2nd Mediterranean Plant Conservation Week
" Conservation of Mediterranean Plant Diversity: Complementary Approaches and new Perspectives "

# Identification of micro-reserves in a context of urban sprawl for the preservation of the endangered endemic *Acis nicaeensis* in the Maritime Alps

**K. Diadema[1], M. Pouget[2], A. Baumel[2], F. Médail[2]**

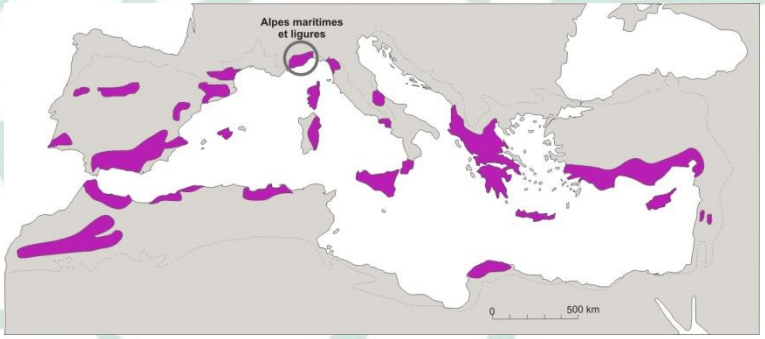
[1] Conservatoire botanique national méditerranéen de Porquerolles (CBNMed)

[2] Aix Marseille Université, Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale (IMBE)

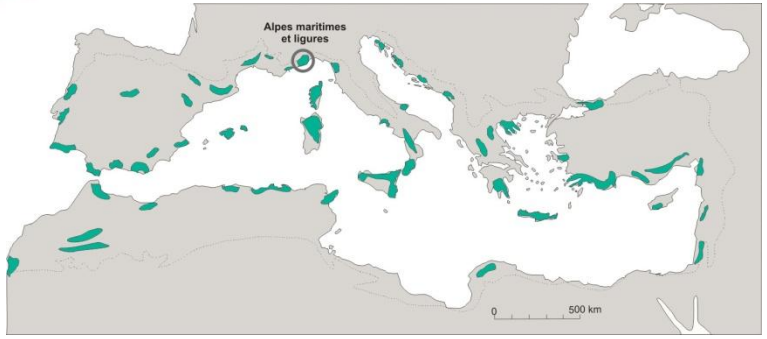
Supported by MAVA FONDATION POUR LA NATURE

# Urban sprawl in biodiversity hotspot

## Maritime Alps regional biodiversity hotspot




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

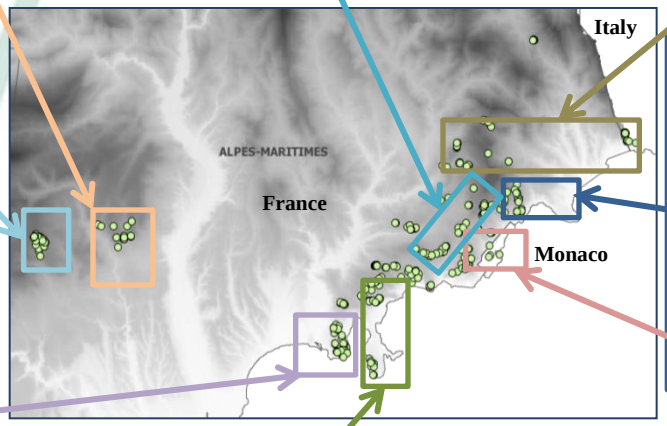



One of the 52 glacial refugia for plants (Médail & Diadema 2009)

- High species diversity level (around 2900 native plants)
- High endemism level (around 160 endemic plants)
- Both center of persistance and speciation for plant species

imbe
Institut méditerranéen de biodiversité et d'écologie marine et continentale
Aix Marseille université
Conservatoire Botanique National Méditerranéen
PORQUEROLLES

