Identification of micro-reserves in a context of urban sprawl for the preservation of the endangered endemic

*Acis nicaeensis* in the Maritime Alps

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Urban sprawl in biodiversity hotspot

Maritime Alps regional biodiversity hotspot

One of the 11 regional biodiversity hotspot in Mediterranean Basin (Quézel & Médail 1997, 1999)

One of the 52 glacial refugia for plants (Médail & Diadema 2009)

- High species diversity level (around 2900 native plants)
- High endemism level (around 160 endemic plants)
- Both center of persistence and speciation for plant species
Urban sprawl in biodiversity hotspot
Urban sprawl in biodiversity hotspot

In this context of a severe conflict between biodiversity and human activities, how can we identify sites to preserve population viability of an endemic plant?

How can we combine landscape and evolutionary approaches to highlight population vulnerability?
A narrow endemic plant

*Acis nicaeensis*, Riviera snowflake

Narrow endemic geophyte from the Maritime Alps (distribution cover 12 x 35 km)

Calcareous rocky grassland from thermo-mediterranean to upper meso-mediterranean vegetation levels (from 5 m to 970 m in elevation)

Reduced dispersal capacity

EN in the French Red List
Delimitation of conservation units (ESU)

The use of genetic and ecological distinctiveness to delineate conservation units (Crandall 2000)

Haplotype + ecological group = unit
3 cpDNA haplotypes detected

For the 63 individuals from 22 populations by combining the polymorphisms of five loci.

Conservation units

3 Ecological groups

21 populations (15 environmental and ecological variables on 100 m² relevés).

Distribution of the 5 conservation units
Defined according to the cpDNA haplotype and the ecological group


Source: bd alti 25 IGN, IMBE, SILENE-Flore
QGIS software
Assessment using vulnerability indice

Using the level of current urbanization and the area of *Acis nicaeensis* populations to quantify its vulnerability

Urbanization level + population surface area = vulnerability indice

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<thead>
<tr>
<th>Superficie</th>
<th>Urbanization</th>
<th>Low</th>
<th>High</th>
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<tbody>
<tr>
<td>Large</td>
<td>III</td>
<td>V0</td>
<td>V3</td>
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<td></td>
<td>II</td>
<td>V0</td>
<td>V4</td>
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<tr>
<td>Small</td>
<td>I</td>
<td>V0</td>
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V0: population of any size with no urbanization
V1: population with low urbanization
V2 and V3: medium or high urbanization according to population size
V4: small or medium and highly urbanized population
Vulnerability

Population structure

🌱 **Data collection of 662 points of occurrence** in SILENE-Flore database ([http://flore.silene.eu](http://flore.silene.eu))

🌱 **Assessment of historical localities from herbarium specimens** (n=195) >> 78 historical occurrences

🌱 **Delimitation of populations** based on geographical discontinuities (>500 m between two populations) >> 52 populations (QGIS)

🌱 **Surface area of each population** as the size of polygon (QGIS) >> 3 classes of superficies (< 20 ha; 20-50 ha, > 50ha)

🌱 **Number of individuals for each population** >> 5 categories (< 100 ind.; 100-200 ind.; 200-500 ind.; 500-1000 ind.; > 1000 ind.)
Urbanization level and urban sprawl

- Artificialisation level was calculated for a 100 x 100 m grid, each representing « past urbanization » and « actual urbanization » pooled in 5 class value of urbanization (0; <25%; 25-50%; 50-75%; > 75%)
- Urbanization of population = mean of all grid value within a population polygon
- Urban sprawl = difference between the 2 values (Actual value minus Past value)
Assessment on vulnerability indices based on urbanization level and population surface area

Significant correlation between the disappearance of 10 populations and the urban sprawl (permutation test, p < 5 %)

Pouget et al. submitted
Actual protected area network

Is protected network sufficient to avoid the loss of the evolutionary potential of the snowflake?

Proportion of each population in protected areas (sensu IUCN categories I to IV)

Pouget et al. submitted
Actual protected area network

Is the N2000 network sufficient to avoid the loss of the evolutionary potential of the snowflake?

Proportion of each population in Natura 2000 network

Source: bd alti 25 IGN, INPN, IMBE, SILENE-Flore
QGIS software
Implications for conservation

Combined spatial and evolutionary approach

- Conservation units (ESU)
- Population vulnerability
- Protected area networks

Identification of rapid setting up of micro-reserves network to avoid the loss of the evolutionary potential of *Acis nicaeensis*
Thank you for your attention