EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION
ORGANISATION EUROPEENNE ET MEDITERRANEENNE
POUR LA PROTECTION DES PLANTES

21-26952 (09-15075)

This PRA document was modified in 2021 to clarify the phytosanitary measures recommended

Report of a Pest Risk Analysis

This summary presents the main features of a pest risk analysis which has been conducted on the pest, according to EPPO Decision support scheme for quarantine pests.

Pest: *Heracleum sosnowskyi* Mandenova
PRA area: EPPO region

Assessor: EPPO Panel on Invasive Alien Species

Date: 2009-04

STAGE 1: INITIATION

Reason for doing PRA: *Heracleum sosnowskyi* is considered invasive in the Baltic States and represents a threat to other EPPO countries.

Taxonomic position of pest: Kingdom: *Plantae*
Class: *Magnoliopsida* (Dicotyledons)
Family: *Apiaceae*

STAGE 2: PEST RISK ASSESSMENT

Probability of introduction

Entry

Geographical distribution: **EPPO region:** Armenia (native), Azerbaidzhan, Russia (Karachay-Cherkessia, Kabardino-Balkaria, North Ossetia, Ingushetia, Chechnya, Dagestan and possibly Black Sea coast), Belarus, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Russia (Central and Northern), Ukraine (introduced).

Major host plants or habitats: Grasslands, forests, wetlands, riverbanks/canal sides, rail/roadsides, woodland, the edges of clearings, rubbish dumps and waste ground and urban areas are suitable habitats.

According to the CORINE Land Cover nomenclature, the suitable habitats are:
- Pastures
- Banks of continental water, Riverbanks / canalsides (dry river beds)
- Road and rail networks and associated land
- Other artificial surfaces (wastelands).

Which pathway(s) is the pest likely to be introduced on:
- Soil/growing medium (with organic matters) as a commodity

- Involuntary entry with soil as a contaminant on used machinery

- Involuntary entry with soil as a contaminant on used vehicles

- Involuntary entry with soil as a contaminant on footwear

- Voluntary entry for agricultural (used as a fodder, melferifous plant) or ornamental purposes. The species is not used as a fodder anymore, and there is no record of its use as an ornamental plant.

Establishment

Plants or habitats at risk in the PRA area:

Grasslands, forests, wetlands, riverbanks/canal sides, rail/roadsides, woodland, grasslands, the edges of clearings and urban areas are suitable habitats.

Climatic similarity of present distribution with PRA area (or parts thereof):

Similar
Low uncertainty

H. sosnowskyi is native from the mountainous areas: Caucasus, Transcaucasia, and North-East Turkey (Jahodová *et al*., 2007) but is invasive in Baltic countries having a different climate, where it has been introduced as a fodder crop.
It is associated with areas with warm to hot wet summers and cool winters. It is not favoured by drier conditions. The new shoots of *H. sosnowskyi* are rather cold resistant and can survive –4 to –7°C. It is found that starting from the second year, they can survive up to -25°C, and under a snow cover, even down to -45°C (Oboļeviča, 2001). Seeds germinate in early spring (but not during summer) and require a period of cold stratification for breaking dormancy (less than 2 month). This makes the plant adapted to temperate climates, and probably unadapted to Mediterranean climates.

Aspects of the pest's biology that would favour establishment:

H. sosnowskyi develops in fresh and slightly moist, neutral soils, rich in nutrients, ranging from pH 6.3 to 7.0. *H. sosnowskyi* communities have developed in artificial and seminatural habitats over the last 20 years. They are nitrophilous and their expansion is stimulated by eutrophication of the environment (Laivins & Gavrilova, 2003).
H. sosnowskyi is a light demanding plant which cannot tolerate shade in the first growth stages (Oboļeviča, 2001).

The flowers of *H. sosnowskyi* are insect-pollinated and self compatible. Reproduction is exclusively by seeds. A plant of *H. sosnowskyi* has been reported to produce on average 8,836 fruits in the Leningrad area, Russia (Tkachenko, 1989). The majority of seeds (98.2%) are distributed in the upper soil layer of 0-5 cm, with little in the deeper layers of 6-10 cm and 11-15 cm (Moravcová *et al*., 2007). Seeds may remain viable for up to 15 years when stored dry, but in the field this period is reduced to 7 years (Andersen & Calov, 1996).