# Urban sprawl in biodiversity hotspot




imbe
Institut méditerranéen de biodiversité et d'écologie marine et continentale

Aix*Marseille université

Conservatoire Botanique National Méditerranéen

PORQUEROLLES

# Urban sprawl in biodiversity hotspot

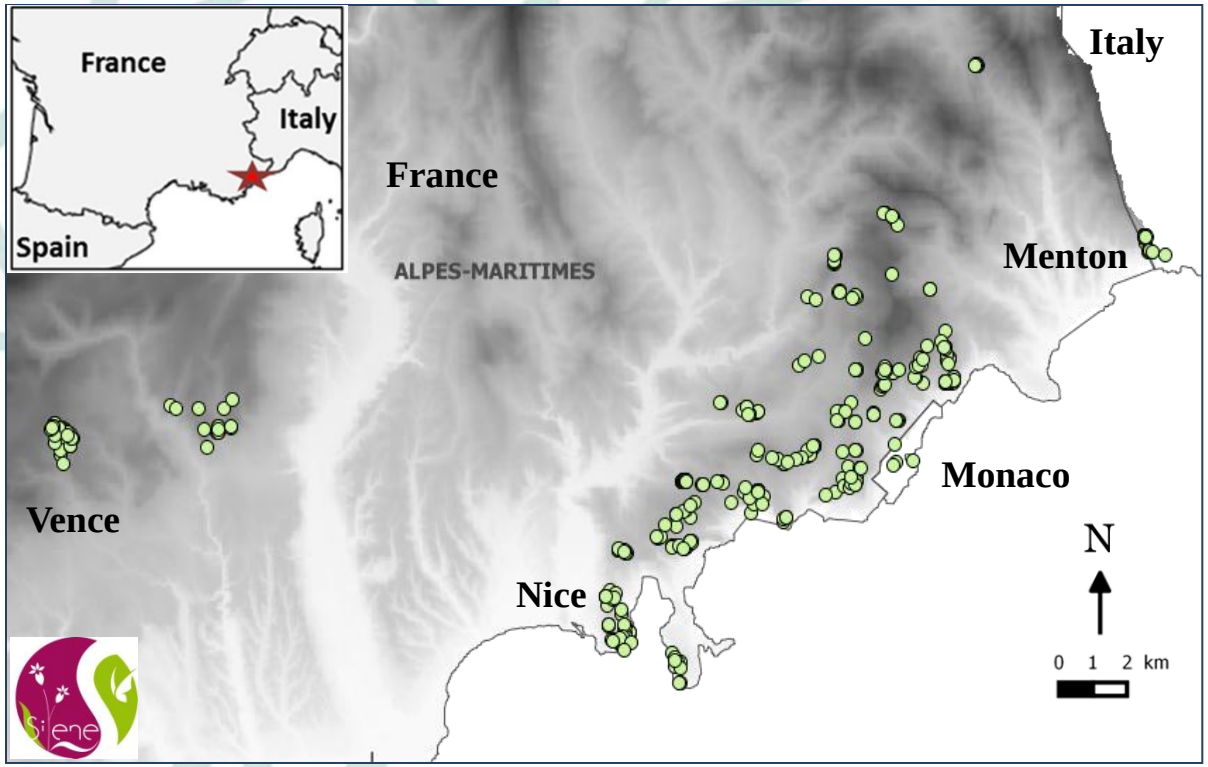
**In this context of a severe conflict between biodiversity and human activities, how can we identify sites to preserve population viability of an endemic plant?**

**How can we combine landscape and evolutionary approaches to highlight population vulnerability?**

imbe
Institut méditerranéen de biodiversité et d'écologie marine et continentale
Aix Marseille université
Conservatoire Botanique National Méditerranéen
PORQUEROLLES

# A narrow endemic plant

## *Acis nicaeensis*, Riviera snowflake



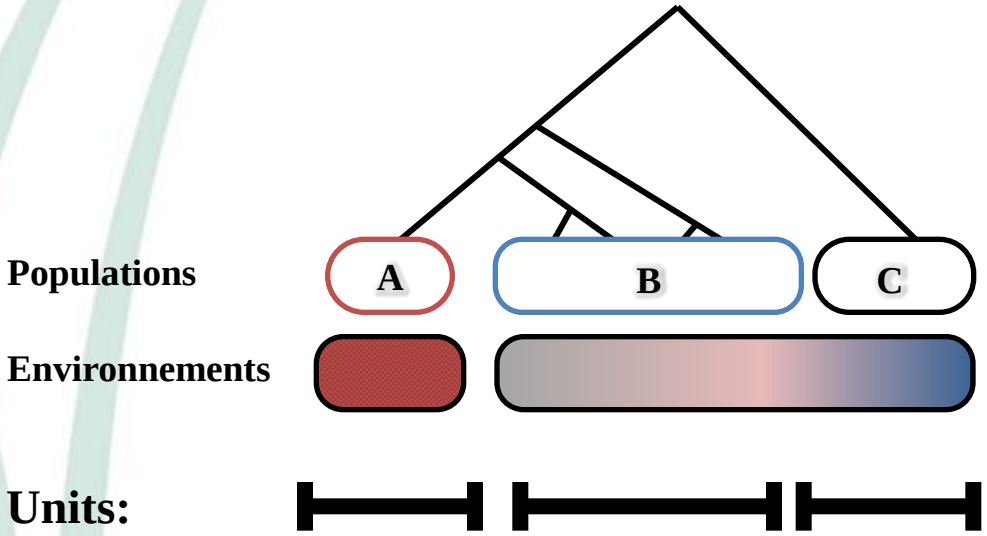

- Narrow endemic geophyte from the Maritime Alps (distribution cover 12 x 35 km)
- Calcareous rocky grassland from thermo-mediterranean to upper meso-mediterranean vegetation levels (from 5 m to 970 m in elevation)
- Reduced dispersal capacity
- EN in the French Red List

