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## LIFE Nature & Biodiversity – Demonstration project

Reference : LIFE14 NAT/BE/000364

Duration : 2015 - 2020

Budget : > 5 M€



Wallonie



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Budget : > 5 M€

Partnership : Multi-sectorial collaboration



*“ Industry – Public Authority – University – NGO ”*



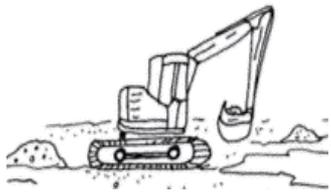
## LIFE Nature & Biodiversity – Demonstration project

Partnership : 17 companies deliberately committed to nature conservation

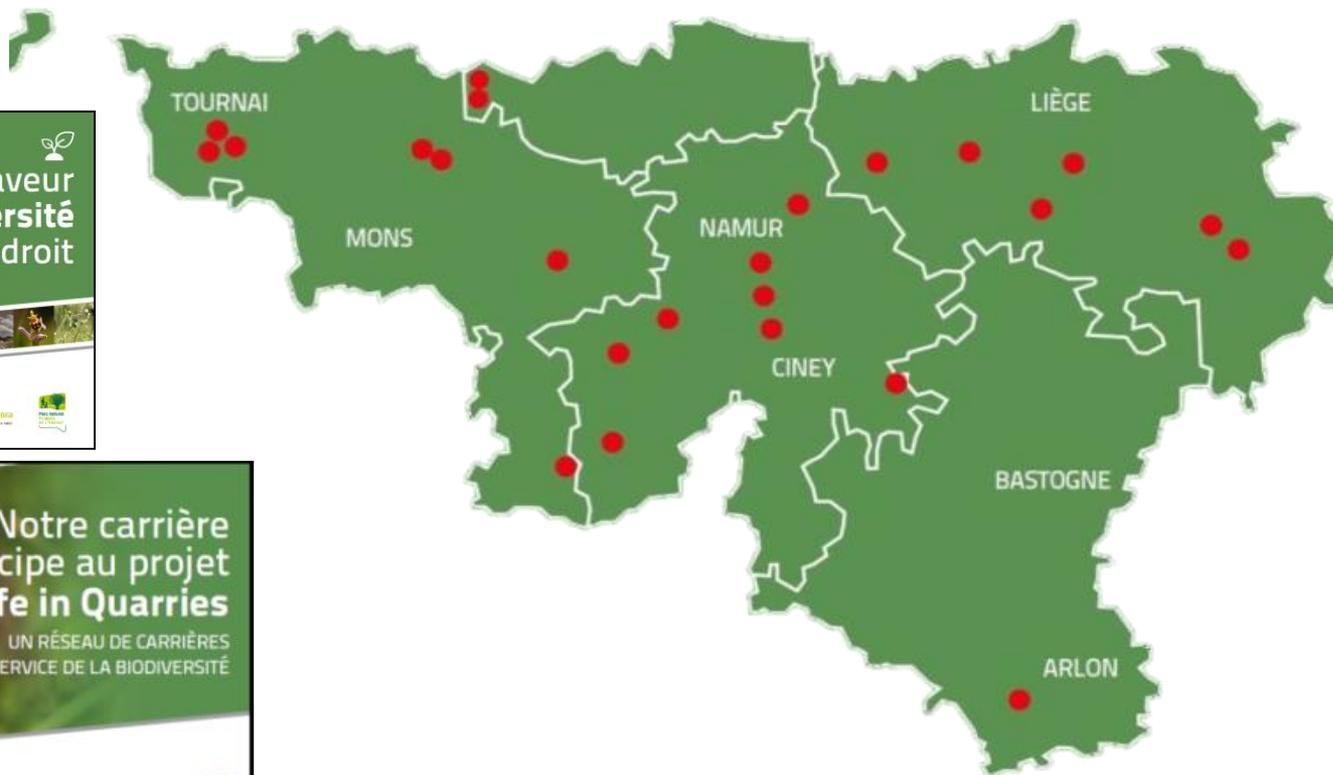


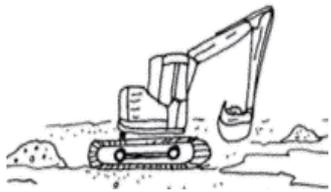
CARRIÈRES DU HAINAUT





## A network of quarries active for biodiversity





## A network of quarries active for biodiversity



*Ecosystem services (ES) = contribution of ecosystems (possibly in combination with other human inputs) to human well-being*



