

BIODIVERSITY PERCEPTION IN THE EXTRACTIVE SECTOR LESSONS FROM THE LIFE IN QUARRIES PROJECT

Life in Quarries Project

LIFE14 NAT/BE/000364

Action D.6

Socio cultural monitoring of communication actions /
consciousness of the sector for biodiversity

Final report



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Context

Extractive sites are profoundly interlinked with their territory. Through their life cycle, quarries modify the landscape with machines progressing through mineral deposits and constantly creating a large diversity of temporary habitats, sometimes left to evolve to ones that are more permanent. In many cases, the biological role and ecosystem services provision of quarries are neglected though they are playing a significant role as stepping-stones in ecological networks and regulating green infrastructure in landscapes. In highly urbanized and controlled landscapes, quarries are an exceptional opportunity to maintain rare and threatened transient habitats hosting fugitive species.

Low perception on the biodiversity potential in quarries would jeopardize dynamic management for such biodiversity installation and could prevent an optimal restoration of ecosystem services in the post-exploitation phase. On active sites, promotion of biodiversity management requests training campaign increasing awareness and competencies. Such trainings are facilitated when they are based on the values and knowledge of the actors at all positions of the business ecosystem. An understanding of biodiversity perception of the sector is thus necessary to identify potential lockouts and opportunities

This report is a deliverable of the Life in Quarries project (LIFE14 NAT/BE/000364 hereafter “Life in Quarries”) under action D6 – *Socio cultural monitoring of communication actions / Consciousness of the sector for biodiversity* – following the implementation of the project between 2015 and 2021. It synthesizes the results of quarry personnel interviews conducted in 2016 and 2021 aimed at assessing knowledge evolution on quarries’ biodiversity resulting from the implementation of concrete conservations actions (project’s actions C), the development of quarry personnel awareness and understanding through trainings (action E5) and implementation of dynamic biodiversity management (action D5).

According to the objective of action D6, it allows to:

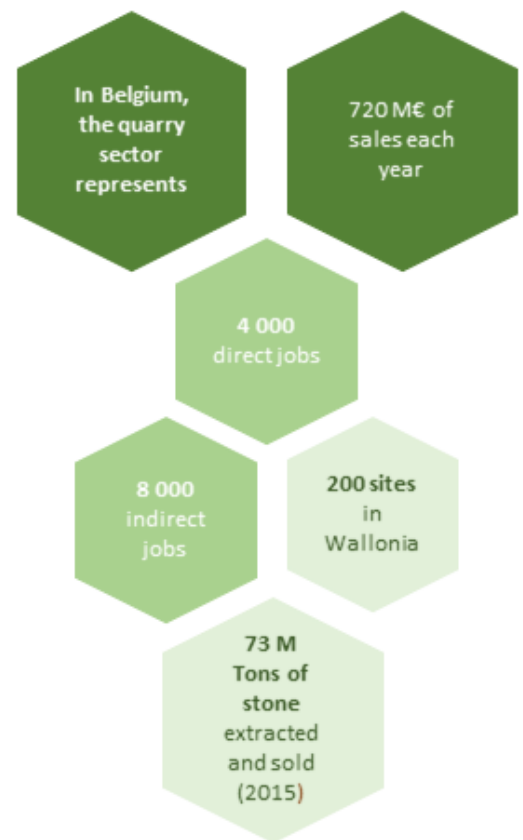
“Evaluate precisely how the communication, dissemination and demonstration actions of the LIFE IN QUARRIES have changed the behaviors and motivations of the sectors and to reveal the innovation lock-out provided by an effective awareness raising strategy.”

Concepts

Extractive industry and EU biodiversity strategy

The extractive industry includes economic activities aiming at extracting soil aggregates and, sometimes, subject them to transformation. The European aggregates industry represents 15 000 companies producing 3 billion tons of aggregates per year with an annual turnover of € 15 to 20 billion. Throughout Europe, a network of some 26 000 sites distributed throughout all biogeographical regions and employing 200 000 persons is a unique opportunity to reconcile biodiversity and economic development.

The large number of extraction sites across Europe combined with the specific characteristics of this industry – working directly on the earth crust, extracting raw materials, supplying a huge flow of heavy goods to the society ... - makes it a major player in the economic and the environmental challenges of the European Union. Sustainable management of resources is one of the challenges facing the extractive sector. By implementing innovative practices, the industry intends to reduce its environmental impact and contribute to the European Green Deal.



Biodiversity is at the heart of the EU environmental policies. The European Commission has adopted the new EU Biodiversity Strategy for 2030 and an associated Action Plan - a comprehensive, ambitious, long-term plan for protecting nature and reversing the degradation of ecosystems. The EU Habitats and Birds Directives are the cornerstones of the Europe's biodiversity policy. At their heart, lies the creation of a network of sites designed to safeguard Europe's rarest and most endangered species and habitat types – the Natura 2000 Network. The Millenniums Ecosystem Assessment (2005) has also popularized the term "ecosystem service", the benefits that flow from nature to people, and changed society's view of ecosystems.



