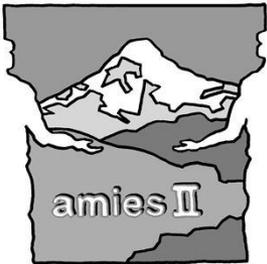


*Final-Meeting in Tbilisi*

*(28<sup>th</sup> – 29<sup>th</sup> September 2017, Goethe Institute Tbilisi)*



## Evaluation of the ornamental value of the Caucasian flora in Georgia - The potentials and risks of trade in ornamental plants –

Katja Beisheim, M. Sc. & Prof. Dr. Annette Otte

Justus Liebig-University

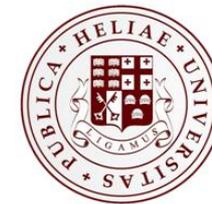
In cooperation with



Centre for  
International Development  
and Environmental Research



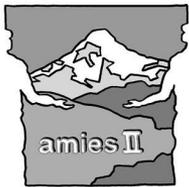
Ivane Javakhishvili Tbilisi  
State University



Ilia Chavchavadze  
State University



Agricultural University  
of Georgia



## INTRODUCTION

- 1 Ornamental plants and their industry

## MATERIAL AND METHODS

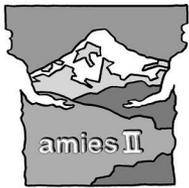
- 2 Comparison of the Kazbegi-Bakuriani database and the PPP-Index
- 3 Literature assessment

## RESULTS AND DISCUSSION

- 4 Comparison of the Kazbegi-Bakuriani database and the PPP-Index
- 5 Literature assessment
- 6 The potentials and risks of trade in ornamental plants

## CONCLUSION

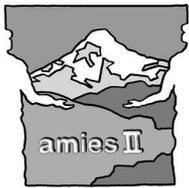




## 1 Ornamental plants and their industry

The Greater and Lesser Caucasus = Biodiversity hotspot





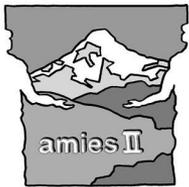
## 1 Ornamental plants and their industry

- **Caucasus = Biodiversity hotspot**
- Biodiversity is recognized for its usage potential  
→ Caucasus is known as one out of eight global centers of domestication for economically important plants
- Food and medicinal value of plants → subject to international scientific research (e.g. BUSSMANN et al. 2014, AKHALKATSI et al. 2010, MILLER et al. 2005)
- Ornamental value not yet fully recognized  
→ Scientific publications are virtually absent

### **AIM of the study:**

**Investigation of the ornamental value of the Caucasian flora in Georgia**

Georgian focus, but Germany as interpretive counterpart and proxy



## 1 Ornamental plants and their industry

Agriculture → Horticulture → Ornamental horticulture

Ornamental plants are mostly used for their **beauty**,  
but **functionality** can also be a criterion for cultivation



*Anemone narcissiflora* subsp.  
*fasciculata* (L.) Ziman &  
Fedor

### Common International Classification of Ecosystem Services (CICES)

Provisioning service

biomass production for direct use or processing, ...

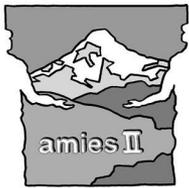
Regulation and maintenance service

erosion protection, water cycling, ventilation, ...

**Cultural service**

**intellectual and spiritual interactions with the  
aesthetics of nature**

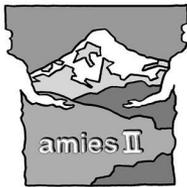
**Global economic significance of the ornamental horticulture industry!**



## 2 Comparison of the Kazbegi-Bakuriani database and the PPP-Index

- Analysis of vegetation data from two mountainous study sites of the Kazbegi and Bakuriani district
- Kazbegi-Bakuriani database:  
**976** vegetation plots in Kazbegi, **197** vegetation plots in Bakuriani: **982** plant species
- Harmonization with THE PLANT LIST (2013) → Synonyms → **958 plant species**
- Comparison with 'Pflanzeneinkaufsführer für Europa' (PPP-Index)  
European suppliers of more than 110,000 plant species (BfN Skript 331, 2013)  
→ Only German suppliers were considered
- All 958 plant species were searched for in the PPP-Index
- Species offered by  $\geq 10$  German suppliers = 'common ornamental plant'