**Regional and local climate**

Floods, erosion

Soil pollution, H<sub>2</sub>O, air

Biological processes

**Regulating**

**Living environment -**

Leisure - Tourism

Experiences and

knowledge

Inspirations and

values

**Cultural**



**Food**

Fibers, materials

H<sub>2</sub>O

Energy

**Provisioning**

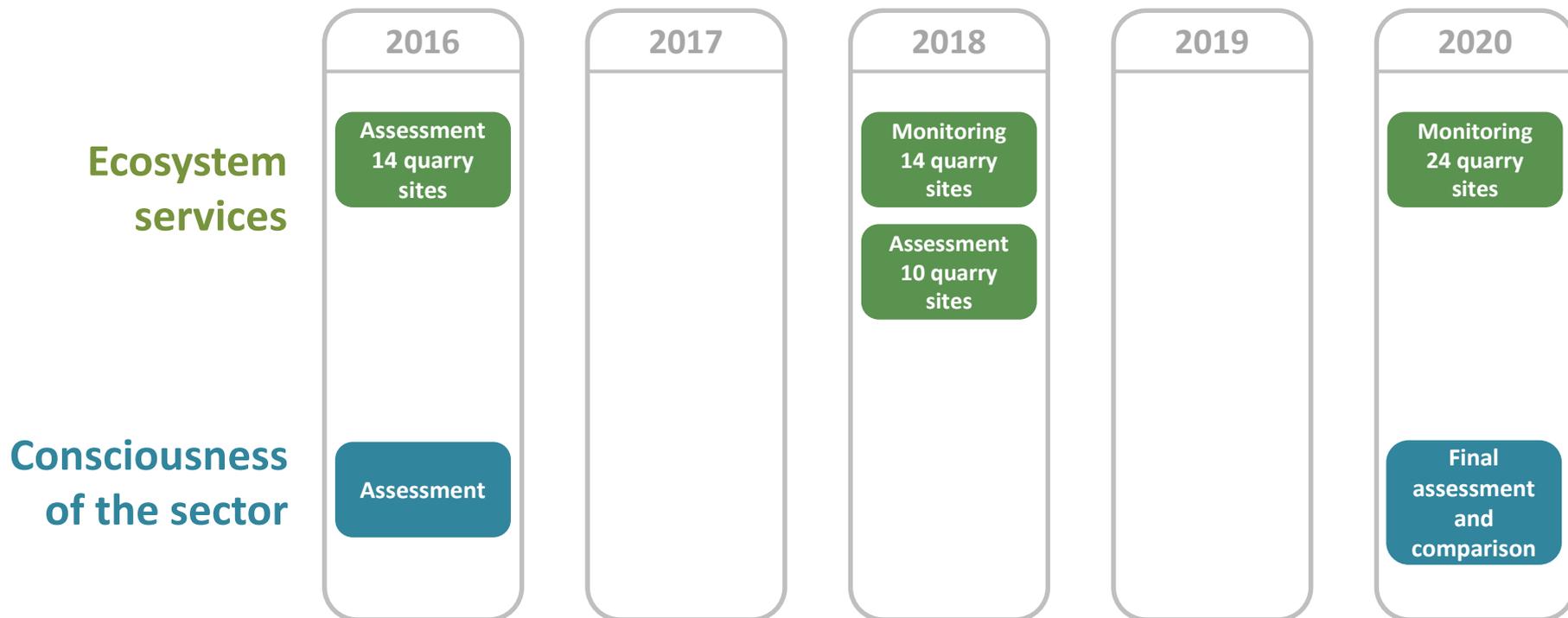


**Ecological functions**

## Goals of ES approach in LIFE in Quarries project

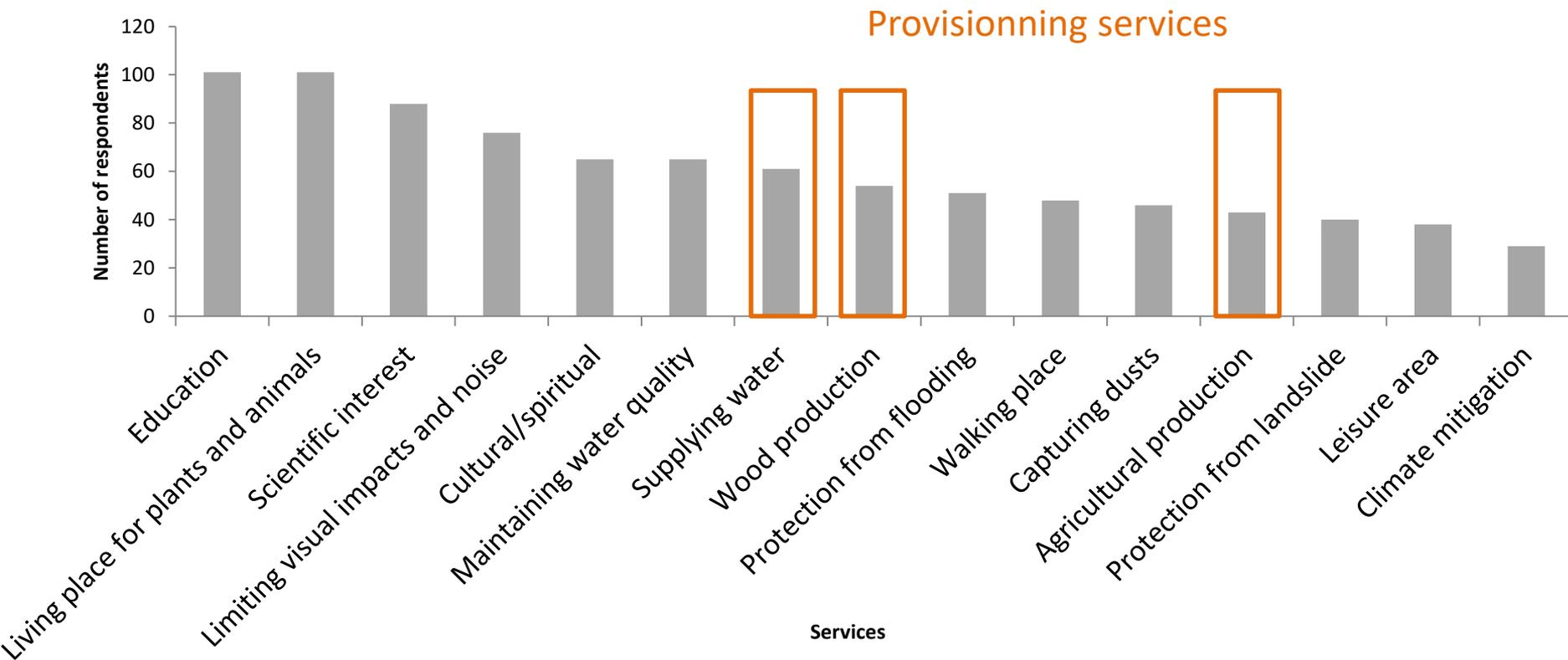
- Understand the **economic, ecological, social and cultural importance** of the quarry in the surrounding landscapes.
- Understand the **impact** of extractive activities and nature management actions on actors;
- Make **better informed decisions** on LIFE actions;
- **Improve ES provision** in active quarries;
- **Communicate** more effectively about the values of the natural environment and the services it provides.

