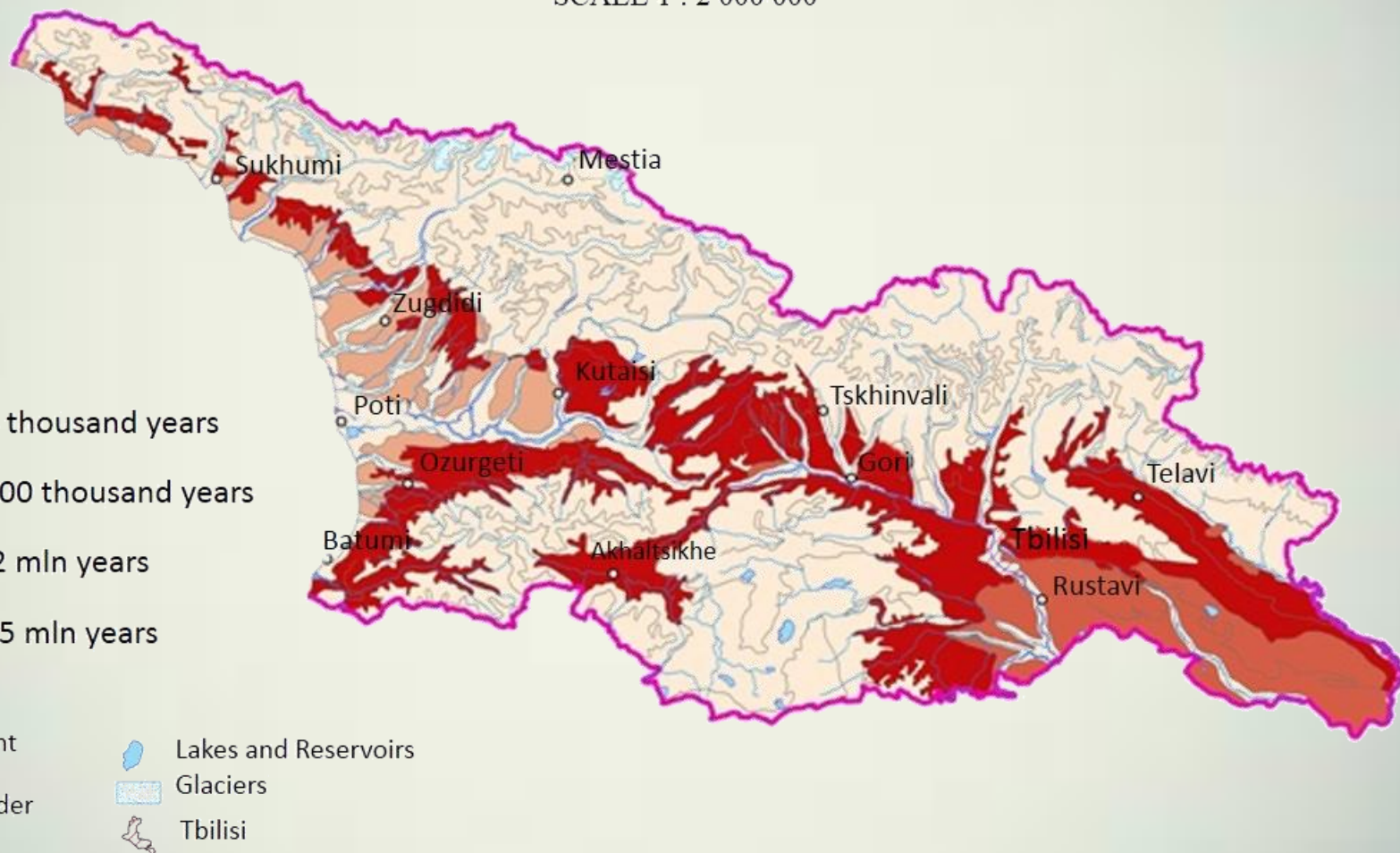
WORMS

ACTIVITIES OF ANIMALS (KORUGHI RESERVE)



MAP OF AGE OF SOIL COVER

SCALE 1 : 2 000 000



AGE

VERY IMPORTANT ARRANGE ABSOLUTE AND RELATIVE AGE
ABOVE 1000 METERS SOIL COVER HAVE HOLOTZEN AGE AND
ABSOLUTE AND RELATIVES AGES ARE COINCIDEN