# Conservation units

## Delimitation of conservation units (ESU)

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

Haplotype + ecological group = unit

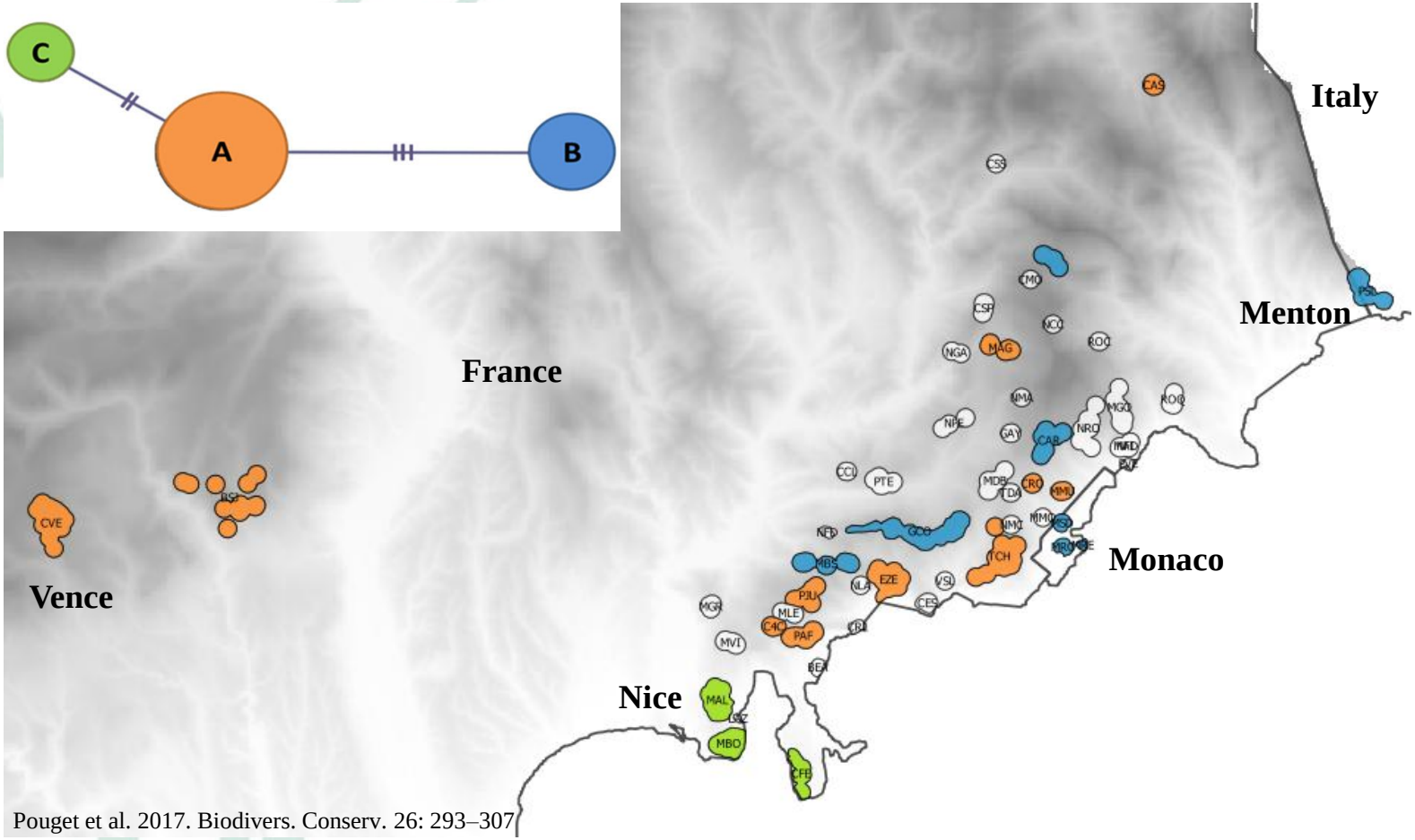


# Conservation units

## 3 cpDNA haplotypes detected

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