## Planning



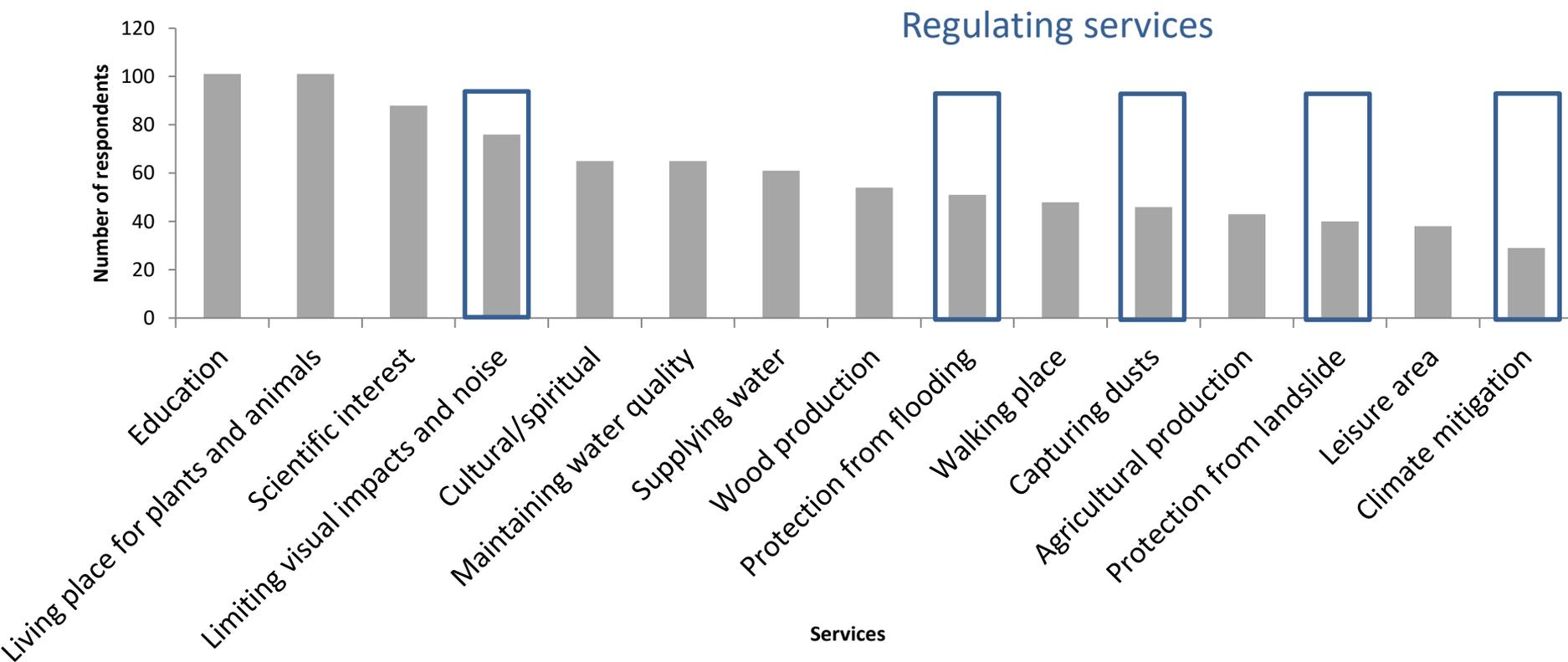
## Consciousness of the sector for biodiversity - 2016

*“In your opinion, besides raw materials production, what are the services supplied by the quarry among the following list?” (n=102)*



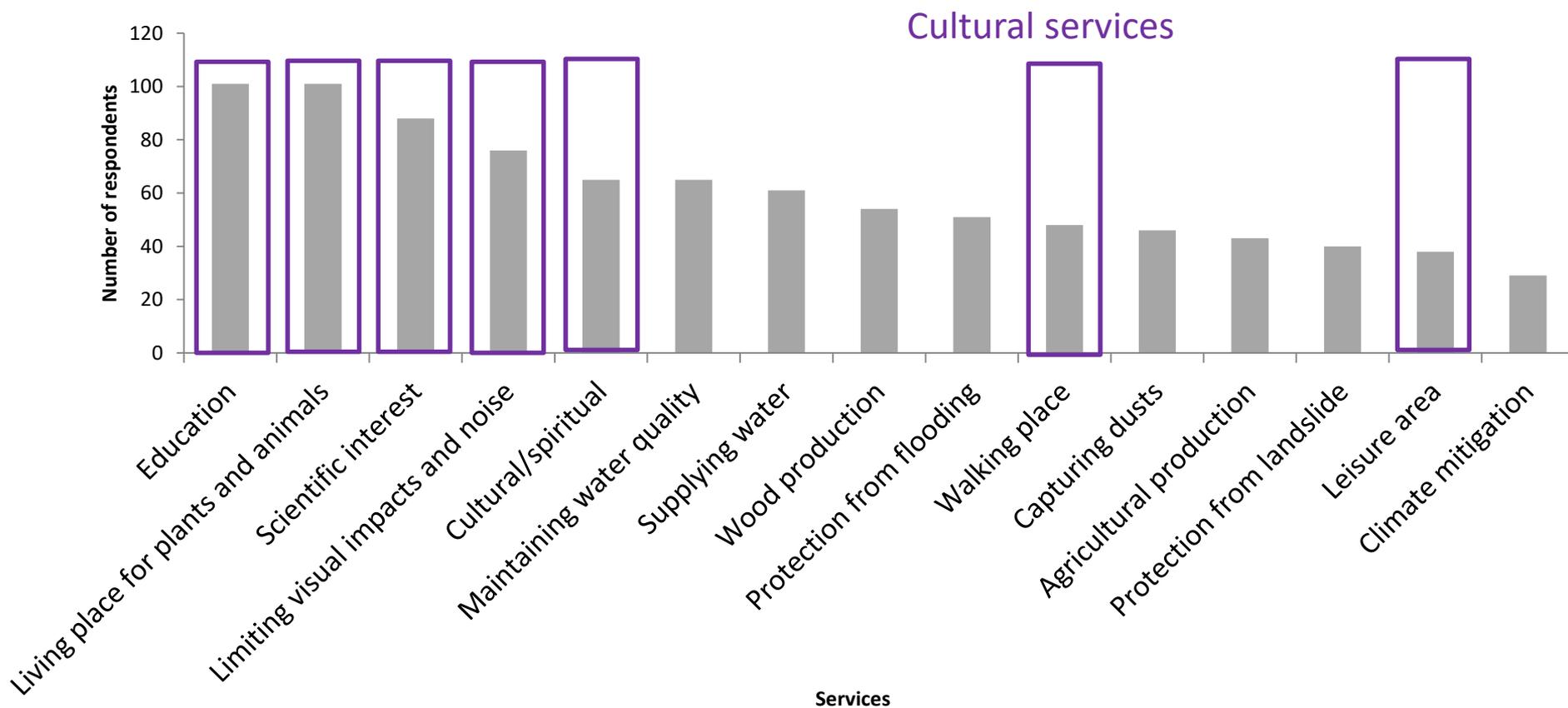
## Consciousness of the sector for biodiversity - 2016