IN HOLOTZEN WERE FORMED BOG, BROWN FOREST<
MOUNTAIN-MEADOW< CHERNOZEMS, ALUVIAL SOILS

CINNAMONIC, MEADOW-CINNAMONIC, GREY-CINNAMONIC,
MEADOW-GREY-CINNAMONIC AND BLACJ IN PLEISTOTZEN
(FROM 12 THOUAND YEARS TILL 700 THOUSAND YEARS

YELLOW-PODZOLIC, YELLOW-BROWN FOREST – LATE PLIOTZEN
(1,5 – 2 MLN YEARS)

RED SOILS, YELLOW SOILS IN LARE MOITZEN (12 – 15 MLN YEARS



RED SOIL



YELLOW-PODZOLIC SOIL



MOUNTAIN-MEADOW

ნიადაგების საველე გამოკვლევას აქვს უაღრესად დიდი მნიშვნელობა





MOUNTAIN-MEADOW-FOREST



RAW-HUMUS



GREY-CINNAMONIC



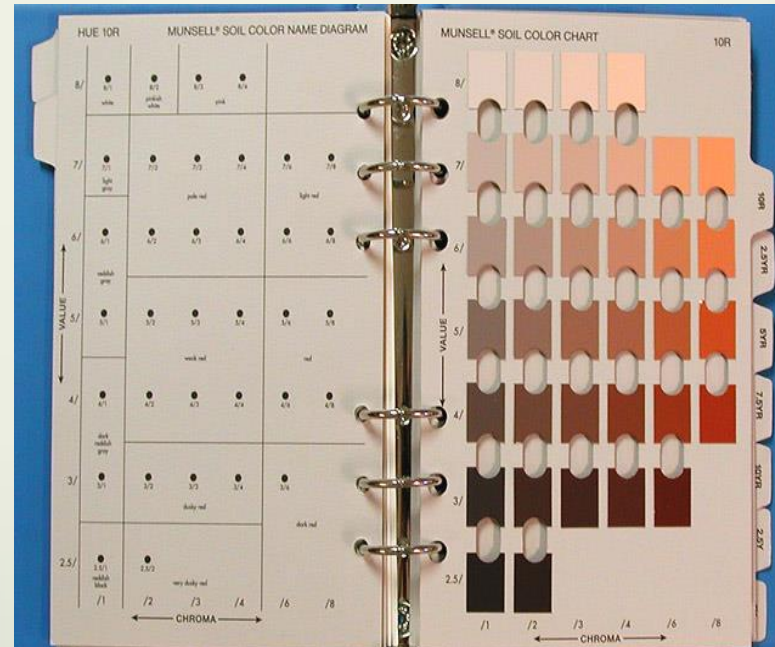
BLACK



ALLUVIAL

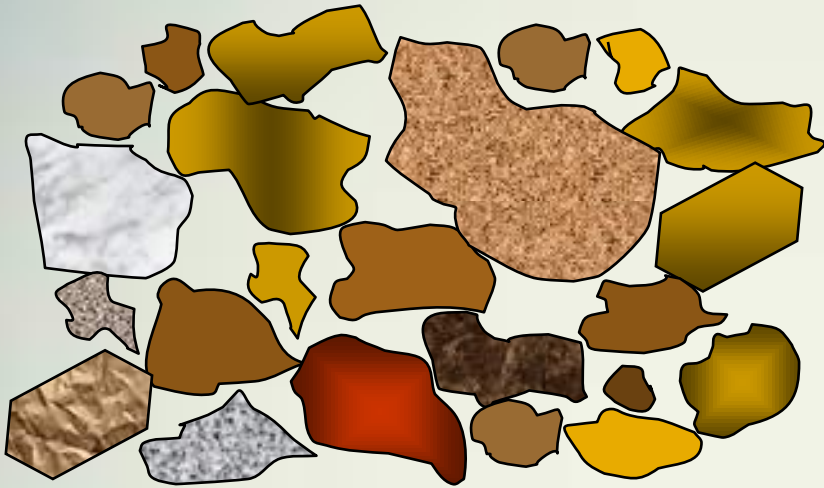


SOIL SUMPLE FROM GLEY HORIZON



MUNSELL

TEXTURE ELEMENTS



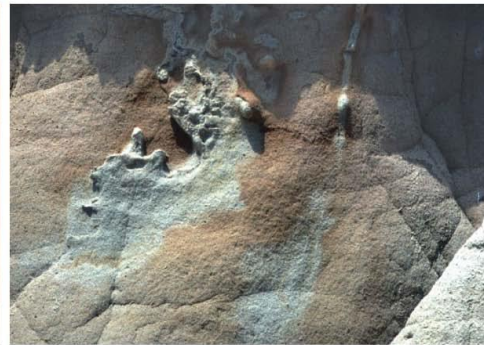
TEXTURE IN FIELD



LUMP STRUCTURE



GRAIN SYRUCTURE



NEW FORMATIONS



FLATNESS OF SLIDE

“FIELD SCHOOL”