Biodiversity - including ordinary biodiversity - and Ecosystems Services are both integrated in the EU Green Infrastructure Strategy, part of the European Green Deal. The Green Deal aims at developing a strategically planned network of natural and semi-natural areas comprising other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation.

Today, the European extractive industry considers that biodiversity and its proactive management, is an intrinsic part of the productive process. There are a number of important synergies between the industry and nature conservation, as shown by the many case studies in which new ecosystems allowing the settlement of new species and an increase in environmental diversity have

been generated. Extractive sites can thus be part of the EU Biodiversity and Green Infrastructure strategies with a significant potential for positive contributions to biodiversity conservation through passive restoration processes (Prach and Pyšek, 2001), through sound rehabilitation of extractive sites but also by implementing biodiversity management measures during the extractive phase ¹. By developing regional biodiversity management schemes, quarries could demonstrate their benefit as stepping-stones between natural areas but also as core populations of endangered species. The sector could thus demonstrate its ability to provide coordinated contributions to rare habitats restoration and species conservation.

The extractive activity is also strongly anchored in the history of Wallonia, Southern Belgium, where a large network of quarries is to be found. Due to the diversity of rocks present in the Belgian subsoil, a multiplicity of products is produced each year: ornamental rock, rubble and paving stones, lime, cement, aggregates, sand and clays.

In Wallonia, FEDiEX (the federation of extractive industry) has integrated biodiversity in its focus for years. In 2012, the signature of a charter on Quarries and Biodiversity with the Walloon minister in charge of nature resulted in the development of active collaborations and to the production of good practices for the sector. These initiatives highlighted the need for a biodiversity project in quarries. The submission of the Life in Quarries falls within this approach.



¹ See : Extractive Sector Species Protection Code of Conduct - A manageable approach for planning and permitting procedures respecting EU legislation and fostering biodiversity
https://uepg.eu/mediatheque/media/Code_of_conduct_With_signatures_Digital_low_res.pdf

Active quarries: an opportunity for biodiversity

The extractive industry, through its activity, causes significant disruption to the landscape (Figure 1). The topography and occupation of the ground change to the benefit of mineral-looking habitats. At first glance, these constantly changing areas seem unwelcoming to flora and fauna. However, a growing number of research projects and field studies are showing that the proper management of extractive sites throughout their entire life cycles allows for the creation of protected species habitats. The biological role and ecosystem services provision of quarries are often neglected though they can play a significant stepping-stones role for species while developing green infrastructure in landscapes.

Specifically, throughout the life of quarries, a large diversity of temporary habitats is generated, sometimes left to evolve to ones that are more permanent. In urbanized landscapes, this represents an exceptional opportunity to maintain rare and threatened transient habitats hosting fugitive species otherwise impacted by canalizations of rivers and flood controls, stabilizations and reforestations of screes and cliffs and eutrophication of waters.

Through their daily exploitation, quarries constantly initiate a succession process generating abiotic conditions for the installation of a diverse flora and fauna through a combination of factors such as recurrent perturbations and the oligotrophic status of soils and water. In a simple exploitation front, with its berms and slopes, a diversity of biotopes benefiting a diversity of amphibians, reptiles, insects, birds or rare plants can coexist. Such ephemeral biodiversity cannot be managed by a site legal protection status. As exploitation progresses, more permanent, biodiverse habitats settle/are restored in abandoned areas but the biological potential could also be maximized by optimized groundwork through the whole exploitation process (Figure 2).



© Etude Poly/art

Figure 1. Simulated evolution of a quarry in its landscape.



Unstable Cliffs

Pioneer vegetation



Riparian sand banks



Screes and gravel beds



Temporary ponds



Muddy banks




© Hunger, Schiel, Rademacher 2015





Figure 2. Extractive activities create ecological conditions (bare soil, oligotrophic conditions ...) similar to that of threatened natural habitats in human dominated landscapes. Such habitats frequently host endangered and protected species.


Perception is key to implement biodiversity strategy in the extractive industry


Quarries staff may miss the full potential of their quarry as a source and a refuge for biodiversity. Such a perception can jeopardize fugitive biodiversity installation successes and generates unnecessary destruction of transient habitats inevitably leading to inadequate actions and unintentional destruction of valuable biodiversity assets. Due to the lack of understanding of habitats value for biodiversity and ecosystem services potential, the potential for optimized exploitation management leading to the creation of valuable habitats is often not seized. In active quarries, promotion of biodiversity management requests training campaign increasing awareness and competencies. Such trainings are facilitated when they are based on the values and knowledge of the actors at all positions of the business ecosystem. The understanding of biodiversity perception of the sector is thus necessary to identify potential lockouts and opportunities.