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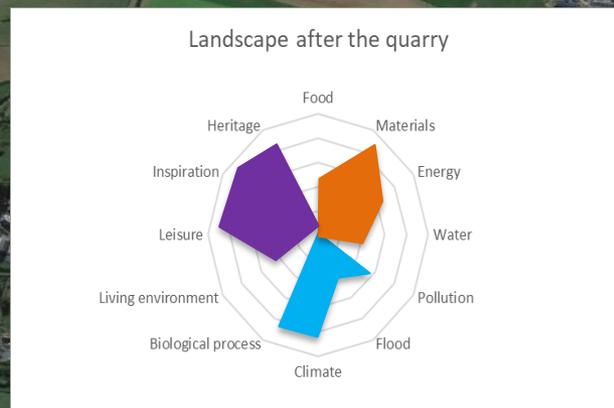
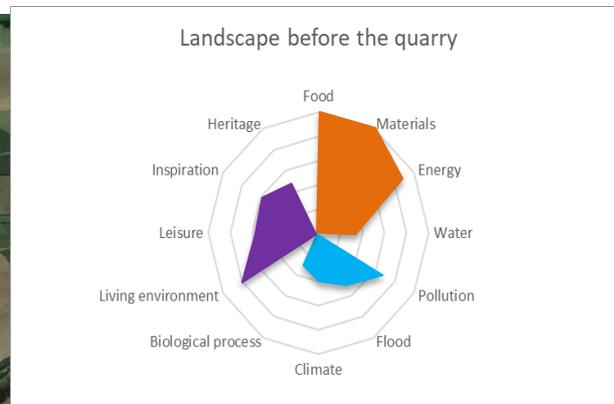
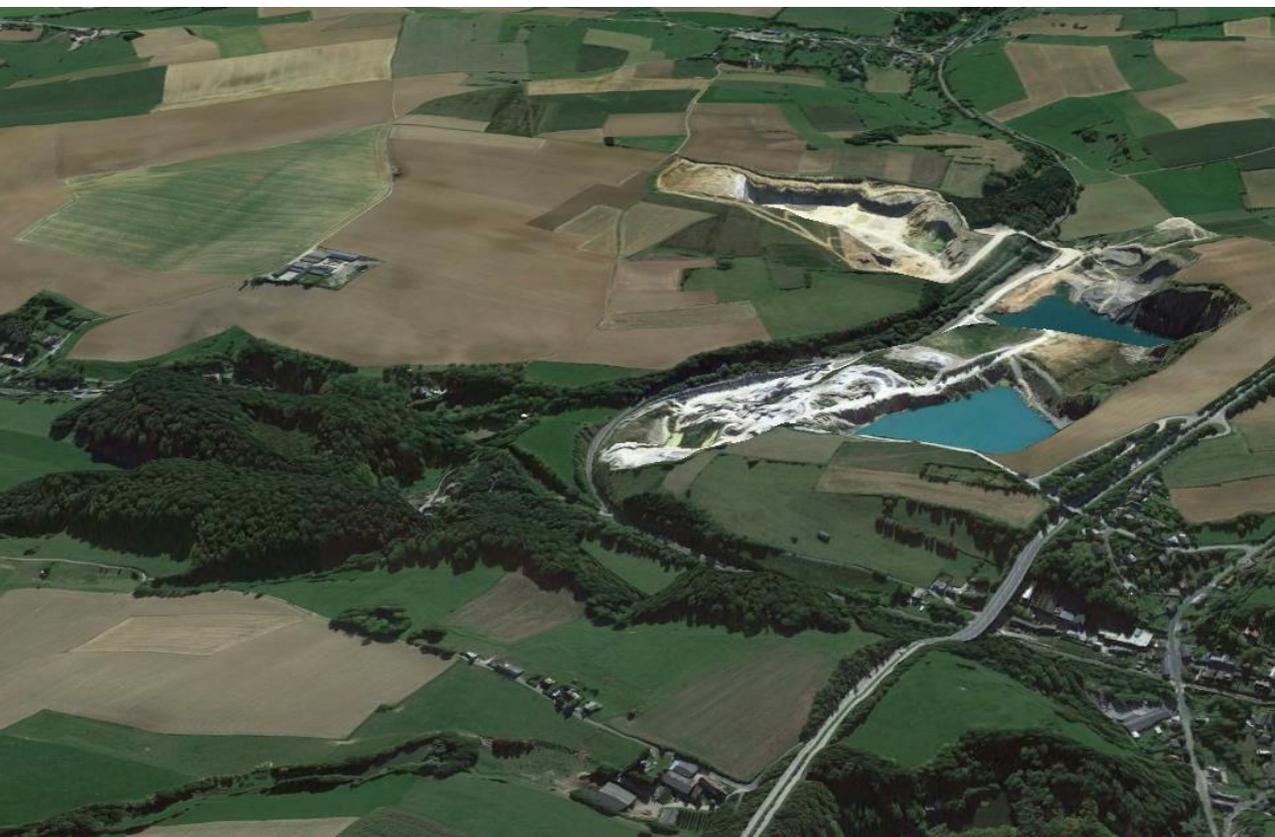