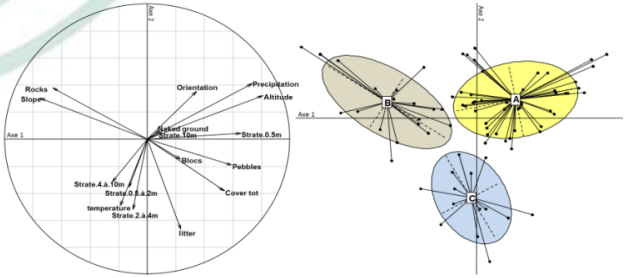




Pouget et al. 2017. Biodivers. Conserv. 26: 293–307

# Conservation units

## 3 Ecological groups

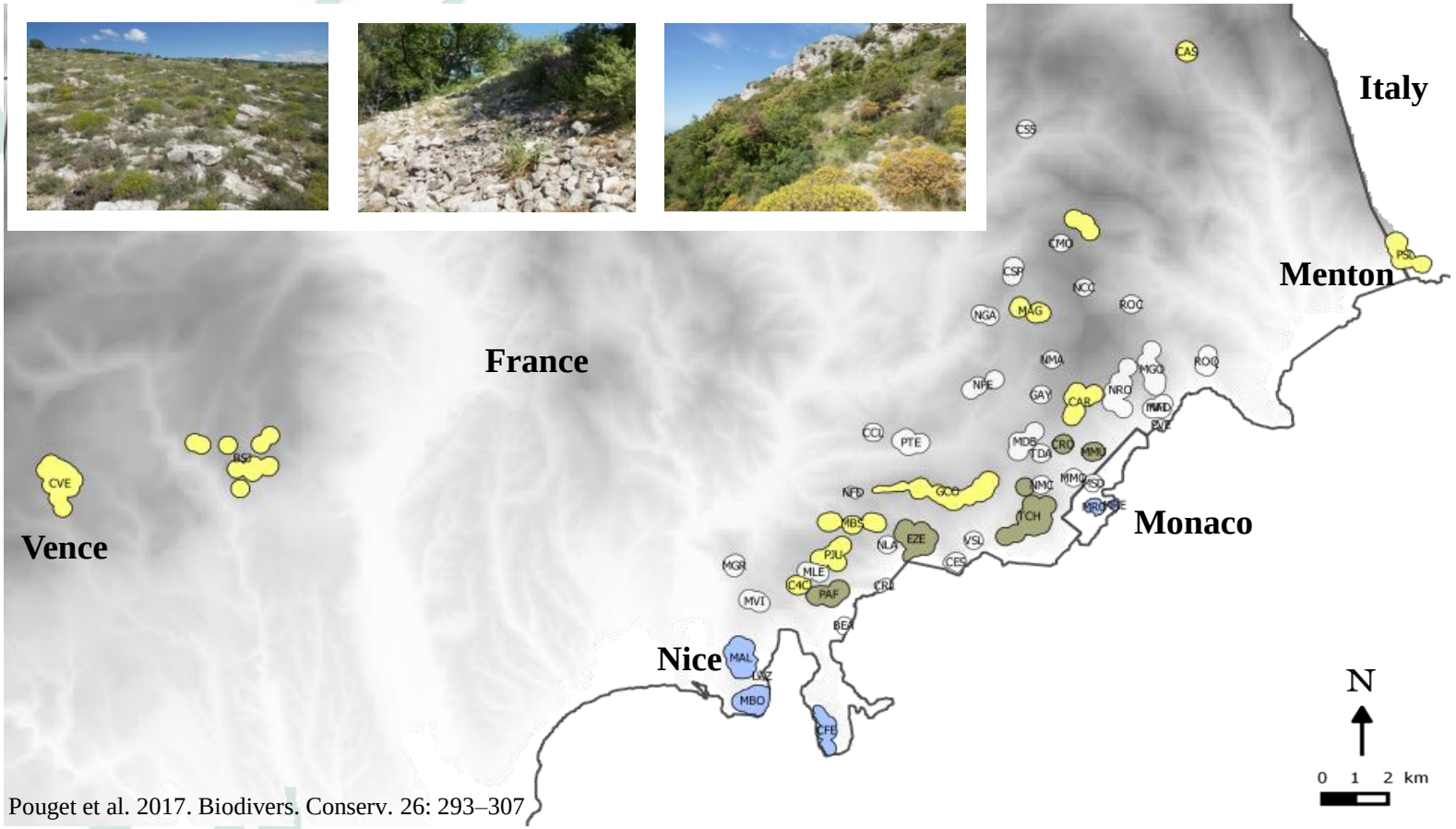
21 populations (15 environmental and ecological variables on 100 m² relevés).