Characteristics (other than climatic) of the PRA area that would favour establishment:

H. sosnowskyi is very often found in managed habitats, since it was planted as a fodder crop, and is reported in abandoned agricultural land, particularly in Latvia (Thiele *et al*., 2007). *H. sosnowskyi* communities have developed in artificial and seminatural habitats over the last 20 years. They are nitrophilous and their expansion is

stimulated by eutrophication of the environment (Laivins & Gavrilova, 2003).

In managed habitats such as pastures and road sides, usual measure is cutting. This existing measure is usually insufficient since there is rapid re-growth from below ground, and it may encourgae the flowering of the plant (Holm, 2005).

Which part of the PRA area is the endangered area:

Grasslands, forests, wetlands, riverbanks/canal sides, rail/roadsides, woodland, grasslands, the edges of clearings, rubbish dumps and waste ground and urban areas of the temperate EPPO region (northern and central parts).

Comparing Riga and Vladikavkav with the world with the software CLIMEX, it appears that central Europe and Scandinavia are the areas the most at risk (see Appendix 1).
Countries with similar climates are: Austria, Belarus, Belgium, Czech Republic, Denmark, Estonia, Finland, France (North-East), Germany, Hungary, Latvia, Lithuania, Norway, Poland, Romania, Russia, United Kingdom (South-East), Slovakia, Sweden, Switzerland, Ukraine.

POTENTIAL ECONOMIC CONSEQUENCES

How much economic impact does the pest have in its present distribution:

Major
Low uncertainty

Control costs

There are no records of direct impact on crops.
Significant costs are incurred by the measures taken to control the plant in amenities and other areas, as well as to turn the land back to agricultural area, particularly in Baltic countries (A. Garkaje, pers comm., 2007). This management activity is also likely to increase soil erosion along stream banks where the plant occurs.
Only in Latvia, the total cost of the 2006-2012 control program of this species is estimated 12 000 000 euros (Cabinet of Ministers Order No. 426), but it should be highlighted that the situation in this country is particular since the species has been planted over large areas in the past.

Social impacts

H. sosnowskyi contains photosensitizing furanocoumarins. In contact with the human skin and in combination with ultraviolet radiation, a phytotoxic reaction can occur 15 minutes after contact, with a sensitivity peak between 30 min and 2 hours causing burnings of the skin.
After about 24 hours, flushing or reddening of the skin (erythema) and excessive accumulation of fluid in the skin (edema) appear, followed by an inflammatory reaction after three days. Approximately one week later a hyper-pigmentation (usually darkening the skin) occurs which can last for months. The affected skin may remain sensitive to ultraviolet for years.
In addition, several furanocoumarins have been reported to cause cancer (carcinogenic) and to cause malformation in the growing embryo (teratogenic) (Nielsen *et al*., 2005).

Moreover, dense infestations can seriously interfere with access to

amenity areas, riverbanks, etc., and along roadsides, large stands can reduce visibility and result in road safety hazards.

Plantation schemes were eventually abandoned in the Baltic States, partly because the anise scented plants affected the flavour of meat and milk from the animals to which it was fed and partly because of the health risk to humans and cattle (Nielsen *et al*., 2005).

Describe damage to potential hosts in PRA area:

Minor
Medium uncertainty

Environmental impact

Heracleum spp. can create stands that may range in extent from square metres to hectares; small patches, linear stands or fringes can be found. The density of populations may also vary: in large stands, it ranges from sparse growth (1-3 adult individuals/10 m²) to almost entire ground cover (more than 20 adult individuals/10 m²) (Nielsen *et al*., 2005).

A strong decline in species richness has been observed in abandoned grasslands and ruderal habitats in Latvia due to *H. sosnowskyi* presence (Nielsen *et al*., 2005). In amenity areas, established colonies compete strongly with, and rapidly replace most other plants except trees. Along riverbanks, it can almost totally replace the natural vegetation and threaten biodiversity, including fauna associated with (native) plants, building a 'giant hogweed landscape' (Nielsen *et al*., 2005). Nevertheless, these impacts are nuanced in Thiele & Otte (2007), stating that loss of plant species diversity in habitats invaded by *H. mantegazzianum* in Germany is a general symptom of successional changes rather than a particular effect of invasive species.