## Consciousness of the sector for biodiversity - 2016

*“In your opinion, besides raw materials production, what are the services supplied by the quarry among the following list?” (n=102)*



## Quarries and ecosystem services



## Quarries and ecosystem services



## Quarries and ecosystem services



## Intrinsic value of existence and inheritance



## Intrinsic value of existence and inheritance



## Ecosystem services assessment

Based on Wal-ES conceptual framework

[www.wal-es.be](http://www.wal-es.be)



The ecosystem services in Wallonia

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### The Wal-ES project

Plateforme Wa-ES

Cadre conceptuel

Emergence du concept

SE en Europe

SE en Wallonie

## Le cadre conceptuel



La plateforme Wal-ES a rédigé un cadre conceptuel autour de la notion de **services écosystémiques**. Ce cadre vise à structurer et à simplifier le système socio-écologique étudié, constitué des multiples interactions et liens de dépendance entre les êtres humains et leur environnement naturel vivant. Il a également comme objectif de clarifier les concepts et définitions utilisées, afin de favoriser une compréhension commune et de servir de base partagée au développement d'outils d'aide à la décision basés sur le concept de services écosystémiques en Wallonie.

Ce cadre conceptuel est schématisé par la figure ci-après, qui représente les interactions entre la biosphère et les sociétés humaines à travers l'analyse des 'services écosystémiques'. Elle met en lumière la dépendance de la vie humaine et du bien-être humain au bon état et fonctionnement des écosystèmes.



Le cœur du schéma est la notion de **services écosystémiques** (SE). Les services écosystémiques sont la contribution des écosystèmes au bien-être humain. Ils représentent les **flux** partant des écosystèmes vers la société humaine.

En fonction des conditions du milieu, les écosystèmes fournissent une **offre** de services potentiels au départ de leurs **fonctions écologiques**, soit directement sans apport humain, soit après des actions humaines sur les écosystèmes (apport

## Ecosystem services assessment

Multiple values for a same ES



## Ecosystem services assessment

Multiple values → **Diversity of assessment form**

⇒ **Integrated assessment**

3 kinds of values

- Biophysical values ;



- Social values;



- Economic values.



## Provisioning services

### Food

- Commercial food crops
- ~~Non-commercial food crops (private or collective)~~
- Commercial breeding
- Non-commercial breeding
- Game
- ~~Plants and wild mushrooms edible land~~
- Fish, crustaceans and molluscs grown in fresh waters
- Wild freshwater fish, crustaceans and molluscs
- ~~Freshwater edible plants~~

### Materials

- ~~Ornamental plants~~
- ~~Ornamental animals~~
- Wood
- ~~Other plant materials~~
- ~~Plants, animals and medicinal microorganisms~~
- ~~Organic matter from waste for fertilization and / or soil improvement~~
- ~~Organic matter derived from agriculture for fertilization and / or soil improvement~~
- Feed
- ~~Genetic material of all living organisms~~

### Energy

- ~~Organic matter from agriculture for energy purposes~~
- ~~Organic matter from waste for energy purposes~~
- Trees and wood residues for energy purposes
- ~~Mechanical energy resources of animals~~

### Waters

- Drinking water
- ~~Drinking underground water~~
- Surface water for purposes other than consumption
- ~~Groundwater for purposes other than consumption~~

## Provisioning services

Biophysical evaluation → Quantities, Areas



Request for information to the quarry manager and the different actors

Calculated on the basis of literature

Economic evaluation



Calculated according to the market prices

## Regulating services

### Extreme events

- Erosion protection
- Sediment retention
- Maintaining the hydrological cycle and water flows
- Flood protection
- ~~• Storm protection~~
- ~~• Fire prevention and control~~

### Pollution

- ~~• Bioremediation of polluted soils~~
- Purification of surface water and oxygenation
- Purification of groundwater and oxygenation
- Capture of dust, chemicals and odors
- Mitigation of noise and visual impacts

### Biological processes

- Pollination
- ~~• Seed dispersal~~
- Habitat maintenance throughout the life cycle of species
- Biological control
- Regulation of invasive alien species
- ~~• Regulation of human diseases~~
- ~~• Process of weathering, decomposition and soil fixation~~

### Climate

- Regulation of global climate by sequestration of greenhouse gases
- ~~• Regional climate regulation~~
- Regulation of the micro-climate

## Regulating services

Evaluation on expert opinion → Qualitative!

Capacity matrix

Score from 0 to 5



## Regulating services

	Weathering protection		Sediment retention		Maintaining the hydrological cycle and water flows		Flood protection		Purification of surface water and oxygenation		Purification of groundwater and oxygenation		Dust, chemicals and smells capture		Mitigation of noise and visual impacts		Pollination		Habitat maintenance throughout the cycle of life of the species	
Backwater	0	3	2	3					2	2	1	0					0	5		
Running water	0	0	1	4					1	1	0	0					0	5		
Aquatic vegetation	0	2	2	3					4	2	0	0					0	5		
Grasslands	2	1	2	0					2	2	1	1					4	5		
Mesophilic meadow	3	2	3	1					2	2	1	1					5	4		
Forest edge	3	3	3	2					2	3	2	2					4	5		
Tall-herb	4	5	3	4					4	2	3	2					4	5		
Temperate thickets	4	3	3	2					2	3	3	3					3	5		
Moors	3	2	2	2					2	2	2	2					4	5		
Hedges	4	3	3	4					3	4	3	3					5	5		
Deciduous forest	5	5	5	5					5	5	4	4					4	5		
Coniferous plantation	3	2	2	3					2	2	5	5					0	2		
Tree alignment	4	3	3	4					3	4	4	4					3	3		
Scree	1	0	1	0					0	0	1	1					1	5		
Rocks and cliffs	0	0	0	0					0	0	1	0					0	5		
Crops	0	0	0	0					0	0	1	1					1	2		
Garden and parcs	2	0	1	0					1	1	2	2					3	2		
Temporary meadows	2	0	1	1					1	0	1	1					1	2		
Low density buildings	0	0	0	0					0	0	0	0					0	0		
Extractive industrial sites	0	0	0	0					0	0	0	0					0	0		
Transport network	0	0	0	0					0	0	0	0					0	0		
Very artificial aquatic habitat	0	0	0	0					0	0	0	0					0	0		



