# SARSAR – SR/00/372

## Automatic redevelopment sites monitoring using SAR and OPTICAL images

### WP1 – Users' Needs

# Overview

1. Introduction
2. Users' needs and requirements
3. Evaluation criteria
4. User feedback

# 1. Introduction

- WP1 Users' Needs
  - Definition:
    - "Establish detailed requirements for the service"
  - Objectives:
    - "To consolidate the requirements for the development of the EO service for dynamic monitoring of RDSs"
    - "To verify if the requirements fulfill the user needs and, if not, to modify them accordingly"

# 1. Introduction

- Project goals

→ Avoid misleading the actors who consult the RDS inventory (available on line since 2017)

→ Reduce time spend on inventory update as the DGO4 estimates that less than 10% of RDSs are likely to "change" from one year to the next

# 1. Introduction

- SAR project (DGO4-ISSeP internal subvention)
  - 2213 RDSs over 3800ha in Wallonia in 2017
  - RDS Inventory update with ortho-photos: photo-interpretation by an operator to detect and qualify change on all sites (ISSeP)
    - Done with ortho-photos from 2012/2013, 2015 & 2016
    - Ongoing with ortho-photos from 2018

  Will be used to validate the SARSAR methodology

# 1. Introduction

- SAR project: methodology
  - Quantification and qualification of a series of predefined and visually observable changes

**Superficies**

**Pourcentage superficie – T0**

*Pourcentage estimé de classe de superficie à 5%. La somme doit faire 100%.*

**Bâtiments** 10 %

**Végétation** 40 %

**Sol** 50 %

**Pourcentage superficie – T1**

*Pourcentage estimé de classe de superficie à 5%. La somme doit faire 100%.*

**Bâtiments** 10 %

**Végétation** 40 %

**Sol** 50 %

**Pourcentage superficie – T2**

*Pourcentage estimé de classe de superficie à 5%. La somme doit faire 100%.*

**Bâtiments** 5 %

**Végétation** 40 %

**Sol** 55 %

| Végétation |
|---|
| Spontanée |
| Abords |
| Terrain de sport |
| Forêt |
| Parc |
| Jardin privé |
| Prairie / Surface enherbée |

| Bâtiments |
|---|
| Unique |
| Multiple |
| Pavillonnaire |
| Simple |
| Composé |
| Spécial / Autre |
| Ruine |
| Shed |
| Construction temporaire |
| Panneaux solaires |

| Sol |
|---|
| Voie d'accès |
| Parking |
| Chemin |
| Zone de stockage structurée |
| Zone de stockage déstructurée |
| Sol nu |
| Terrassement |
| Plan d'eau |
| Revêtement artificiel |
| Engins de chantier |

| N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|

# 1. Introduction

- SAR project: example




Pourcentage superficie – T0

*Pourcentage estimé de clas*

**Bâtiments** 75 %

**Végétation** 10 %

**Sol** 15 %

Pourcentage superficie – T1

*Pourcentage estimé de cl*

**Bâtiments** 0 %

**Végétation** 5 %

**Sol** 95 %

Evolution de la végétation

**T0 - Type de végétation**

| | NON | OUI |
|---|---|---|
| Spontanée | | X |
| Abords | | X |
| Terrain de sport | X | |
| Forêt | X | |
| Parc | X | |
| Jardin privé | X | |
| Prairie / Surface enherbée | X | |

**T1 - Type de végétation**

| | N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|---|
| Spontanée | | X | | | | | |
| Abords | | | | | | | X |
| Terrain de sport | X | | | | | | |
| Forêt | X | | | | | | |
| Parc | X | | | | | | |
| Jardin privé | X | | | | | | |
| Prairie | X | | | | | | |

**T2 - Type de végétation**

| | N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|---|
| Spontanée | | | X | | | | |
| Abords | | | | | | | X |
| Terrain de sport | X | | | | | | |
| Forêt | X | | | | | | |
| Parc | X | | | | | | |
| Jardin privé | X | | | | | | |
| Prairie | X | | | | | | |