DETERMINATION OF CARBONATES



FAMILIARIZE CINNAMONIC SOIL

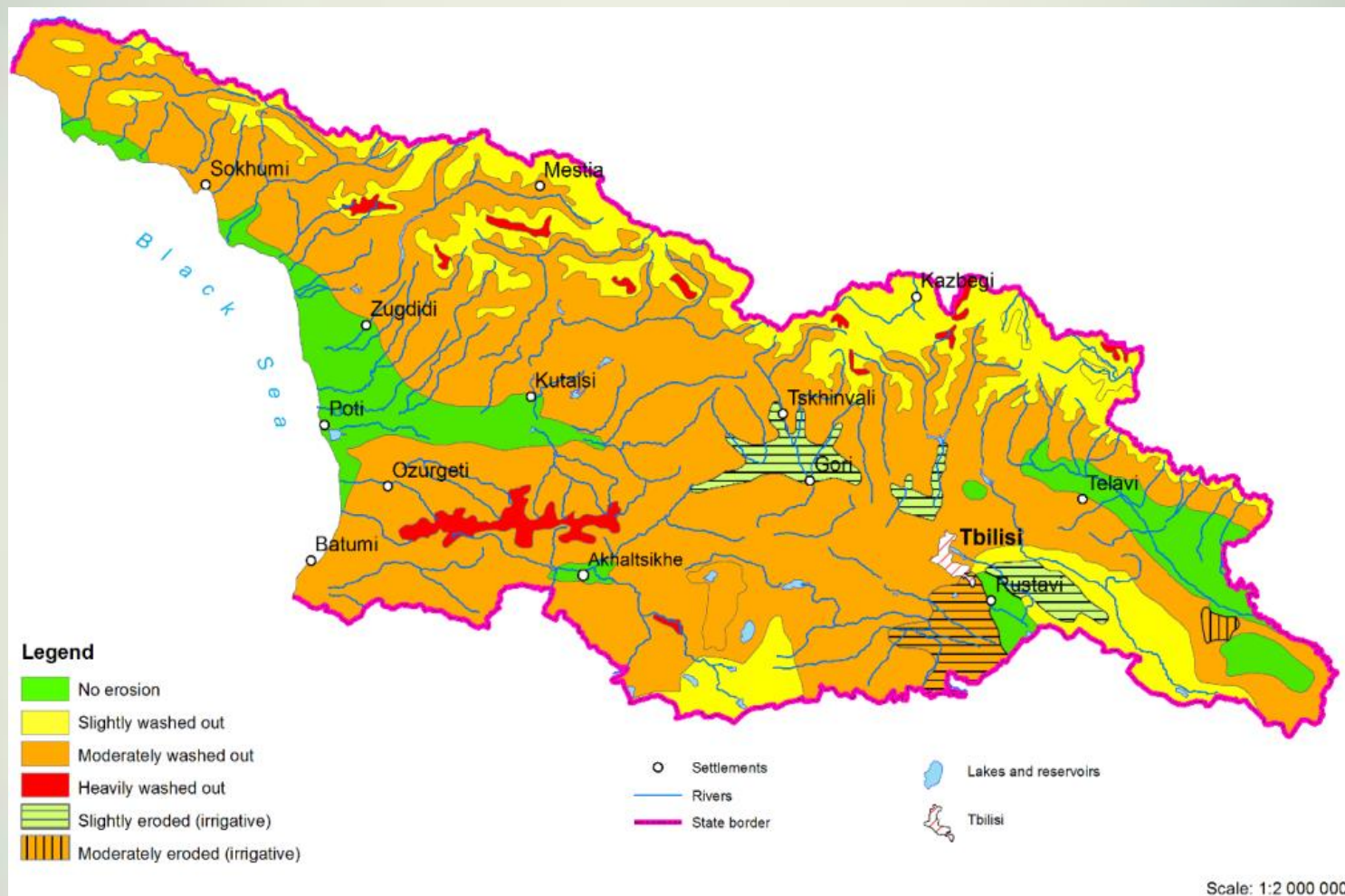


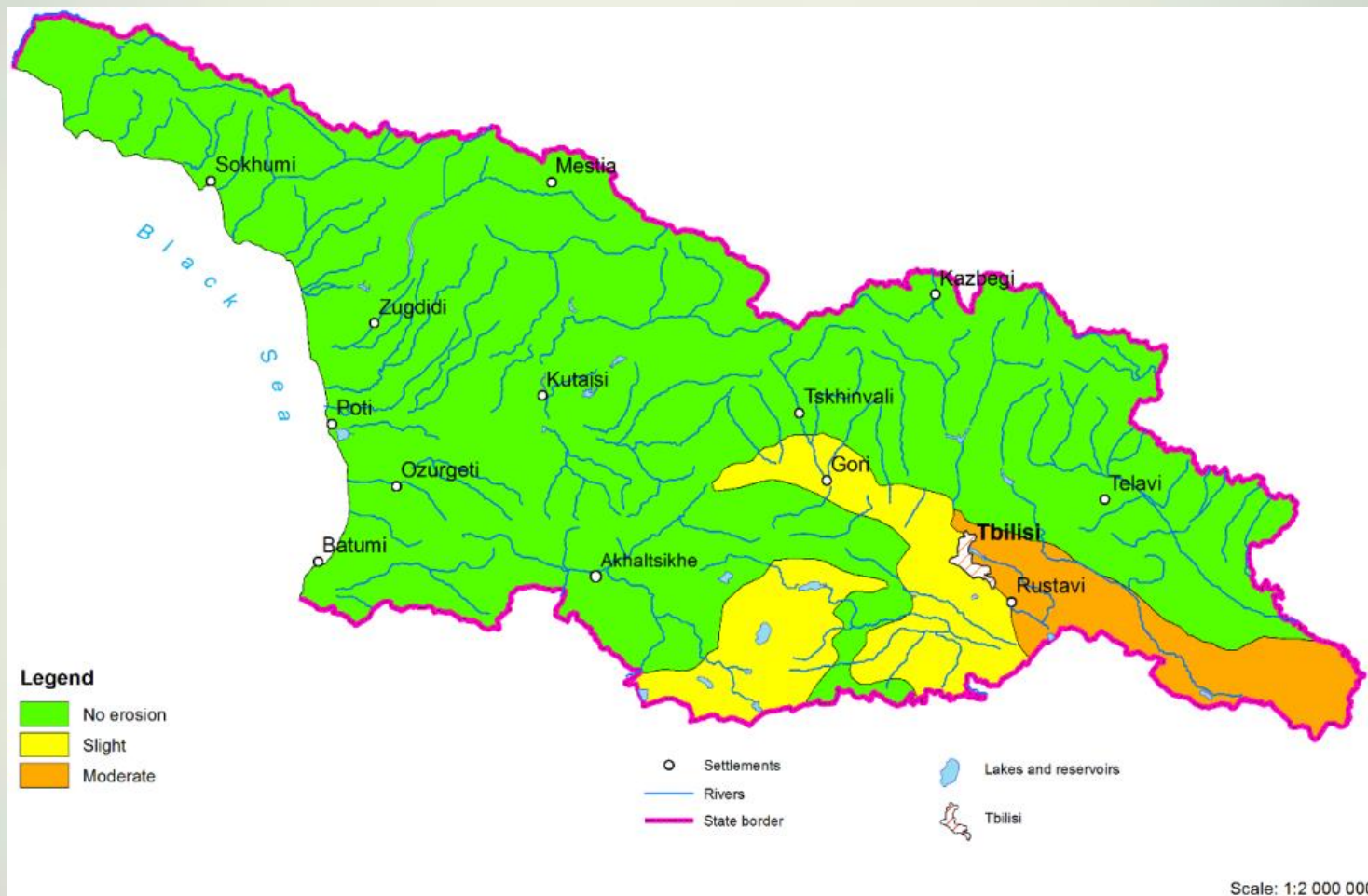
FIELD DISCUSSION

STUDENTS AND SCHOOLBOY OLYMPIADS IN SOIL SCIENCE



- THE SOILS OF GEORGIA ARE UNDER THREAT, ESPECIALLY BY INTENSIVE SOIL EROSION AND CONTAMINATION WITH HEAVY METALS AND RADIONUCLIDES