## Cultural services

### Environment of everyday life

- Biological environment of places of life, work and study
- ~~Biological environment of health and rehabilitation institutions~~
- Non-exclusive natural space suitable for daily outdoor activities
- ~~Exclusive natural space suitable for daily outdoor activities~~

### Environment for recreation

- ~~Non-exclusive natural area for outdoor recreation~~
- Exclusive natural area for outdoor recreation
- ~~Non-exclusive natural area for productive leisure activities~~
- Exclusive natural space for productive leisure activities

### Sources of experience and knowledge

- Natural space and biodiversity serving as a support for the experience of nature (aesthetic quality)
- Natural space and biodiversity serving as a support for education
- Natural space and biodiversity serving as a support for scientific research

### Sources of inspiration and values

- Natural space and biodiversity sources of inspiration and entertainment
- ~~Natural space and biodiversity sources of heritage and sentimental values~~
- ~~Natural space and biodiversity sources of symbolic and cultural values~~
- ~~Natural space and biodiversity sources of sacred or religious values~~
- Natural space and biodiversity sources of intrinsic values of existence and inheritance

## Cultural services

*“Did you enjoy your visit in the quarry?”*

## Social evaluation

*“What did you like during your activity in quarry ?”*

- Biking
- Company visit
- Mineralists visit
- Mountaineering
- Naturalists visit
- Open doors days
- School visit
- Trail
- Trekking
- University visit
- Walking

*“Would you like to do this activity again?”*

*“Would you like to do another activity in quarry?”*

*“If so, what activities do you find interesting to do in quarries?”*



*Fill out the  
Questionnaire*

## Example of results – 2016

## Provisionning ES

### Commercial food crops



#### 2015

Crop	Number of plots	Area (ha)	Yield (t/ha)	Production (t)	Market price (€/t)	Income (€)
Winter triticale	3	24,3	4,7	114,0	140	15963
Winter wheat	6	19,2	8,0	153,2	145	22221
Spelt	2	3,3	7,7	25,1	190	4768
Winter rape	2	2,7	2,4	6,4	360	2293
Spring wheat	1	1,9	4,9	9,4	145	1363
<b>Total</b>		<b>51,2</b>		<b>308,1</b>		<b>46607</b>

#### 2014

Crop	Number of plots	Area (ha)	Yield (t/ha)	Production (t)	Market price (€/t)	Income (€)
Winter rape	2	2,7	2,4	6,4	360	2293
Spring wheat	1	1,9	4,9	9,4	145	1363
Corn	5	10,9	12,7	139,0	170	23633
Rape and turnip	3	10,4	2,4	24,9	360	8979
Winter wheat	4	8,7	8,0	69,6	145	10099
Spelt	2	8,4	7,7	64,3	190	12224
Other vegetables	2	5,1		0,0		0
Sugar beet	2	4,8	67,0	324,2	31	10049
Winter barley	2	3,3	8,0	26,3	140	3680
<b>Total</b>		<b>56,2</b>		<b>664,2</b>		<b>72319</b>

#### 2013

Crop	Number of plots	Area (ha)	Yield (t/ha)	Production (t)	Market price (€/t)	Income (€)
Winter rye	4	25,1	7,6	191,0	140	26737
Winter barley	2	13,8	8,0	110,6	140	15491
Winter wheat	6	7,5	8,0	59,8	145	8668
Sugar beet	2	3,2	67,0	211,2	31	6548
<b>Total</b>		<b>49,6</b>		<b>572,6</b>		<b>57444</b>

#### Final result: average of 3 years of rotation

Area (ha)	Yield (t/ha)	Production (t)	Market price (€/t)	Income (€)
52,3	13,6	515,0	175	58790

## Example of results – 2016 *Provisionnement ES*

### *Game*

30 roe deers, 20 wild boars, a dozen ducks and a hundred pigeons.  
The cost price of this game is +/- 4025 € (economic value of this service).



	Price	Average weight	Average price (€)
<b>Boar</b>	1 €/kg	70 kg	70 €
<b>Deer</b>	2.50 €/kg	200 kg	500 €
<b>Roe deer</b>	2-5 €/kg	25 kg	87,50 €
<b>Doe</b>	3 €/kg	100kg	300 €
<b>Fawn</b>	3.50 €/kg	10 kg	35 €