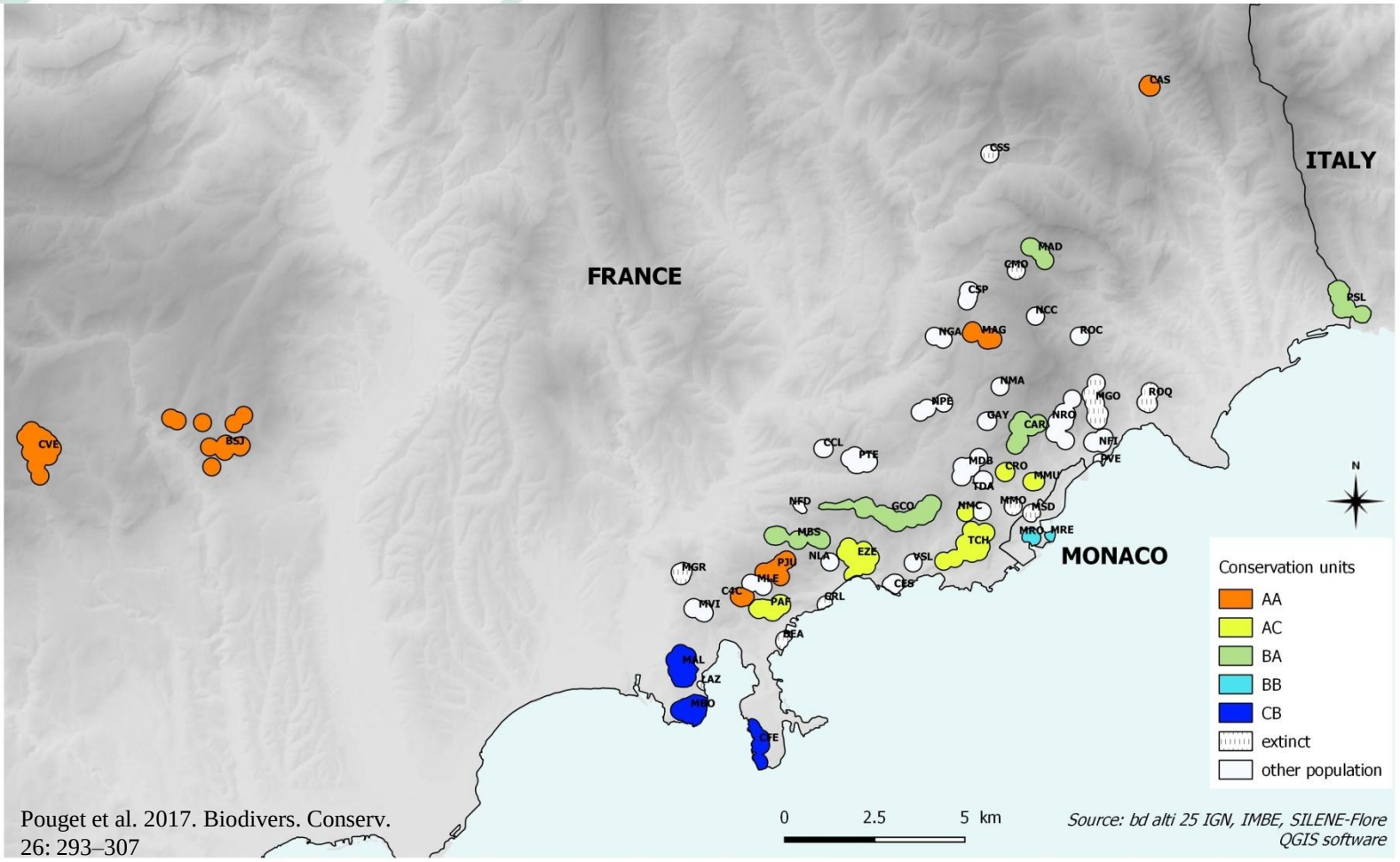




Pouget et al. 2017. Biodivers. Conserv. 26: 293–307

# Conservation units

## Distribution of the 5 conservation units

Defined according to the cpDNA haplotype and the ecological group




Pouget et al. 2017. Biodivers. Conserv. 26: 293–307

# Vulnerability

## 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

| Superficie \ Urbanization | | Low → High | | | |
|---|---|---|---|---|---|
| | | I | II | III | IV |
| Large → Small | III | V0 | V0 | V2 | V3 |
| | II | V0 | V1 | V2 | V4 |
| | I | V0 | V1 | V3 | V4 |

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

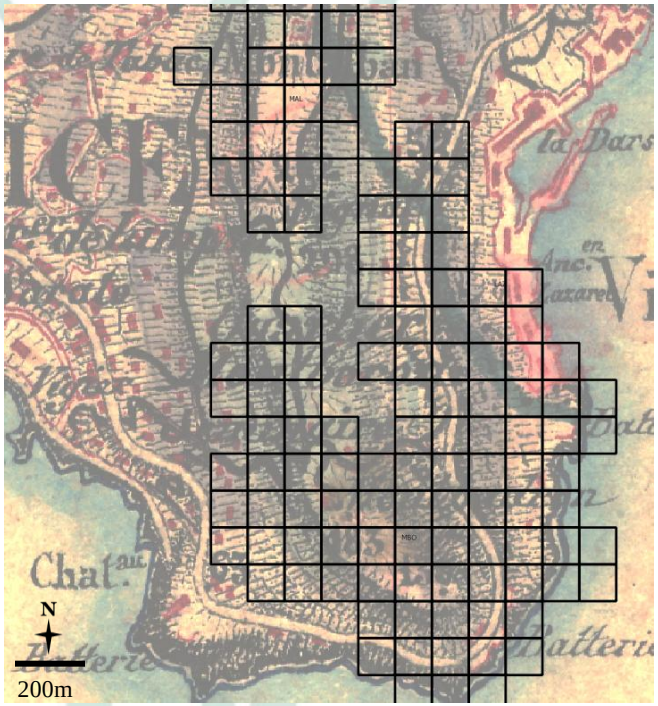
## Population structure

- **Data collection of 662 points of occurrence** in SILENE-Flore database (http://flore.silene.eu)
- **Assesment of historical localities from herbarium specimens** (n=195) >> 78 historical occurences
- **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.)