**Analysis of these species regarding relation to the Caucasus and natural distribution range**



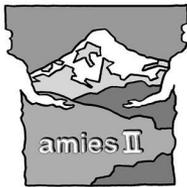
### 3 Literature assessment

Compilation of a list with  
**herbaceous ornamentally valuable plant species  
endemic to the Caucasus & occurring in Georgia**



#### Evaluated literature:

- BRANDES, D. (2014): Zierpflanzen aus dem Kaukasus: Hotspots der Biodiversität oder Stalins Rache? – Technische Universität Braunschweig, Braunschweig: 75 pp.
- SHULKINA, T. (2004): Ornamental Plants from Russia and Adjacent States of the Former Soviet Union. A botanical guide for travelers and gardeners. – Russian Academy of Sciences, St. Petersburg: 320 pp.
- SOLOMON, J., SHULKINA, T. & SCHATZ, G. E. (eds.) (2014): Red list of the endemic plants of the Caucasus: Armenia, Azerbaijan, Georgia, Iran, Russia, and Turkey. – Missouri Botanical Garden Press, St. Louis: 451 pp.



### 3 Literature assessment

Ornamental value → Species highlighted by BRANDES, SHULKINA or SOLOMON et al.

Endemism → Listed in the Red List, indicated provenance in Georgia

Herbaceousness → Attribution of life form categories on genus/ species level

- Analysis regarding the species' usage status as ornamental plants
- Evaluation of their characteristics concerning a potential ornamental use on local/ global level

*Geranium platypetalum* Fisch. & C.A.Mey.



*Inula orientalis* Lam.



*Galanthus platyphyllus* Traub & Moldenke





## 4 Comparison of the Kazbegi-Bakuriani database and the PPP-Index

958 species listed in the Kazbegi-Bakuriani database

→ **150 species** are offered by  $\geq 10$  German plant suppliers in the PPP-Index

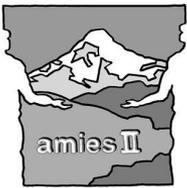
The 150 species belong to

**104 different plant genera** and **49 different plant families**

Genus	Species abundance
<i>Geranium</i>	8
<i>Campanula</i>	6
<i>Carex</i>	5
<i>Acer</i>	3
<i>Gentiana</i>	3
<i>Potentilla</i>	3
<i>Salvia</i>	3
<i>Sedum</i>	3
<i>Tanacetum</i>	3

Family	Species abundance
Compositae	17
Rosaceae	16
Lamiaceae	6
Poaceae	5
Geraniaceae	4
Campanulaceae	3
Cyperaceae	3
Caprifoliaceae	3
Plantaginaceae	3
Crassulaceae	3

Overlap with the species-richest genera and families occurring in the wild in both the **Caucasus** and **Germany** !



## 4 Comparison of the Kazbegi-Bakuriani database and the PPP-Index

**Surprising:** the list gives an accurate reflection of the plant genus and family composition in the wild in Germany.

Assuming that this trend also extends to species level, **two explanations are possible:**

1. All 150 Caucasian plant species have been brought to Germany for ornamental purposes, all escaped to the wild  
→ Formation of a German flora resembling the Caucasian flora
2. The Caucasian and the German flora do not differ immensely  
→ The Georgian species sold as ornamental plants in Germany do not necessarily originate from the Caucasus

→ Evaluation of the 150 species regarding **origin** and **distribution**.

## 4 Comparison of the Kazbegi-Bakuriani database and the PPP-Index

### Floristic status of plant species' origin

- Indigenous
- Archaeophyte: Introduction before 1500 AD
- Neophyte: Introduction after 1500 AD

Out of the 150 species, 127 are recorded (23 missing data)  
in Germany (UFZ 2002)

- 106 species indigenous,
- 11 species archaeophytes (2 questionable) and
- 10 species neophytes