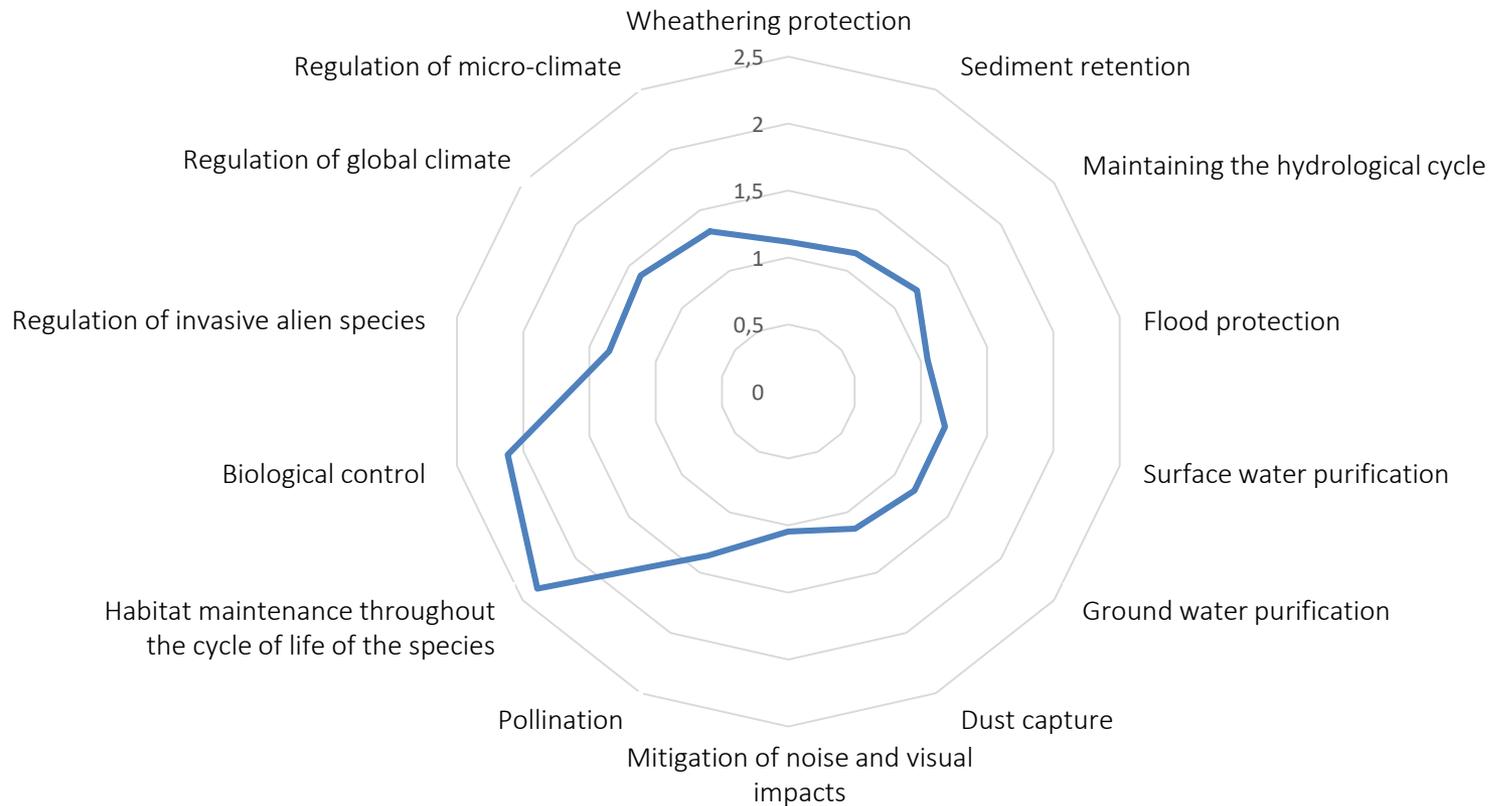
### *Wood*

+/- 1000 m<sup>3</sup> of wood exploited annually in the quarry





## Example of results – 2016 *Regulating ES*



## Example of results – 2016 *Cultural ES*

- Open day
- Hiking
- School visit
- Biking
- Hunt



**Outdoor recreation service**

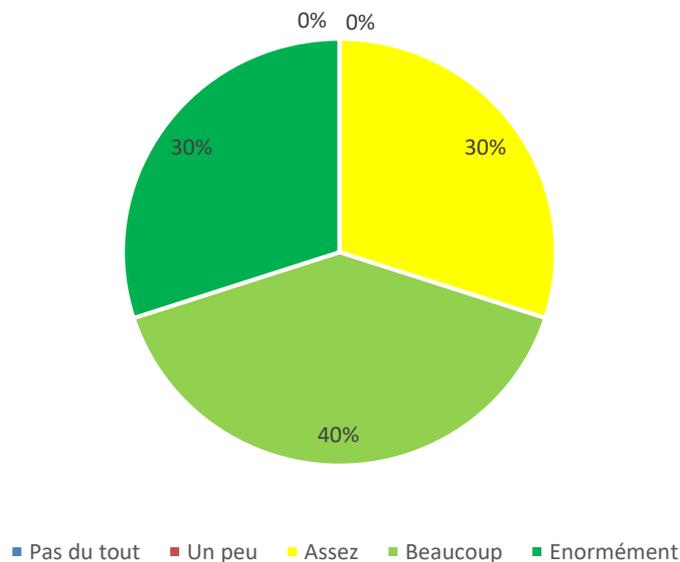
**Education service**

**Productive leisure service**

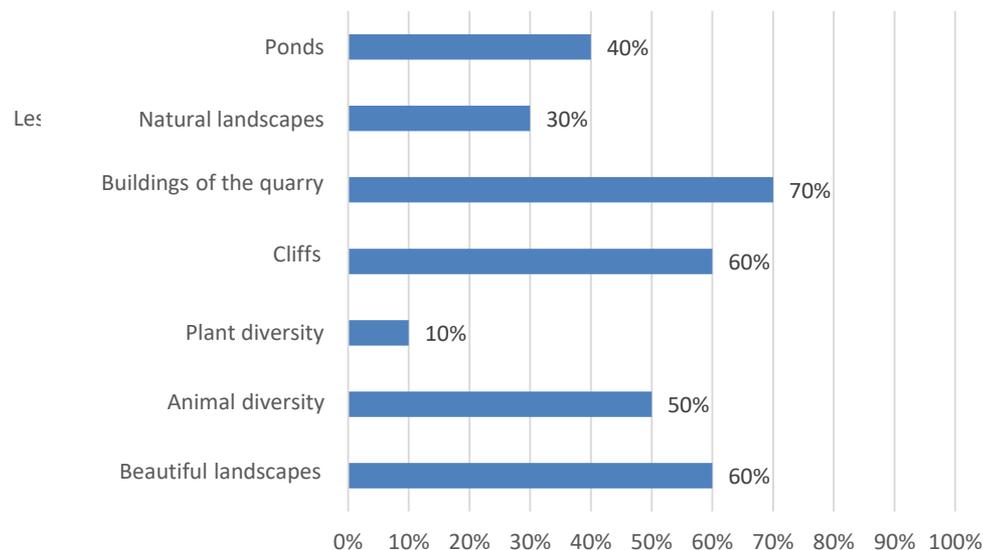


## Example of results – 2016 *Cultural ES*

Did you enjoy your visit in the quarry? (n=10)