# 1. Introduction

- SAR project: example

Evolution des bâtiments

**T0 - Types de bâtiments**

| | NON | OUI |
|---|---|---|
| Unique | | X |
| Multiple | X | |
| Pavillonnaire | X | |
| Simple | X | |
| Composé | | X |
| Spécial / Autre | X | |
| Ruine | | X |
| Shed | X | |
| Construction temporaire | X | |
| Panneaux solaires | X | |

**T1 - Types de bâtiments**

| | N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|---|
| Unique | | X | | | | | |
| Multiple | X | | | | | | |
| Pavillonnaire | X | | | | | | |
| Simple | X | | | | | | |
| Composé | | X | | | | | |
| Spécial / Autre | X | | | | | | |
| Ruine | | X | | | | | |
| Shed | X | | | | | | |
| Construction temporaire | X | | | | | | |
| Panneaux solaires | X | | | | | | |

**T2 - Types de bâtiments**

| | N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|---|
| Unique | X | | | | | | |
| Multiple | X | | | | | | |
| Pavillonnaire | X | | | | | | |
| Simple | X | | | | | | |
| Composé | X | | | | | | |
| Spécial / Autre | X | | | | | | |
| Ruine | X | | | | | | |
| Shed | X | | | | | | |
| Construction temporaire | X | | | | | | |
| Panneaux solaires | X | | | | | | |

Evolution Sols

**T0 - Types de couverture de sol**

| | NON | OUI |
|---|---|---|
| Voie d'accès | X | |
| Parking | X | |
| Chemin | X | |
| Zone de stockage structurée | X | |
| Zone de stockage déstructurée | X | |
| Sol nu | | X |
| Terrassement | X | |
| Plan d'eau | X | |
| Revêtement artificiel | | X |
| Engins de chantier | X | |

**T1 - Types de couverture de sol**

| | N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|---|
| Voie d'accès | X | | | | | | |
| Parking | X | | | | | | |
| Chemin | X | | | | | | |
| Zone de stockage structurée | X | | | | | | |
| Zone de stockage déstructurée | X | | | | | | |
| Sol nu | | | | | X | | |
| Terrassement | | | X | | | | |
| Plan d'eau | X | | | | | | |
| Revêtement artificiel | | | | | | | X |
| Engins de chantier | | | X | | | | |

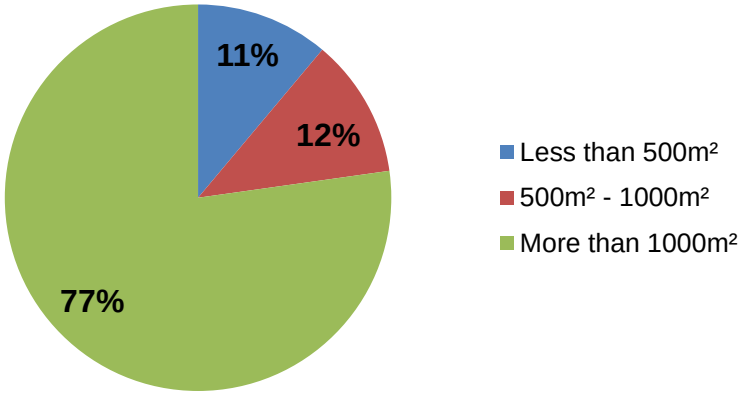
**T2 - Types de couverture de sol**

| | N/A | Disparition | Apparition | Diminution | Augmentation | Réaménagement | Stable |
|---|---|---|---|---|---|---|---|
| Voie d'accès | X | | | | | | |
| Parking | X | | | | | | |
| Chemin | X | | | | | | |
| Zone de stockage structurée | X | | | | | | |
| Zone de stockage déstructurée | X | | | | | | |
| Sol nu | | | | X | | | |
| Terrassement | | X | | | | | |
| Plan d'eau | X | | | | | | |
| Revêtement artificiel | | | | X | | | |
| Engins de chantier | | X | | | | | |

# 1. Introduction

- Sentinel data
  - Sentinel-2:
    - Spatial resolution: 10 m
    - Estimated minimal RDS area for change detection: 500 m²
    - Clouds
    - Sensitive to spectral properties
  - Sentinel-1:
    - Spatial resolution: 20 m
    - Estimated minimal RDS area for change detection: 1000 m²
    - Sensitive to height, shape and water content
  - Sentinel-1 & Sentinel-2
    - Proportion of RDS area