# Vulnerability

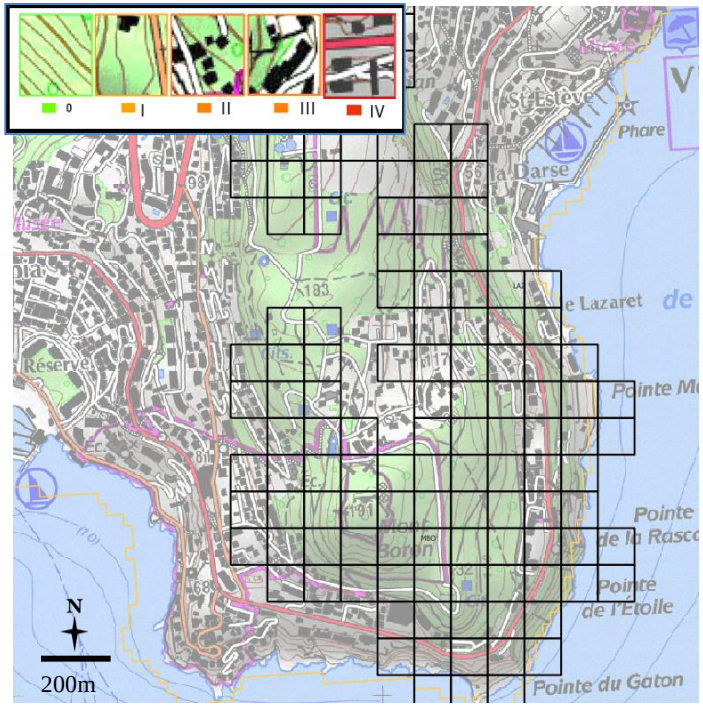
## Urbanization level and urban sprawl

- **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)




Past land-use (1820-1866)

+ 150 years



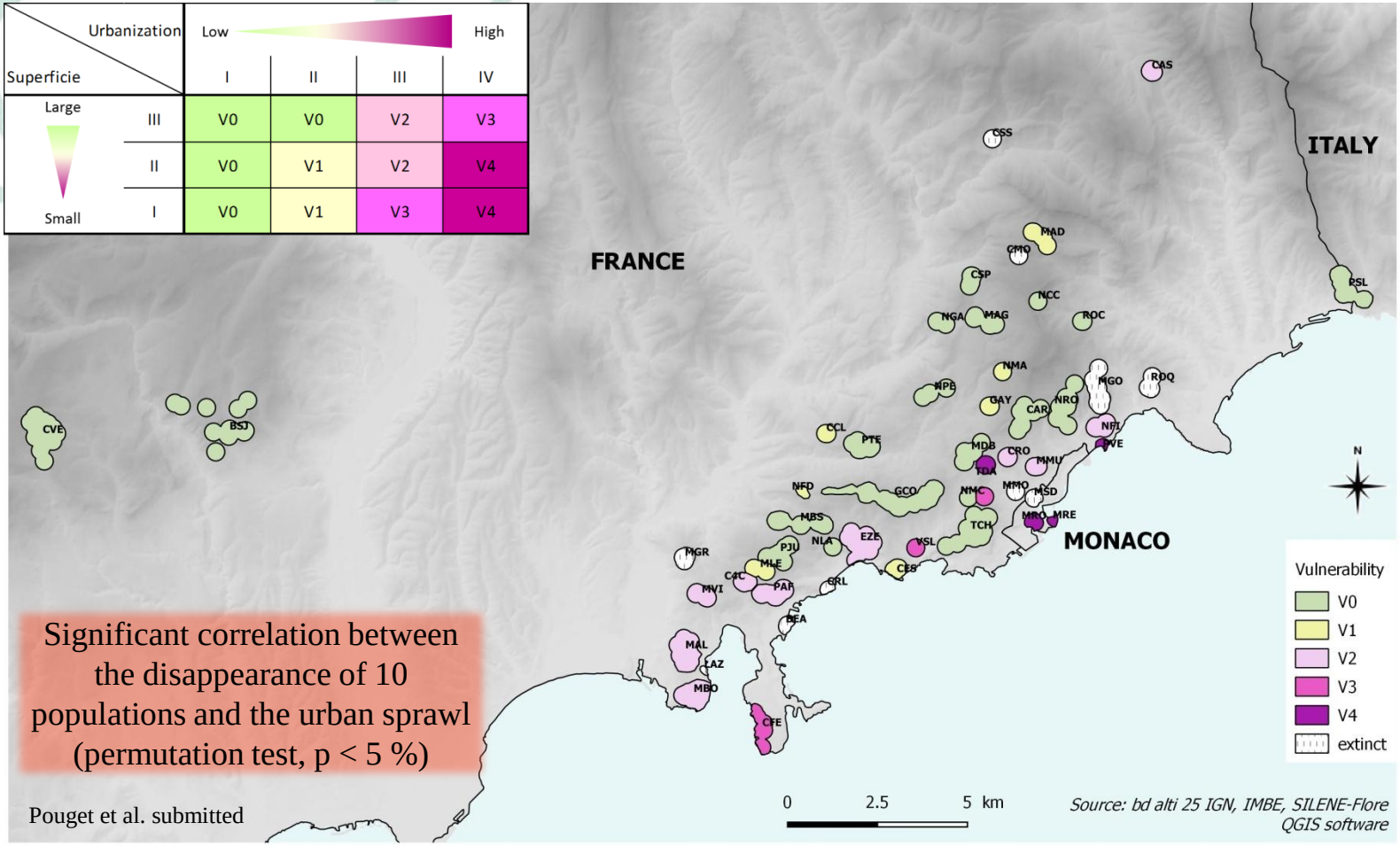

Current land-use (2006)