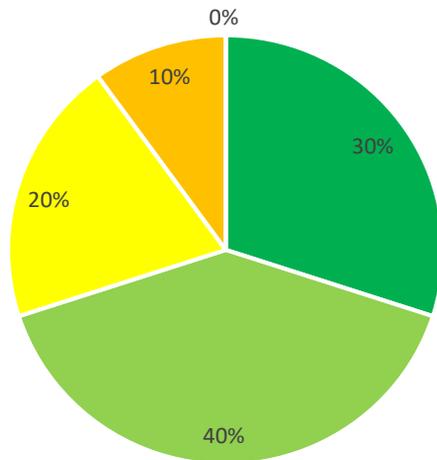


What did you enjoy during your visit? (n=10)



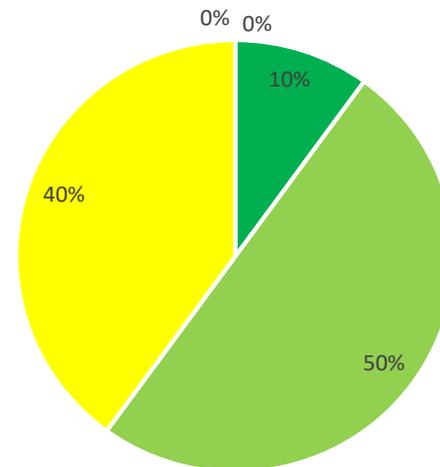
## Example of results – 2016 *Cultural ES*

Would you like to do this activity again? (n=10)



 Certainly not  Probably not  I don't know  Likely yes  Definitely yes

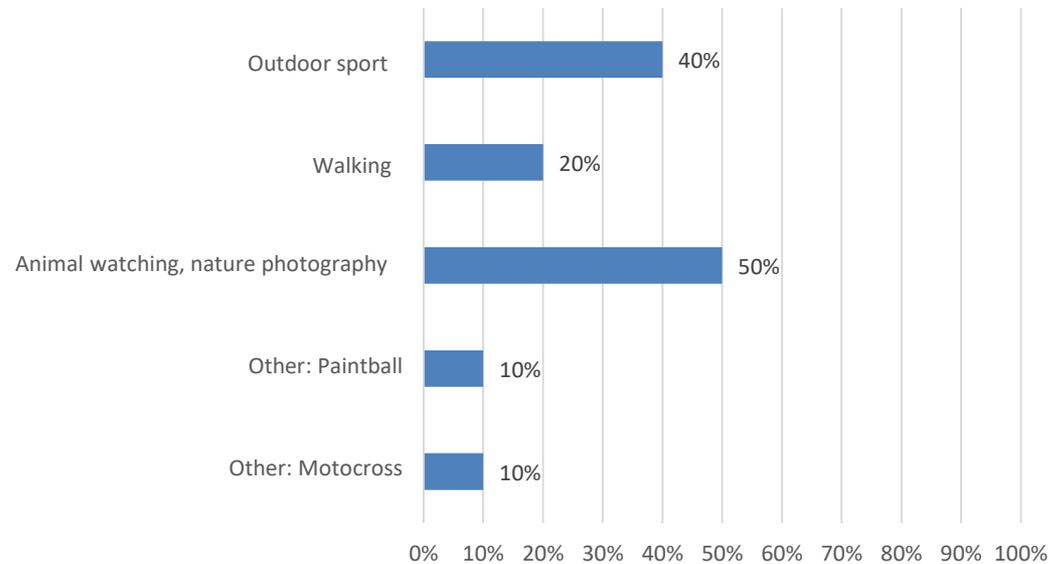
Would you like to do another activity in quarries? (n=10)



 Certainly not  Probably not  I don't know  Likely yes  Definitely yes

## Example of results – 2016 *Cultural ES*

If so, what activities do you find interesting to do in quarries?  
(n=10)



## Conclusion

### Provisioning services

- Monetary evaluation,
- Negatively impacted by
  - Quarry progress,
  - LIFE in Quarries actions → tree cut
- Positively impacted by
  - LIFE in Quarries actions → Mowing, grazing

### Regulating services

Impacts of LIFE in Quarries project are difficult to assess, qualitative evaluation based on expert opinion

### Cultural services

Positively impacted by the LIFE in Quarries project

- Highlighting of the demand and the use of ES

## Under progress

1) Monitoring 14 quarry sites + ES assessment 10 quarry sites

Insist on cultural services



Distribute questionnaires to quarries visitors



*« In relation to your activity, what is the point of going to a quarry? »*

*« What did you like during your visit? »*

*« Would you like to return to the quarry for a new visit? »*

## Under progress

- 1) Monitoring 14 quarry sites + ES assessment 10 quarry sites
- 2) Assessment of the public awareness of biodiversity in quarries



*Ecosystem service: "Natural space and biodiversity sources of intrinsic values of existence and inheritance"*

*« Do you think that interesting animals can be present in the quarry? »*

*« Do you think that interesting plants can be present in the quarry? »*

*« Did you know that quarries could host biodiversity? »*

*« In your opinion, are there important quarry areas for plants and animals? Which ones? »*

## Limits

### Questionnaires survey

- Investment of quarry managers
- Some questions may highlight tensions or issues



## Take home message

Consequent study which requires an investment of the quarry manager

Cultural ES are the most impacted by the LIFE in Quarries project → Focus on!



# Thank you for your attention !



## Ecosystem services assessment

[https:// www.wal-es.be](https://www.wal-es.be)  
<https://cices.eu>

<http://www.lifeinquarries.eu/>



Gembloux Agro-Bio Tech  
Université de Liège