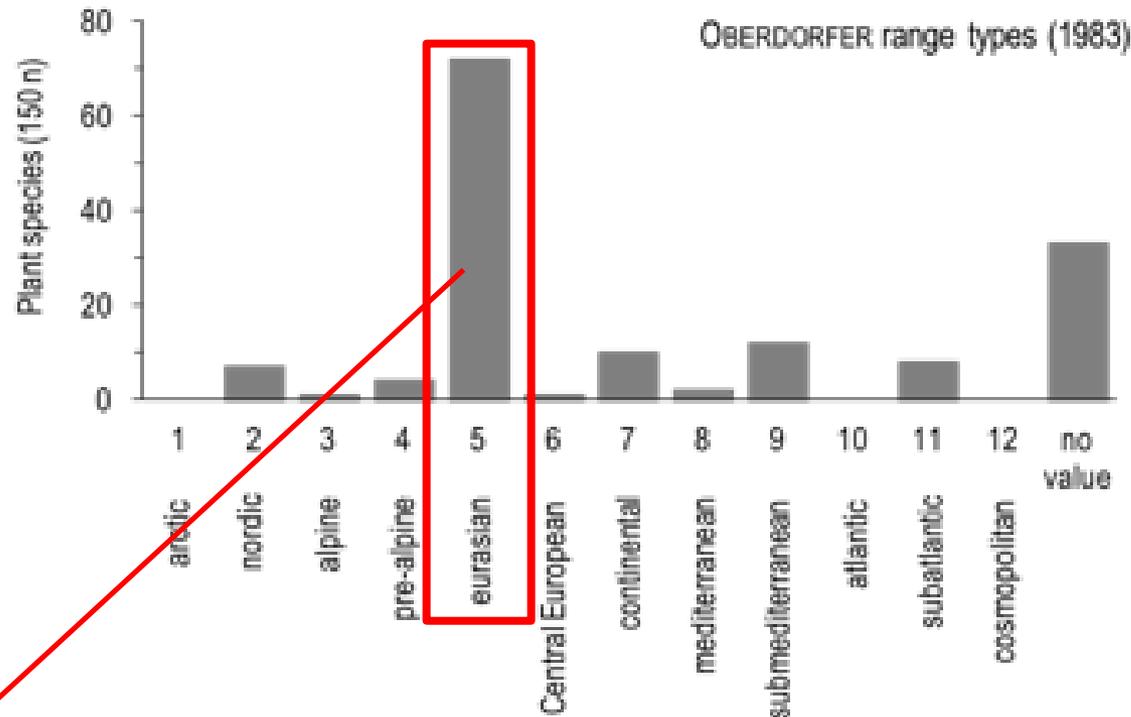




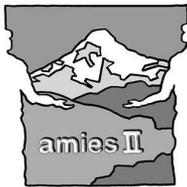
#### 4 Comparison of the Kazbegi-Bakuriani database and the PPP-Index

**Range type – classifies a species' main distribution area**

→ 117 species are classified in OBERDORFER (1983), 33 species have no value.



**72 species have a 'eurasian' distribution range!**



## Range type

Out of the 150 species,

→ 117 occur in **Georgia** and have a natural or long established distribution range in **Germany**

WALTER & BRECKLE (1986, 1999)

Germany belongs to:

- **Temperate (nemoral) Zone of Europe (Zonobiome VI)**

Caucasus:

- **Northern and southern Caucasus lowlands:** Temperate (nemoral) Zone of Europe (Zonobiome VI)
- **Western Colchic lowlands:** Warm-temperate humid climate (Zonobiome V)  
→ mesophytic deciduous broad-leaved forest with evergreen elements)
- **Eastern Caspic lowlands:** Kontinental Steppe to Semi-Desert (Zonobiome VIIa)
- **Mountain range: Multizonal Orobiome**  
altitudinal climate belts → Including VI, V and VII



## Range type

- Out of the 150 species, 29 species do not occur in the wild in Central Europe
- 33 species have no natural or long-established distribution range in Germany

→ Are they 'true' Caucasian plants?