# Vulnerability

## Population vulnerability

Assessment on vulnerability indices based on urbanization level and population surface area

| Superficie \ Urbanization | | Low → High | | | |
|---|---|---|---|---|---|
| | | I | II | III | IV |
| Large | III | V0 | V0 | V2 | V3 |
| | II | V0 | V1 | V2 | V4 |
| Small | I | V0 | V1 | V3 | V4 |

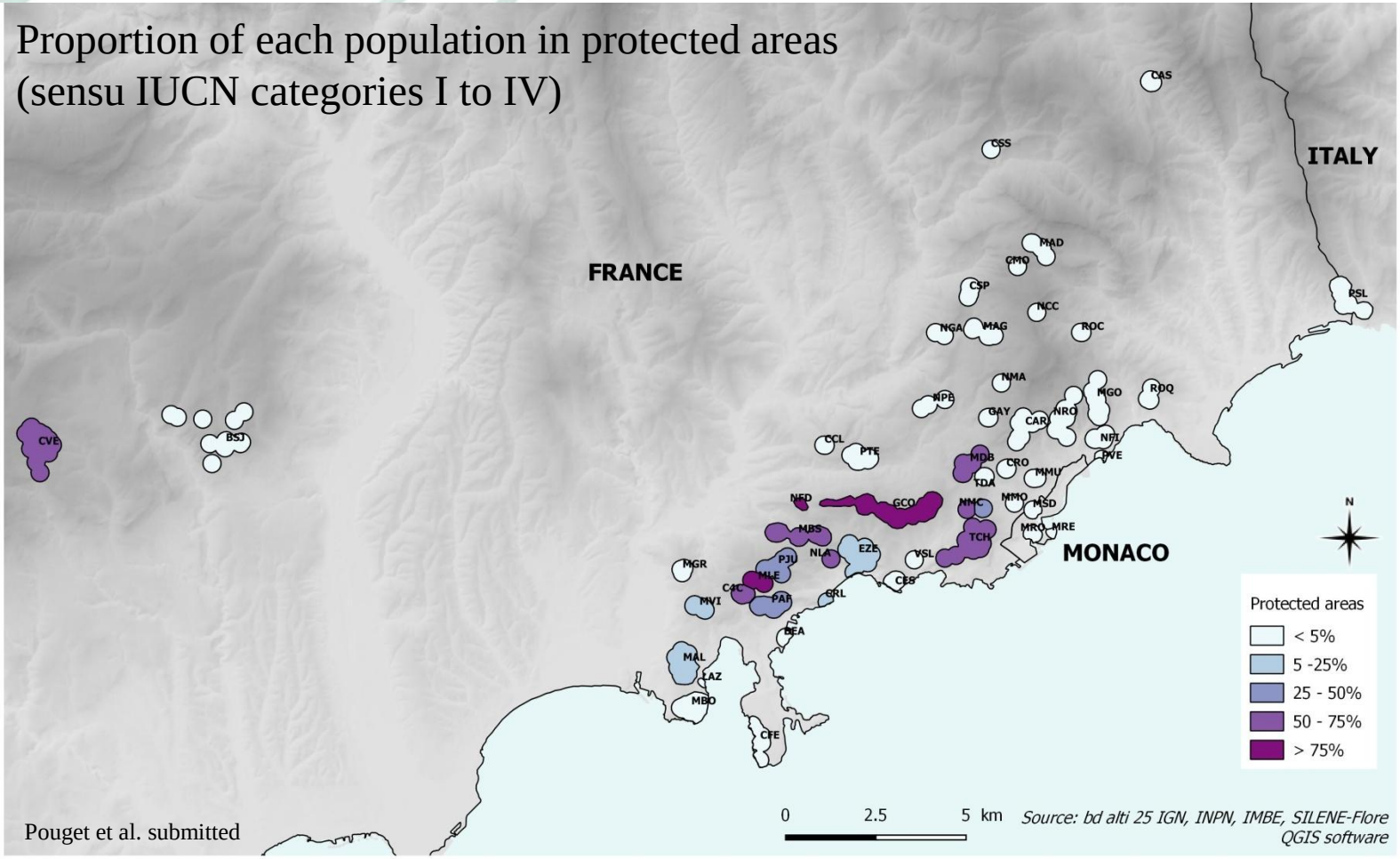



Significant correlation between the disappearance of 10 populations and the urban sprawl (permutation test, $p < 5\ \%$)