Hybridization of both *H. mantegazzianum* and *H. sosnowskyi* with the native *Heracleum sibiricum* is expected in Lithuania (Z. Gudžinskas, pers. comm., 2007).

How much economic impact would the pest have in the PRA area:

Low to moderate
Medium uncertainty

In other countries than the ones where the species is already present, impacts are expected to be lower than in the Baltic States, since there had not been extensive planting of the species in these countries.

CONCLUSIONS OF PEST RISK ASSESSMENT

Summarize the major factors that influence the acceptability of the risk from this pest:

Estimate the probability of entry:

Moderate
Medium uncertainty

- Soil/growing medium (with organic matters) as a commodity: unlikely to moderately likely in EU countries, unlikely in non EU EPPO countries.

- Involuntary entry with soil as a contaminant on used machinery: moderately likely

The probability of *H. sosnowskyi* to be on tires of used machinery is quite high, but the movement of such machinery is considered to be restricted to local areas, or neighbouring countries.

- Involuntary entry with soil as a contaminant on used vehicles: moderatly likely. The probability of the seed of *H. sosnowskyi* to be a contaminant of vehicles is lower than its probability to be associated to machinery, but the movement of vehicles is

more frequent and widespread than the movement of machinery.

- Involuntary entry with soil as a contaminant on footwear: moderately likely.

- Voluntary entry for agricultural (used as a fodder, melferifous plant) or ornamental purposes: unlikely. The species is not used as a fodder anymore, and there is no record of its use as an ornamental plant.

Estimate the probability of establishment:

Moderate
Medium uncertainty

H. sosnowskyi is already established in some countries of the EPPO region, though, it has been planted there, and the species is unlikely to be planted in other countries. The species would enter a new country as a seed, and it has a short longevity and needs cold temperatures for 2 months. The temperate countries seem to have a more suitable climate.

Estimate the potential economic impact:

Moderate
Medium uncertainty

The most important impact are on:

- Erosion of river banks
- Costs of management of the plant
- Impact on biodiversity through competition with other species
- Human health,

Degree of uncertainty

Medium

When performing the PRA the following uncertainties have been identified:

- The difficulty in differentiating the *Heracleum* species adds uncertainty in the PRA and interpretation of the literature.
- Longevity of seeds
- Soil pathway: volumes, frequency, uses
- Impact on environment.

OVERALL CONCLUSIONS

The species represents a threat to land and biodiversity and human health, in Baltic countries, where the plant has been largely planted. Voluntary introduction is unlikely, and the most likely entry pathways identified are not regulated (in the European Union). National management measures could be efficient measures as well.

STAGE 3: PEST RISK MANAGEMENT

IDENTIFICATION OF THE PATHWAYS

Pathways studied in the pest risk management

- Soil/growing medium (with organic matters) as a commodity
- Involuntary entry with soil as a contaminant on used machinery
- Involuntary entry with soil as a contaminant on used vehicles
- Involuntary entry with soil as a contaminant on footwear

Other pathways identified but not studied

- Voluntary entry for agricultural (used as a fodder, melferifous plant) or ornamental purposes. The species is not used as a fodder anymore, and there is no record of its use as an

ornamental plant.

IDENTIFICATION OF POSSIBLE MEASURES

Possible measures for pathways	**<u>Soil/growing medium (with organic matters) as a commodity (for entry in the EU)</u>**
Measures related to consignments:	/
Measures related to the crop or to places of production:	Pest-free place of production Pest-free area
Other possible measures	Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

Possible measures for pathways	**<u>Involuntary entry with soil as a contaminant on used machinery</u>**
Measures related to consignments:	Cleaning of machinery
Measures related to the crop or to places of production:	/
Other possible measures	Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

Possible measures for pathways	**<u>Involuntary entry with soil as a contaminant on used vehicles</u>**
Measures related to consignments:	/
Measures related to the crop or to places of production:	/
Other possible measures	Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