**25 species: 'KAUK-WAS' / 'OEUR+KAUK' / ...**

→ **13 species limited to the Caucasus ('KAUK')**

→ **ENDEMIC SPECIES ?**

Species	Range formula
<i>Abies nordmanniana</i>	m-sm//mo·c3-4 KAUK-WAS
<i>Anthemis marschalliana</i>	m-sm//mo·alp·c3-5 KAUK-WAS
<i>Astrantia maxima</i>	m-sm//mo·alp·c4-7 KAUK-WAS
<i>Campanula alliariifolia</i>	m-sm/mo·c3-6 KAUK
<i>Campanula collina</i>	m-sm//salp·alp·c4-7 KAUK
<i>Campanula lactiflora</i>	m-sm//mo·salp·c3-6 KAUK
<i>Campanula sarmatica</i>	m-sm//mo·salp·c3-6 KAUK
<i>Cephalaria gigantea</i>	m-sm//mo·salp·c3-6 KAUK
<i>Centaurea macrocephala</i>	m-sm//mo·salp·c3-6 KAUK
<i>Dianthus cruentus</i>	sm/mo·c3-6 EUR
<i>Digitalis ferruginea</i>	m-sm//mo·salp·c3-6 OEUR-KAUK
<i>Doronicum orientale</i>	sm/mo·c3-4 OEUR
<i>Gentiana septemfida</i>	sm/salp·alp·c4-7 KAUK-WAS
<i>Geranium ibericum</i>	sm/salp·c4-6 KAUK
<i>Geranium platypetalum</i>	sm/salp·c4-6 KAUK

**Table 3** Range formula of the species that are not Central European according to ELLENBERG et al. (2001) and/ or have no natural or long-established (pre 1500 AD) distribution range in Germany (UFZ 2002, KORNECK et al. 1998). Information was provided by WELK (2016) (non-exhaustive).



*Gadellia lactiflora* (Bieb.) Schulkina



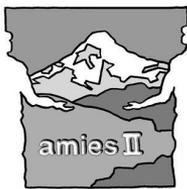
*Gentiana septemfida* Pall.



*Geranium platypetalum* Fisch. & C. A. Mey.



*Fritillaria collina* Adams



## 5 Literature assessment (SHULKINA 2004, SOLOMON et al. 2014)

Genus	Life form	Species
<i>Allium</i>	G	<i>Allium candolleianum</i> Albov
<i>Amberboa</i>	T	<i>Amberboa moschata</i> (L.) DC.
<i>Anemone</i>	H	<i>Anemone narcissiflora</i> subsp. <i>fasciculata</i> (L.) Ziman [ <i>Anemone fasciculata</i> L.]
<i>Aquilegia</i>	?	<i>Aquilegia gegica</i> Jabr.-Kolak.
	H	<i>Aquilegia olympica</i> Boiss.
<i>Asperula</i>	T, H, C	<i>Asperula abchasica</i> V.I.Krecz.
		<i>Asperula prostrata</i> (Adams) K.Koch
<i>Astragalus</i>	H, G	<i>Astragalus captiosus</i> Boriss.
		<i>Astragalus kazbeki</i> Kharadze
<i>Astrantia</i>	H	<i>Astrantia biebersteinii</i> Fisch. & C.A.Mey.
<i>Asyneuma</i>	H	<i>Asyneuma campanuloides</i> (M.Bieb. ex Sims) Bornm.
<i>Salvia</i>	T, H, C	<i>Salvia garedjii</i> Troitzky
<i>Scilla</i>	G	<i>Scilla mischtschenkoana</i> Grossh.
<i>Sempervivum</i>	C	<i>Sempervivum pumilum</i> M.Bieb.
<i>Stachys</i>	H, G	<i>Stachys abchasica</i> (N.P.Popov ex Grossh.) Czerep. [B
		<i>abchasica</i> (N.P.Popov ex Grossh.) Chinth.]

Complete list of  
79 endemic ornamental species  
(occurrence in Georgia)

28 species found in the PPP-  
Index  
(1 - 51 German suppliers)

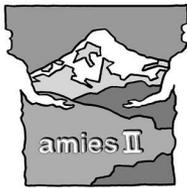
Life-form categories

Mainly **hemicryptophytes** or  
**geophytes**

→ Prevailing in temperate  
zones

→ Valuable for ornamental  
purposes

**Table 4** Selection of herbaceous **Caucasian endemic plant species with an ornamental value** that occur in Georgia. An attempt was made to attribute the respective life form to determine herbaceousness.



