PLEIADES HR
A TOOL FOR BIODIVERSITY CONSERVATION

Case of Common Hamster on the Alsace Plain

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EO imagery and biodiversity

Potential of Earth Observation data for green and blue landscape networks characterization and biodiversity conservation

- Benefit of Pléiades HR images

Assessment of EO data efficiency with the case of the Common Hamster in Alsace (the most endangered mammal in France – protected species today)

Characterization of hamster biotope through the analysis of burrows’ environment

- landcover mapping and monitoring, highlighting hamster-friendly crops
- favorable crops density analysis

SPOT 5 data = basis of the study, method transposable to other optical HR and VHR data

- Geometric and thematic benefits of Pléiades HR through simulated data (Worldview-2)
Context of the study

France sued for non-assistance by the European Commission

La France est toujours sous le coup d’une amende de 17 millions d’euros
Pléiades HR, a tool for biodiversity conservation: case of Common Hamster on the Alsace Plain

Context of the study
Presentation of the Common Hamster

A small rodent, in France only present on the Alsace plain

- An element of the national natural heritage

Population in 2011:
~460 individuals, when survival is estimated to require 1500 individuals

Weight: 200 - 500 g
Length: 20 - 30 cm, of which tail: 5 - 7 cm

Behaviour: solitary, crepuscular or nocturnal, keeps to its burrow during the day
Moves little, a maximum of 300 m from its burrow
Home range of 2.50 hectares for males, 0.50 ha for females
Hibernates from end September to end March
Habitat: animal feed crops (alfalfa, clover) and winter cereals (wheat, barley)

Seen as a pest in the past

Today, a critically endangered species, the most endangered mammal in France, part of an ecosystem, participates in a natural equilibrium

- A Protected Species in France since 1993 (as are the wolf, lynx and bear): EU Habitats Directive, ministerial decree in 1996
Pléiades Days
Toulouse, France - January 17, 2012

Pléiades HR, a tool for biodiversity conservation: case of Common Hamster on the Alsace Plain

Context of the study
Causes of the Common Hamster decline

The threats to the hamster
1. Mono-culture: reduction of animal fodder and winter cereals, replaced by intensive maize production that reaches 70 to 80% on the Alsace plain
2. Urban development, that eats into the natural environment
3. Fragmenting ecosystems through road infrastructure: isolating populations
4. Natural predation on the remaining weak populations
5. The impact of phytosanitary products

Distribution of the remaining population centres in 2008

Population evolution within the historical ranges of the hamster

Number of individuals
Context of the study
Plan of action for Common Hamster conservation in Alsace

Plan of Action (2007-2011) to insure the longterm viability of the hamster populations in France

- Conserve and restore habitats, concentrating on targeted areas (for example financial support for winter crops)
- Population monitoring
- Inform the public
- Conservation of the Alsatian genetic type in order to proceed with reinforcing the populations
- Launch of research programmes with foreign partners

➢ Elaboration of a new plan in 2012

Hamster’s environment mapping in Alsace using EO imagery

Study carried for the DREAL Alsace (Regional Direction of French Ministry of Environment)

➢ To analyze and monitor the pressures exerted on the rodent
➢ To rapidly assess the effectiveness of the existing environmental biodiversity protection measures

Analysis realised using burrows surveyed in 2009, 2010 and 2011
Landcover mapping using SPOT 5 HR data
Acquisition of satellite data at the end of hibernation
Pléiades Days
Toulouse, France - January 17, 2012

Landcover mapping using SPOT 5 HR data
Differentiation of winter cereals and feed crops

Landcover mapping using 5 classes
1. Feed crops
2. Winter cereals
3. Bare soils
4. Artificial features (urban areas, large transport infrastructure)
5. Others: forest, prairies, vineyards, water bodies

Biotope of the hamster

Landcover mapping in 2 stages
1. Processing of the whole image
2. Validation within a 300 m radius of each burrow


A transferable method to other high and very high resolution optical sensors (Pléiades HR ...)