Pouget et al. submitted

# Actual protected area network

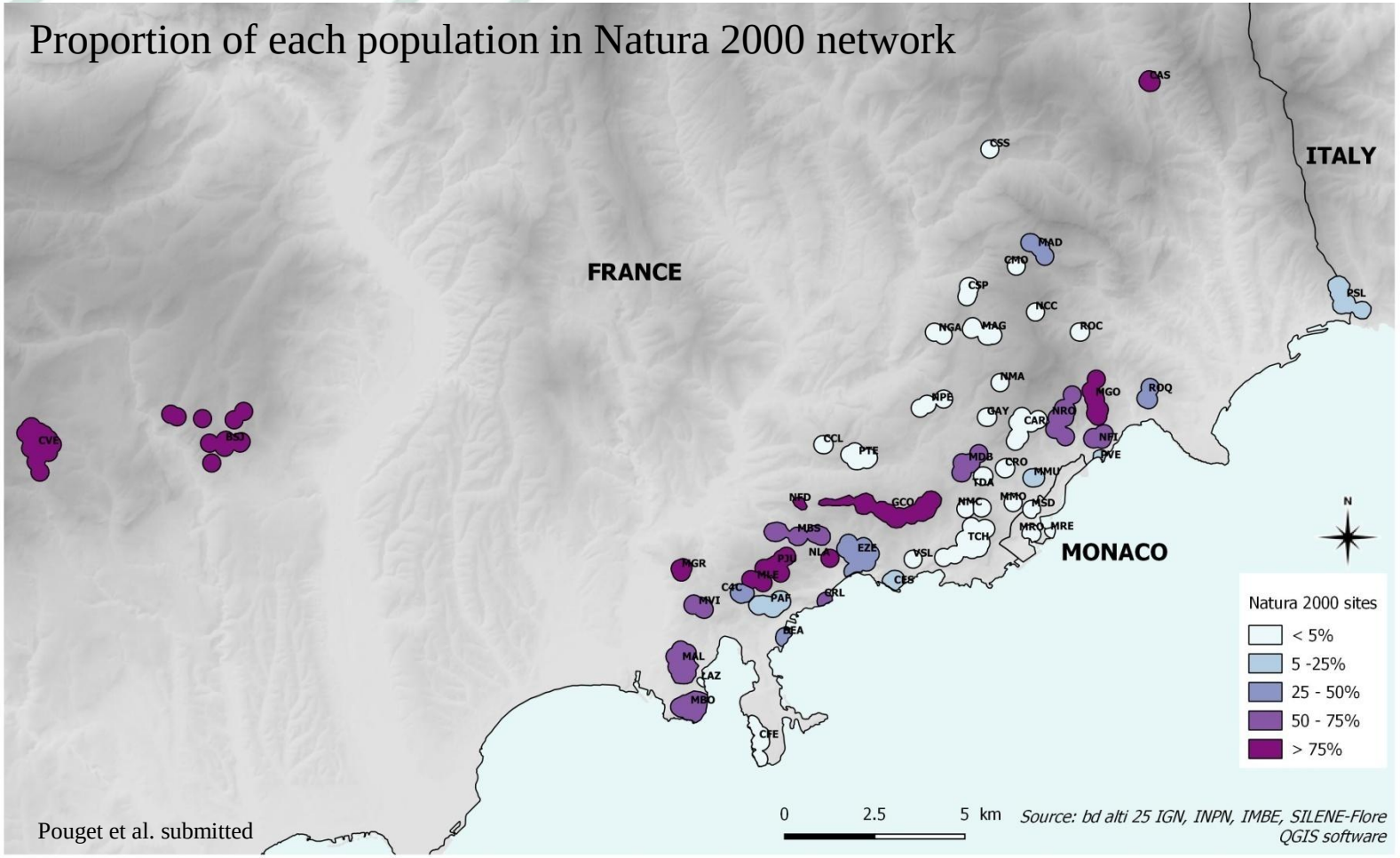
## Is protected network sufficient to avoid the loss of the evolutionary potential of the snowflake?




Pouget et al. submitted

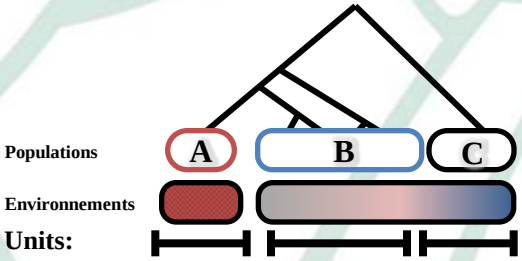
# Actual protected area network

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



# Implications for conservation

## Combined spatial and evolutionary approach




Conservation units (ESU)

| Superficie \ Urbanization | Low → High | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| Large ↓ Small III | V0 | V0 | V2 | V3 |
| II | V0 | V1 | V2 | V4 |
| I | V0 | V1 | V3 | V4 |

Population vulnerability

NATURA 2000

Protected area networks

**Identification of rapid setting up of micro-reserves network to avoid the loss of the evolutionary potential of *Acis nicaeensis***

imbe
Aix*Marseille université
Conservatoire Botanique National Méditerranéen
PORQUEROLLES

# Thank you for your attention

© P. Amblard

Project supported by