## 6 The potentials and risks of trade in ornamental plants

### Nature conservation

Many Caucasian plant species are endemics  
→ More threatened by extinction than cosmopolitan  
species ('biodiversity hotspot' principle)

Out of the 150 species → 19 are on the Red List  
*Astrantia maxima* = NT, the rest was assessed NE, LC, or DD

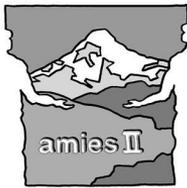
Out of the 79 endemic species → all are Red List-species (exclusion criterion)  
EN = *Dioscorea caucasica*, *Primula juliae*, *Pulsatilla violaceae*, *Gymnospermium smirnovii*

Usage for ornamental purposes ambivalent

Increased interest → intensifies the search and extraction from the wild

**Cultivation** → **reduces the need for gathering from the wild**





## 6 The potentials and risks of trade in ornamental plants

### Biological invasion control

Globalized ornamental horticulture =  
major cause for biological plant invasions

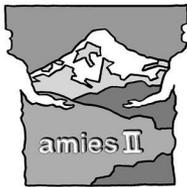
Out of the 150 species, 11 are archaeophytes and 10 are neophytes

- 1 archaeophyte and 7 neophytes = escaped ornamental plants
- 2 archaeophytes and 2 neophytes = escaped ornamental plants and crops

Categorization into

- Non-invasive (White List),
  - Potentially invasive (Grey List)
  - Invasive (Black List)
- **Out of the 90 listed species, 11 are of Caucasian origin and 3 are found among the evaluated species in this study**





## 6 The potentials and risks of trade in ornamental plants

### Genetic resource maintenance

Genetic erosion plays an important role in ornamental horticulture:

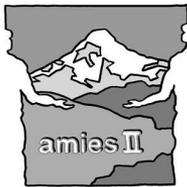
- Decreased and fragmented habitats
  - populations with lower fitness/ reduced gene pool
  - difficult to meet standards/ requirements for new ornamental plants
- Uncontrolled and excessive harvesting of wild species
- Demand for uniformity between and within species

**BUT ornamental horticulture can also be a source of genetic diversity!**

(some private gardens contain large collections or rare and old ornamental plants)



*Paeonia daurica* subsp. *mlokosewitschii*  
(Lomakin) D.Y. Hong



## 6 The potentials and risks of trade in ornamental plants

### Socio-economic progress

Ornamental plants = luxury product, no central human need

→ Level of industrialization/ urbanization positively correlated with **demand** for ornamental plants

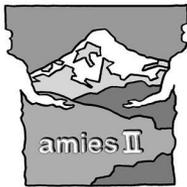
However, **supply** is provided from developed and developing countries!

Georgia: Significance of ornamental market is likely to increase in terms of demand AND supply

→ Economic growth/ modernization in the cities

→ Potential land use strategy for the rural population





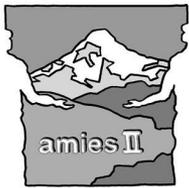
- Next to food and medicinal plants, plant diversity in the Caucasus Ecoregion encompasses many plant species of ornamental value
- Some mountainous species are commonly known to the ornamental horticulture industry (Germany as a proxy)
- **BUT many are Eurasian species and few are Caucasian endemics**



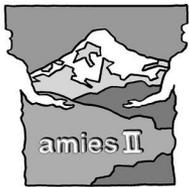
*Digitalis ferrugienea* L.