Possible measures for pathways	**<u>Involuntary entry with soil as a contaminant on footwear</u>**
Measures related to consignments:	/
Measures related to the crop or to places of production:	/
Other possible measures	Publicity to enhance public awareness on pest risks Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

EVALUATION OF THE MEASURES IDENTIFIED IN RELATION TO THE RISKS PRESENTED BY THE PATHWAYS

Degree of uncertainty Low

CONCLUSION:
Recommendation for possible measures (type presentation):

Soil/growing medium (with organic matters) as a commodity (for entry in the EU)	*PC* AND Pest free areas (see ISPM no. 4) Or Pest free place of production A lower level of protection can be achieved with: Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

Involuntary entry with soil as a contaminant on used machinery	Cleaning of machinery A lower level of protection can be achieved with: Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

Involuntary entry with soil as a contaminant on used vehicles	Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

Involuntary entry with soil as a contaminant on footwear	Publicity to enhance public awareness on pest risks Internal surveillance and/or eradication campaign (See EPPO PM9 on *Heracleum* spp.)

References

Cabinet of Ministers Order No. 426 (2006) On Distribution Control Program of Giant Hogweed for the Period of 2006-2012

Holm B (2005) Biology, distribution and control of invasive *Heracleum* species. Master thesis in Estonian Agricultural University.

Jahodová Š, Fröberg L, Pyšek P, Geltman D, Trybush S & Karp A (2007) Taxonomy, Identification, Genetic Relationship and Distribution of Large *Heracleum* Species in Europe (Chapter 1). In Pyšek P, Cock MJW, Nentwig W, Ravn HP (eds) (2007) Ecology and management of Giant Hogweed (*Heracleum mantegazzianum*). CAB International. P. 1-19.

Laivins M, Gavrilova G (2003) *Heracleum sosnowskyi* in Latvia: sociology, ecology and distribution. *Latvijas Veģetācija* **7**, 45-65.

Moravcová L, Pyšek P, Krinke L, Pergl J, Perglová I & Thompson K (2007) Seed Germination, Dispersal and Seed Bank in *Heracleum mantegazzianum* (Chapter 5) in Pyšek P, Cock MJW, Nentwig W, Ravn HP (eds) (2007) Ecology and management of Giant Hogweed (*Heracleum mantegazzianum*). CAB International. P. 74-91

Nielsen C, Ravn HP, Nentwig W & Wade M (eds.) (2005) The Giant Hogweed Best Practice Manual. Guidelines for the management and control of an invasive weed in Europe. - Forest and Landscape Denmark, Hoersholm, 44 pp.
http://www.giant-alien.dk/pdf/Giant_alien_uk.pdf

Oboļeviča D (2001) [Hogweed and its distribution in Latvia].
http://www.lva.gov.lv/daba/eng/biodiv/lauks_latvanis_e.htm

Thiele J & Otte A (2007) Impact of *Heracleum mantegazzianum* on invaded vegetation and human activities. In Pyšek P, Cock MJW, Nentwig W, Ravn HP (eds) (2007) Ecology and management of Giant Hogweed (*Heracleum mantegazzianum*). CAB International. P. 144-156

Tkachenko KG (1989) Peculiarities and seed productivity in some *Heracleum* species grown in Leningrad area. *Rastitelnye Resursy* **1**, 52–61. [In Russian.]

Appendix 2

Climatic prediction for *Heracleum sosnowskyi*

The CLIMEX model is a computer programme aiming at predicting the potential geographical distribution of an organism considering its climatic requirements. It is based on the hypothesis that climate is an essential factor for the establishment of a species in a country.

For *Heracleum sosnowskyi*, a match climate has been performed.