Example of hamster’s historical area in Alsace
Landcover mapping using SPOT 5 HR data
Geographic analysis

Isolated burrows and landscape fragmentation

Winter crops parcels separated by a very busy road

Isolated burrow
Problem for meeting
and reproduction

600 m
Landcover mapping using SPOT 5 HR data

Geographic analysis

Isolated burrows, landscape fragmentation, unfavourable environment

- Urban encroachment: No favorable crops
- Isolated burrow: No favorable crops
- Road network fragmentation

➢ Human pressures on the hamster populations
Landcover mapping using SPOT 5 HR data
Statistical analysis

Burrows - 2010
Objective: 22 % of winter crops in burrow environs

Feed crops: 4.8 %
Winter cereals: 20.1 %

- These 2 classes (Hamster biotope) = 24.9 % of burrows’ environment in 2010

Feed crops: 4.6 %
Winter cereals: 16.3 %

- These 2 classes (Hamster biotope) = 20.9 % of burrows’ environment in 2011

- Decrease of favorable crops in 2011 surrounding burrows (increase between 2009 and 2010)
Spatial distribution of hamster-friendly crops
Density indicators generation

Survival and development of Common Hamsters depend on a fairly dense spatial distribution of winter crops

- Good proportion of favorable crops inefficient if not well distributed
- Winter crops should be in every burrow environment
- Dense spatial distribution favorable to hamster biotope expansion and its development
- Connected burrows leading to hamsters meetings and reproduction

➢ Generation of winter crops density indicators ...
Pléiades HR, a tool for biodiversity conservation: case of Common Hamster on the Alsace Plain

Spatial distribution of hamster-friendly crops
Density indicators generation

Favorable and unfavorable areas highlighted
- Favorable areas: dense winter crops environment
- Vision of possible networks and their quality: biotope connected or not
- Ecological corridors at a local scale revealed

Exemple of winter crops density indicator in the main area

Percentage of favorable crops in 300 m radius area in 2010:
- > 40 %
- < 40 %
- < 22 %
- < 10 %
- < 5 %

Favorable crop
Artificial feature
Burrow surveyed on field in 2010
Spatial distribution of hamster-friendly crops
Temporal evolution of density indicators

Major changes in favorable area distribution
- Increase of critical areas in 2011
Spatial distribution of hamster-friendly crops
Density indicators: need of annual monitoring

- Big changes in classification because of crops turnover
- Favorable and unfavorable areas movement
- Network evolution, changes in burrows connection
- Need of annual monitoring
- Major roads = connection barriers but not taken into account in these indicators

Percentage of favorable crop in 300 m radius area:

- > 40 %
- < 40 %
- < 22 %
- < 15 %
- < 10 %
- < 5 %
Landcover mapping using Pléiades HR-like data
A more detailed analysis

Work in progress with sub-metric Worldview-2 data (0.50m resolution)

- to evaluate the potential of Pléiades HR data in this application of biodiversity conservation

Improvements both thematically and geometrically thanks to spatial resolution:

- more precise detection of landscape features
- better differentiation between favorable crops and prairies
- detection of agricultural works

Worldview-2 data of end of March 2011 over the main area
Landcover mapping using Pléiades HR-like data
A more detailed analysis

More precise detection of landscape features

- More precision as regards of the limits of parcels
- Better distinction between neighbouring narrow parcels

- Smaller elements can be identified
Need of detecting smallest and narrowest parcels of favorable crops, which are as important as the largest ones for hamster conservation
- More detail in landcover mapping and density analysis

= Geometrical and thematical improvements
Landcover mapping using Pléiades HR-like data
A more detailed analysis

Better differentiation between favorable crops and prairies

SPOT 5
- Similar spectral signatures
- Spatial resolution not sufficient
  ➢ Errors are possible in landcover mapping

Pléiades HR like
- Texture of sub-metric data reveals furrows in agricultural fields
  ➢ distinction of crops and prairies
  ➢ Thematic improvement
Landcover mapping using Pléiades HR-like data
A more detailed analysis

Detection of agricultural works

SPOT 5: coarse detection of parcels

Pléiades HR like: detection of furrows, harvested crops, plastic covering ...
= Thematic improvement
**Conclusion - Perspectives**

**Benefits of Earth Observation HR and VHR optical data in characterising Common Hamster biotope within the context of species conservation**

- EO data well adapted to multi-scale and multi-temporal analysis
- Work applicable to the whole green and blue landscape network and then to other regional (Curlew, Capercaillie, Green Toad ...) or international endangered species

Operational application, interest of DREAL Alsace for an annual monitoring ➔ proposed by SERTIT

**Geometric and thematic benefits of Pléiades HR-like data for small scales biotopes characterization**

- Expectations related to Pléiades HR commissioning phase
  - an ever improved mapping of the landscape
  - spring and autumn acquisitions
Thank you for your attention
Many thanks to the ORFEO Pléiades team