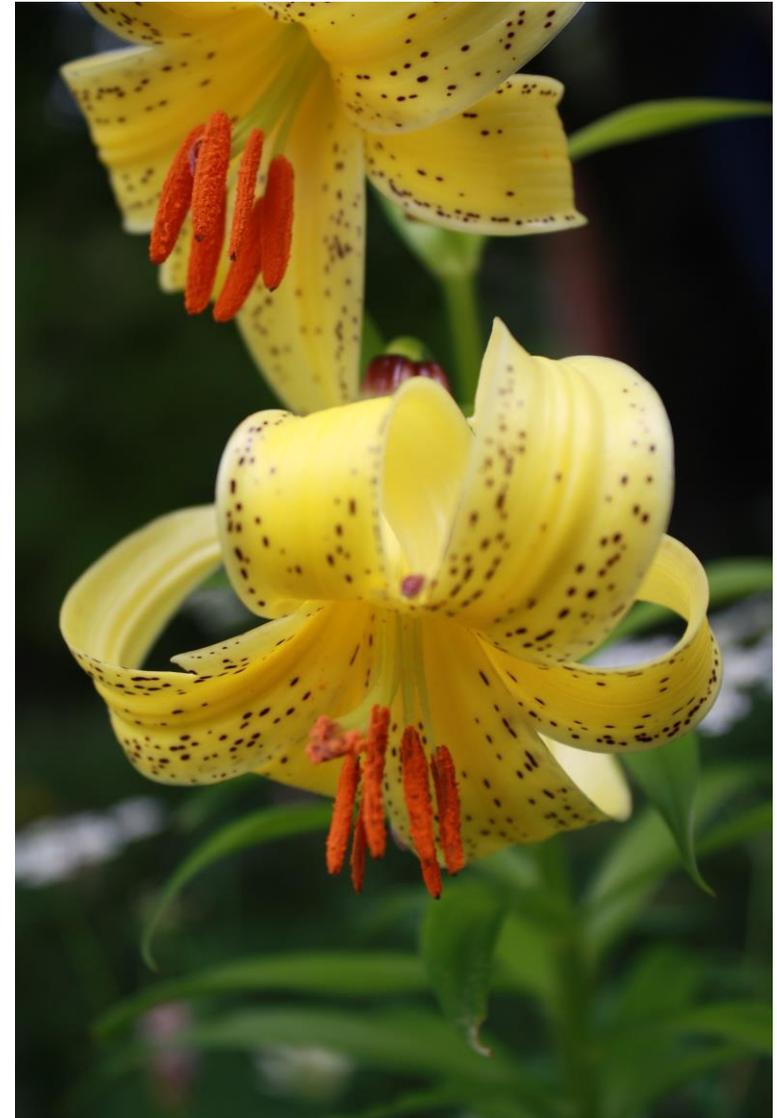
*Galanthus platyphyllus* Traub & Moldenke



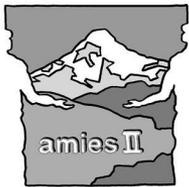
- List of 80 herbaceous Caucasian endemic species occurring throughout Georgia (mountain and intermountain areas) highlights the ornamental significance of the unique Caucasian flora
  - Only 1/3 of these species can currently be bought as ornamental plants through the PPP-Index
    - Much of the value has not yet been discovered
  - Trade in ornamental plants can be seem ambiguously concerning risks and potentials for humans and nature
  - Can be a blessing or a curse in terms of nature conservation and genetic resource maintenance
  - Increases the risk of the introduction of invasive species
  - Socio-economic potential for Georgia
- **Can the ornamental value of the Caucasian flora be used to a greater extent?**



Mostly used for their **beauty**



*Lilium szovitsianum* Fisch. & Avé-Lall.

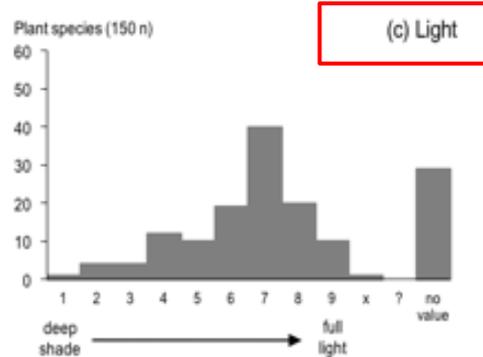
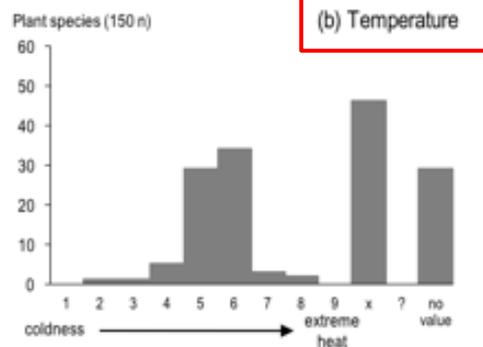
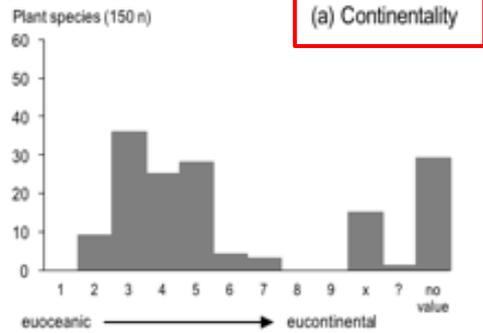


**Scenario development for sustainable land use  
in the Greater Caucasus, Georgia**

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**Climatic factors**



**Edaphic factors**