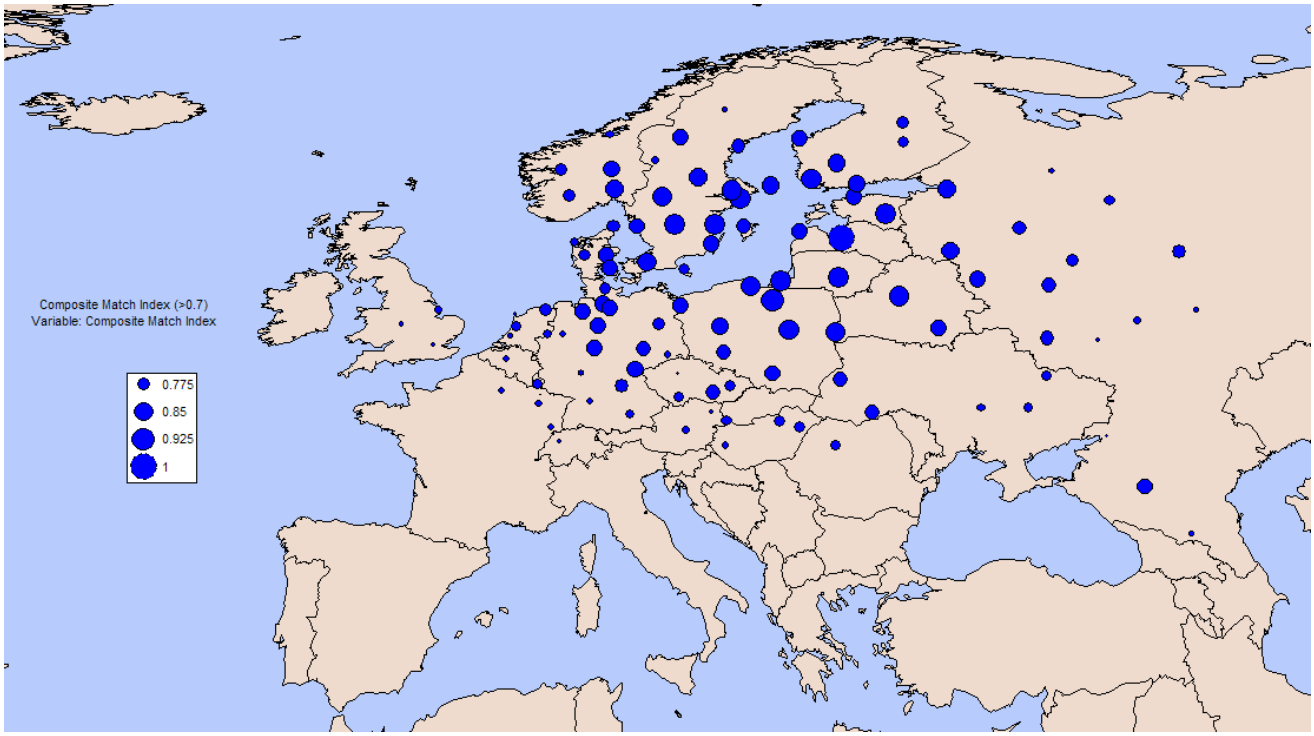
1. **Geographical distribution of the species**

H. sosnowskyi is native from the mountainous areas: Caucasus, Transcaucasia, and North-East Turkey (Jahodová *et al*., 2007) but is invasive in Baltic countries having a different climate, where it has been introduced as a fodder crop.
It is associated with areas with warm to hot wet summers and cool winters. It is not favoured by dry conditions. The new shoots of *H. sosnowskyi* are rather cold resistant and can survive –4 to –7°C. It is found that starting from the second year, they can survive up to–25°C, and under a snow cover, even down to -45°C (Oboļeviča, 2001). Seeds germinate in early spring (but not during summer) and require a period of cold stratification for breaking dormancy (less than 2 month). This makes the plant adapted to temperate climates, and probably unadapted to Mediterranean climates.
The distribution of the species is:
EPPO region: Armenia (native), Azerbaidzhan, Russia (Karachay-Cherkessia, Kabardino-Balkaria, North Ossetia, Ingushetia, Chechnya, Dagestan and possibly Black Sea coast), Belarus, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Russia (Central and Northern), Ukraine (introduced).

2. **Match climates**

Comparing Riga and Vladikavkav with the world with the software CLIMEX, it appears that central Europe and Scandinavia are the areas the most at risk.
Countries with similar climates are: Austria, Belarus, Belgium, Czech Republic, Denmark, Estonia, Finland, France (North-East), Germany, Hungary, Latvia, Lithuania, Norway, Poland, Romania, Russia, United Kingdom (South-East), Slovakia, Sweden, Switzerland, Ukraine.