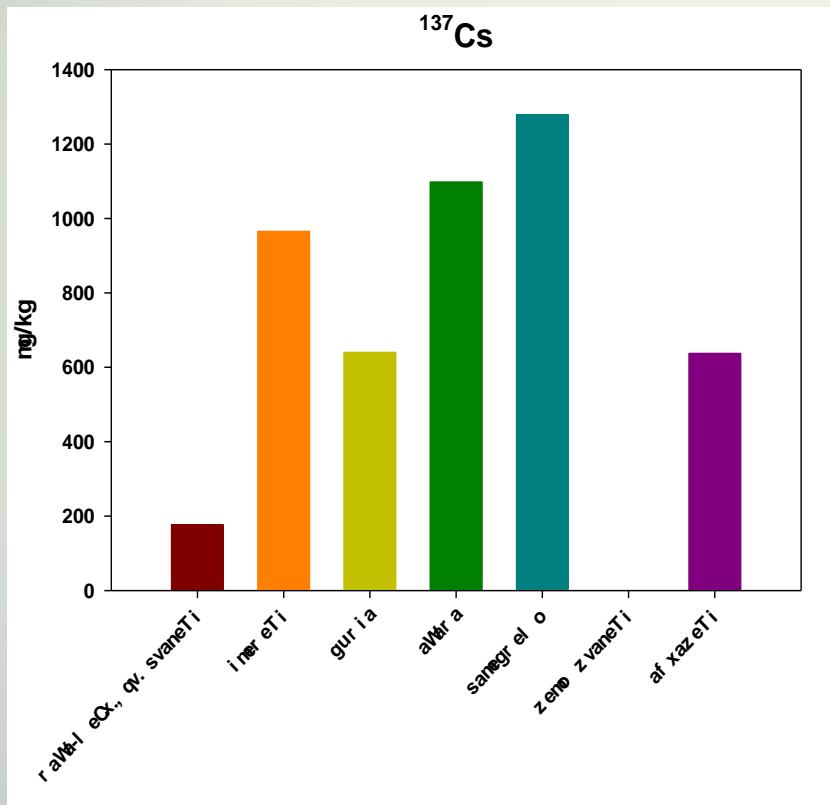
CONTAMINATION WITH HEAVY METALS

(PROJECT LEAD BY
PROF. PETER FELIX-HENNINGSEN)

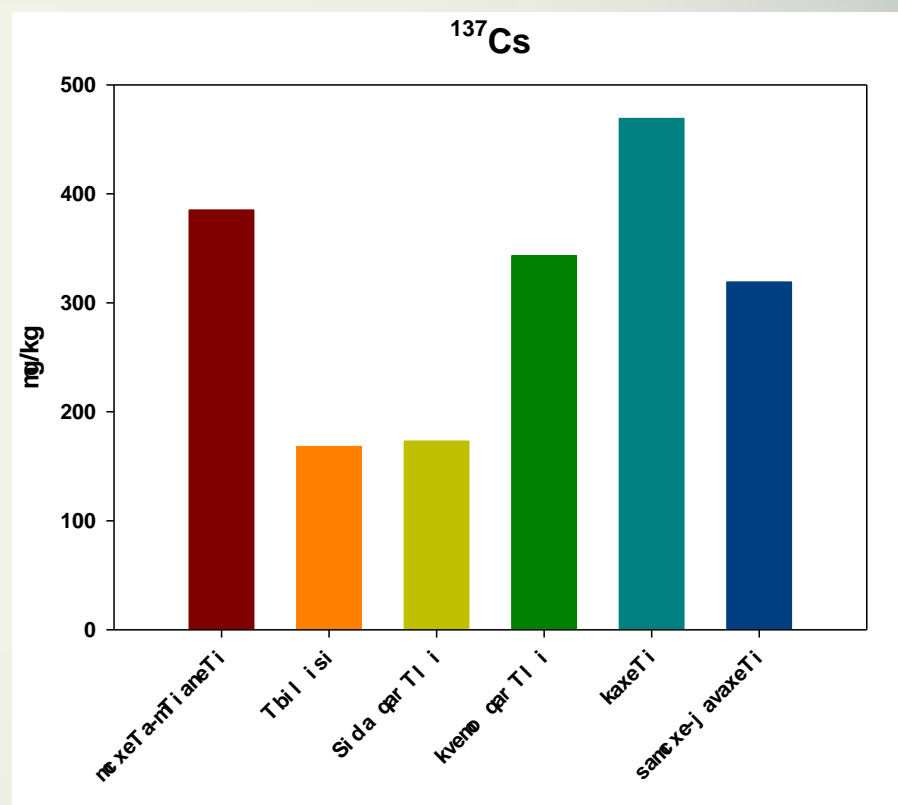


RADIONUCLIDES IN SOILS (DEPTH 0 – 40 CM)