    Based on the 2213 sites in 2017



# 2. Users' needs and requirements

"Analysis of users' needs and analysing the requirements"

- Users' needs
  - Lower costs by limiting the number of sites to be field verified
  - Automate, as much as possible, change detection
  - Facilitate the work of the operators by pre-identifying the elements to check
  - Decrease the subjectivity of the operator

# 2. Users' needs and requirements

- Users' requirements
  - Determination of categories of changes → highlight different types of change scenarios and their importance
  - Deadlines for the RDS inventory updates
  - Respect of the users' priorities
  - Dissemination and sharing of results
  - Implementation of trainings

# 2. Users' needs and requirements

- Users' needs vs requirements

| Requirements / Needs | Categories and types of changes | Deadlines | Users' priorities | Dissemination and sharing | Trainings |
|---|---|---|---|---|---|
| Lower costs | | X | X | | |
| Change detection automatisation | | | | X | |
| Type of change pre-identification | X | | X | | X |
| Decreased subjectivity | X | | | | X |

# 2. Users' needs and requirements

- Categories and types of changes

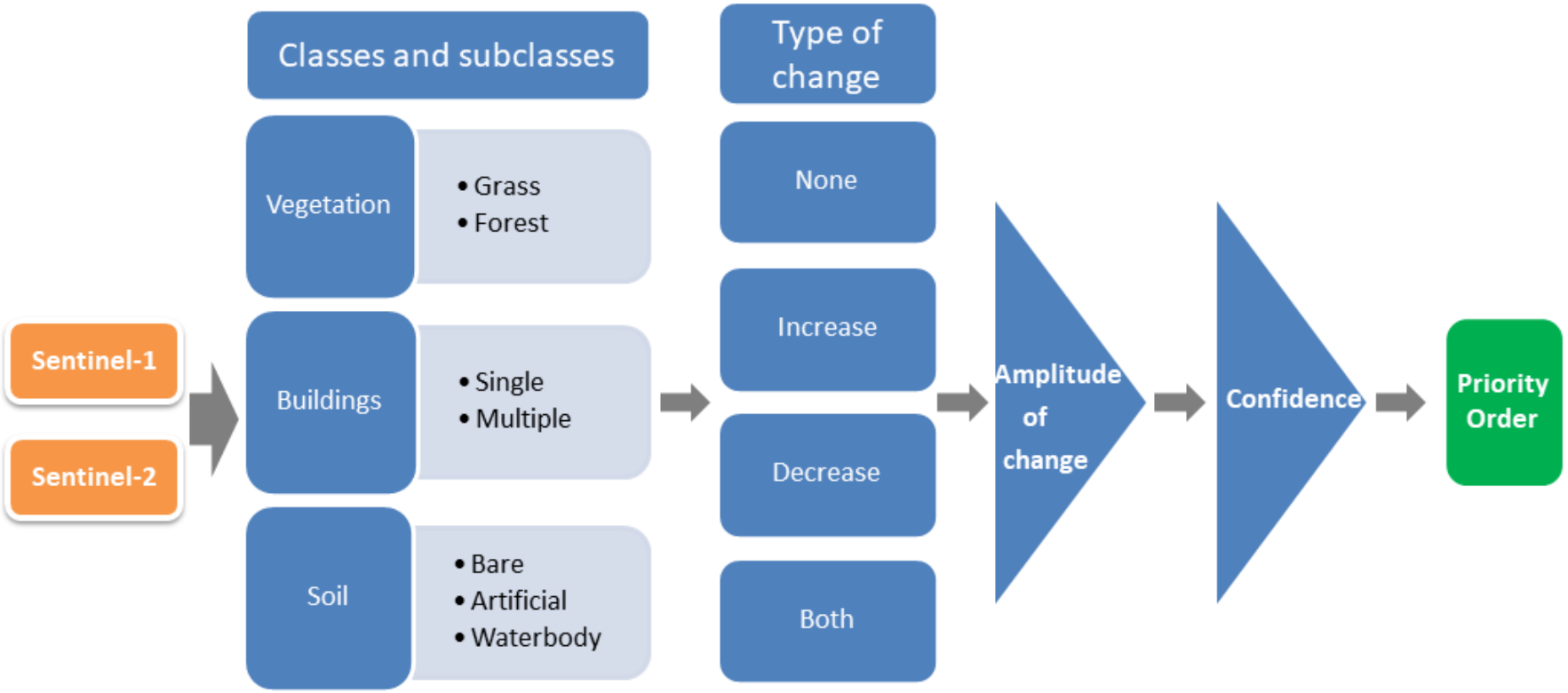
Categories of changes → highlight different types of change scenarios and their importance:

- Must have: list of sites with their probability of having changed (based on the list of the sites most likely to have not changed)

- Nice to have: confidence, site-by-site, of changes based on a selection of pre-established scenarios (categories and types of changes). Importance of taking into account specific situations where no long-term change may mean that the site is maintained (e.g. pasture meadow)

# 2. Users' needs and requirements

- Categories and types of changes: Process



# 2. Users' needs and requirements

- Deadlines
  - Two time steps proposed:
    - Must have: 1 time per year
    - Nice to have: 1 time every 2 months

    → The process will thus be applied several times

    → Two values will be reported for each RDS

    → Reliability will be different due to the noise in the Sentinel-1 data and variability in the availability of Sentinel-2 images
  - On demand (special request)

# 2. Users' needs and requirements

- Users' priorities
  - Impossibility to set up a project and obtain a result which is exhaustive, with a strong confidence in the accuracy and which makes it possible to minimize the costs of future management
  - According to users' needs:
    1. Completeness
    2. Reliability
    3. Money saving (as long as the budget remains within the realistic range of 100 sites field verified per year)

# 2. Users' needs and requirements

- Dissemination and sharing
  - Method:
    - Python scripts
    - Terrascope Virtual Machine
  - Format:
    - Easy-to-use and sustainable:
      - CSV
      - TXT
    - The file will include:
      - Identifier of the RDS
      - Priority order based on change detection
    - Results sent by email
    - Raw results will be made available on demand
    - Nice to have:
      - WFS
      - Alert system on the RDS website

# 2. Users' needs and requirements

- Trainings
  - Face-to-face
  - ½ to 1 day
  - Theoretical and practical parts
  - User manual in PDF

- The service may be presented to national events and existing Regional Earth Observation Working Groups:
  - GTEO
  - GT-COWAL
  - …

# 2. Users' needs and requirements

- Summary of the proposed solutions

| Requirements | | Proposed solutions |
|---|---|---|
| Categories and types of changes | | • 3 classes et 7 subclasses<br>• 4 types<br>• Amplitude<br>• % of confidence |
| Deadlines | | • 1X/year<br>• On demand<br>• Nice to have: 1X/2months |
| Users' priorities | | 1. Completeness<br>2. Reliability<br>3. Money saving |
| Dissemination and sharing | Method | • Python Scripts<br>• Terrascope Interface<br>• Sent via email |
| | Format | • CSV or TXT files with ID & Priority order<br>• Raw data on demand<br>• Nice to have: WFS<br>• Nice to have: alert system on the RDS website |
| Trainings | | • ½ to 1 day<br>• Theoretical and practical parts<br>• Manual<br>• Working Groups |

# 3. Evaluation criteria

"Definition of the evaluation criteria and performance metrics"

- The data will be validated and evaluated throughout the project lifetime
- A Validation report will provide estimates of the completeness and reliability of change detection based on 'historical' data provided by the Walloon Region (DGO4)

# 3. Evaluation criteria

- Technical evaluation:
  - Verification based on the reference RDS inventories carried out by ISSeP (SAR project)
  - Image-based verification at higher spatial resolution: Peliades (method to be developed in WP3)
  - Field verification by the DGO4 based on:
    - Validation grid set up by ISSeP
    - Photos if necessary

# 4. User feedback

"Review of user feedback and update of the requirements"

- Regular evaluation of user feedback and update of the Users'Needs

- Evaluation and approbation of the feedback:
  - by all 3 partners (DGO4/ERM/ISSeP)
  - Face-to-face meetings or conference calls
  - Documented in the minutes


Thank You