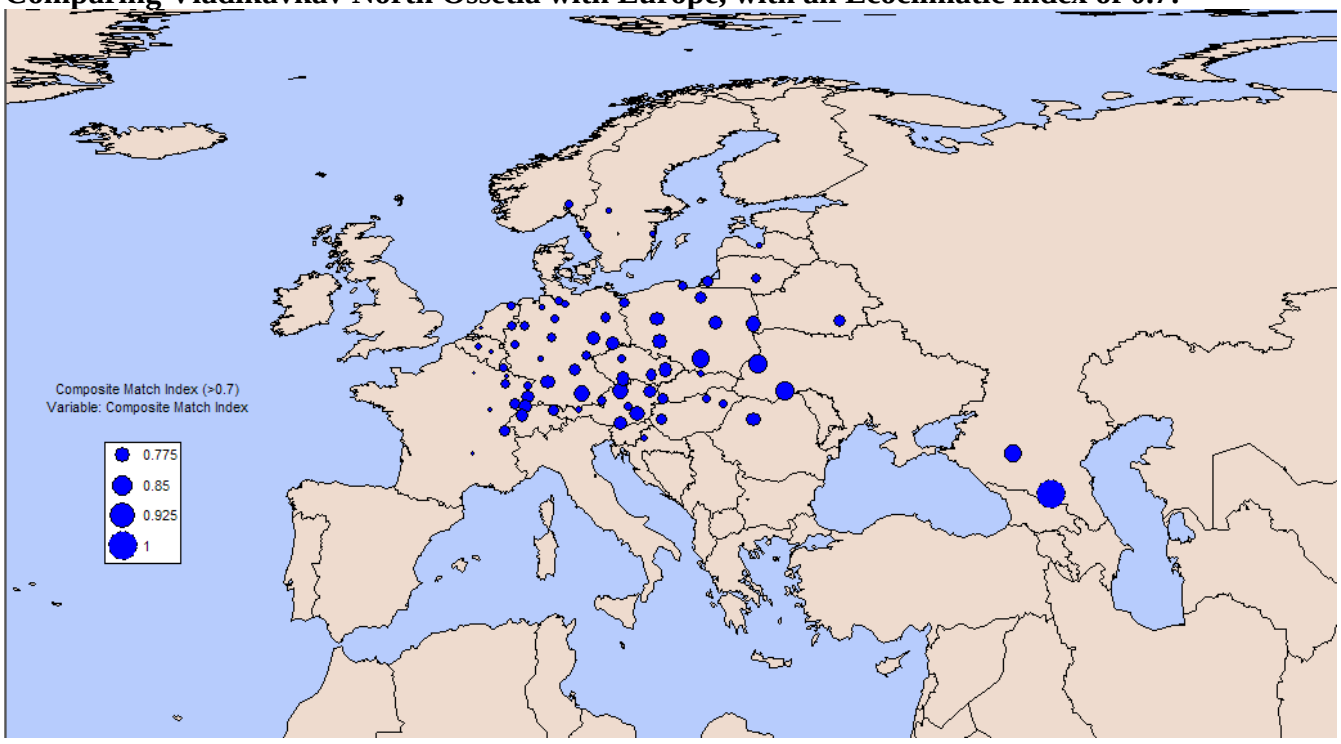
Comparing Riga (Latvia) with Europe, with an Ecoclimatic index of 0.7:



Areas where the species is present do not appear on this match climate map (e.g. Armenia)

Countries with similar climates are: Austria, Belarus, Belgium, Czech Republic, Denmark, Estonia, Finland, France (North-East), Germany, Hungary, Latvia, Lithuania, Norway, Poland, Romania, Russia, United Kingdom (South-East), Slovakia, Sweden, Switzerland, Ukraine.

Comparing Vladikavkav North Ossetia with Europe, with an Ecoclimatic index of 0.7:



Countries having a similar climate with Vadikakav are almost the same as the ones having a similar climate with Riga.

Countries like Armenia, Azerbaijan may not appear as the plant is present in these areas in mountainous areas, while there are only a few climatic stations for these areas in CLIMEX which may not capture these climatic conditions.