WEST



EAST



Density of pollution by ^{137}Cs , kbk/m^2

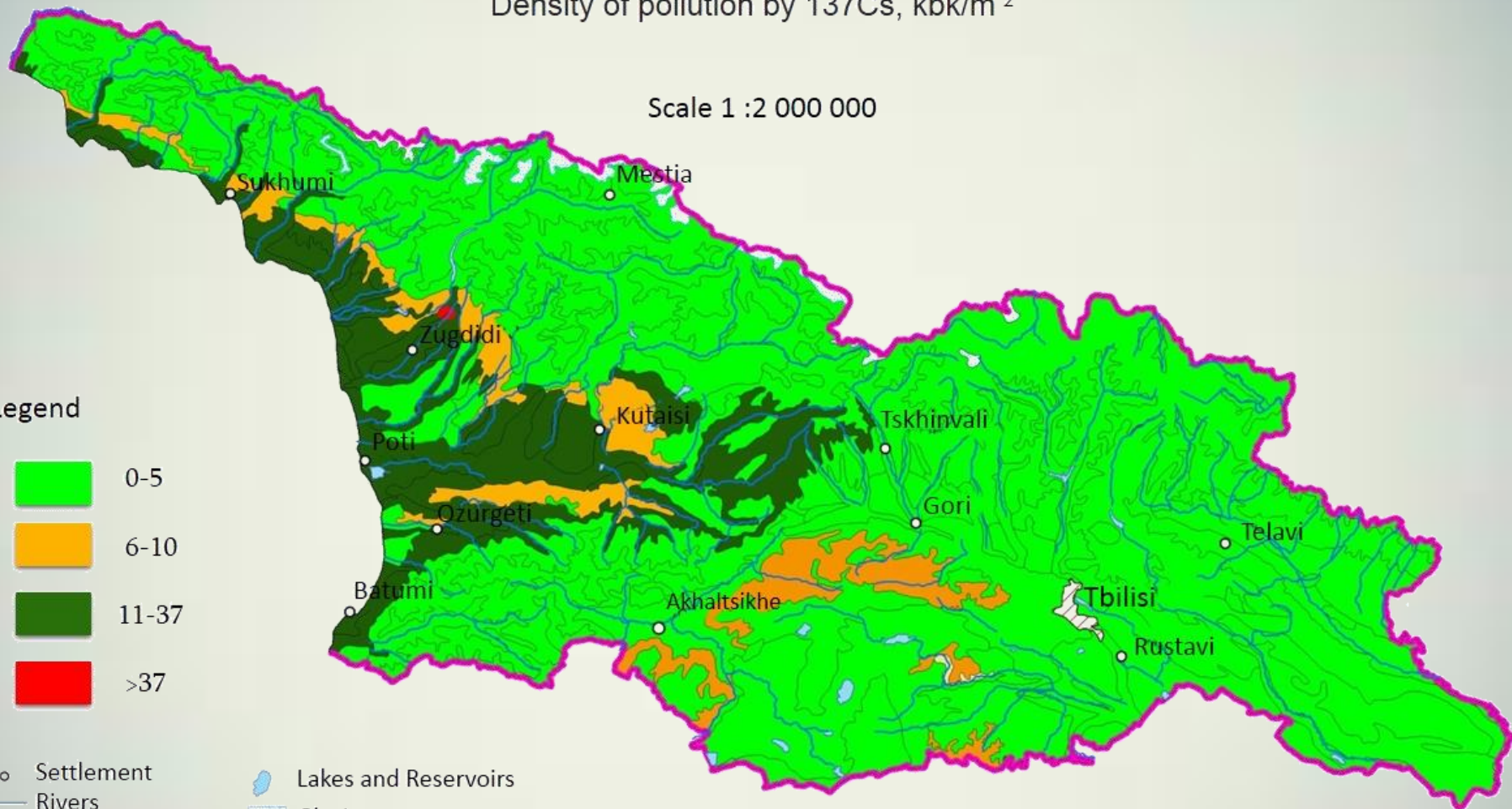
Scale 1 : 2 000 000

Legend



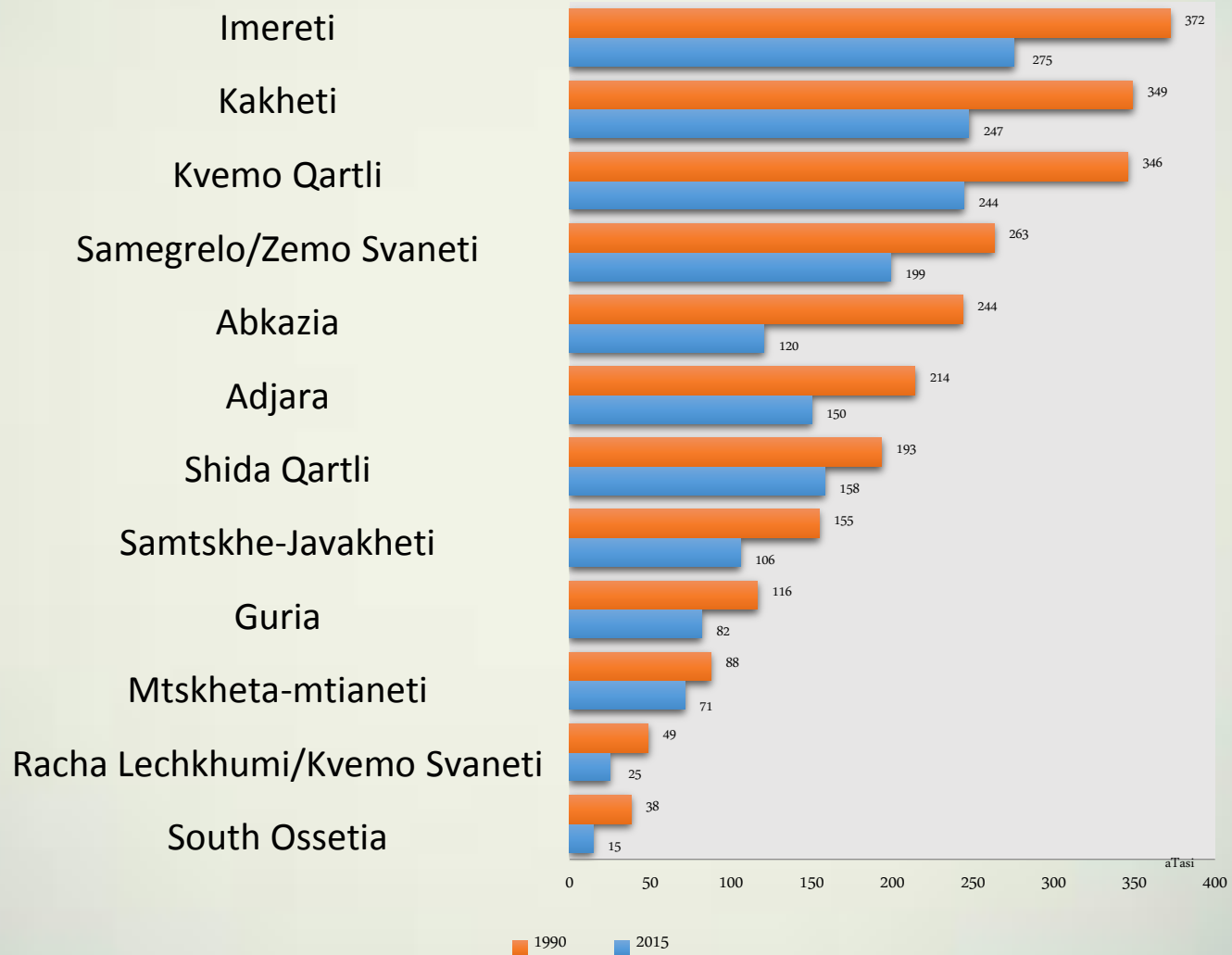
- Settlement
- Rivers
- State Border

- Lakes and Reservoirs
- Glaciers
- Tbilisi



- UNFORTUNATELY WE HAD FIRST “SOIL MIGRATION”

Changes in the rural population of Georgia





THANK YOU FOR YOUR ATTENTION