 **Key concepts**

 **Biodiversity** : Variability of living organisms from all sources. This includes diversity within species, between species and the diversity of ecosystems.
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 **Perception** : The quality of being aware of an object/subject, combination of value and knowledge about a subject. A belief or opinion based on how it appears.
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 **Knowledge** : Scientifically established fact whose mastery and acquisition are linked to learning and contact with the subject. Understanding of information about a subject that you get by experience or study.
©pngwing

 **Value** : Inherent importance attributed to biodiversity, direct interest and concern for the subject.
©pngwing

Perception is defined here as the combination of **value** and **knowledge** on a subject (in this case biodiversity). These two components are self-reinforcing (Figure 3) and can lead to an increased biodiversity awareness. This development of perception will result in higher sector and individual stewardships of biodiversity (Chan, E. S., 2014). Perception is based on the values developed to the contact of an object/subject. Increasing contact with an object or a concept makes it more familiar and creates an attachment by reinforcing its associated value. By becoming attached, one will want to increase its understanding of the object/subject inevitably leading to a higher familiarity and an enhanced attributed value.

Effective environmental education and awareness training for employees is decisive to lead business culture towards sustainable development by allowing employees to learn and adopt new green attitudes, ideas and skills (Ahmad et al., 2012; Beard, 1996a; Madsen and Ulhøi, 2001; Perron et al., 2006; Stringer, 2009). Trained and educated to environmental issues, employees will often gain knowledge and significantly change their values and behavior towards the environment (Domasik-Bilocq et al., 2002; Law, M. M. S. and al., 2017) while developing trust and satisfaction of the company (Law, M. M. S. and al., 2017, Unesco, 1978, p. 24).

Learning efficiency is based on the collaborative construction of the training action, the sharing of responsibilities and the reciprocity of knowledge transfer (Domasik-Bilocq et al., 2002).

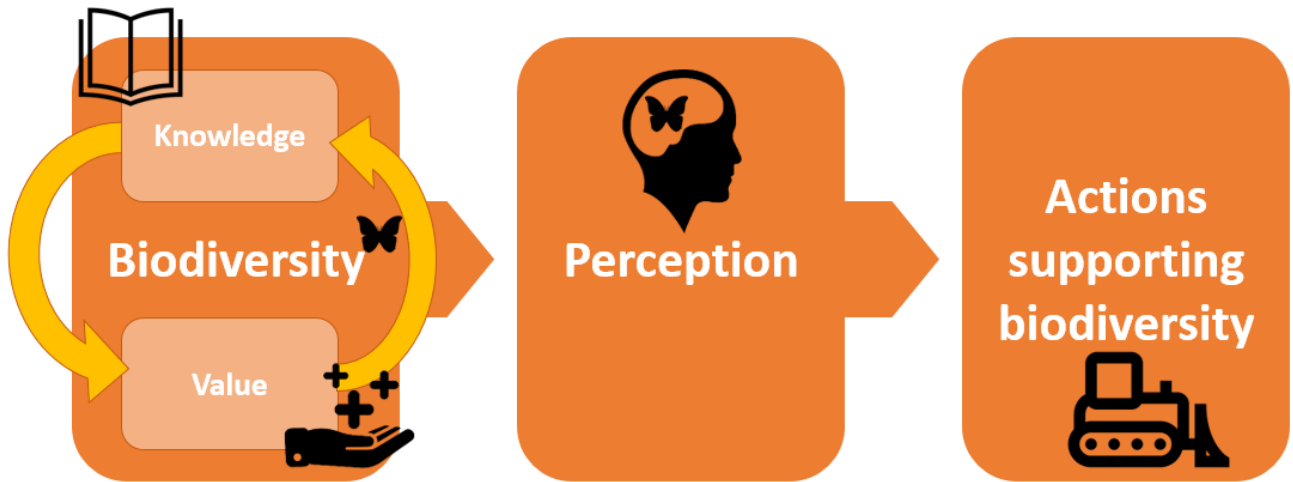


Figure 3. Combination of value and knowledge on biodiversity, self-reinforcing and leading to a better perception of the concept, resulting in higher support to the implementation of biodiversity actions.

Biodiversity perception in the Life in Quarries

Life in Quarries: a project for biodiversity in active quarries

The Life in Quarries (LIFE14 NAT/BE/000364)² is an EU LIFE funded project. Running from 2015 and 2021, it demonstrated that operational biodiversity solutions can be proposed and implemented through controlled investments benefiting nature protection as well as the private sector. The general idea of the project is to define measures acceptable to the private operator, legally and scientifically valid and favorable to biodiversity. The partnership forged on this basis includes the private sector, regional authorities, scientists and NGOs. The project is led by FEDIEX (Fédération des Entreprises Extractives) in partnership with the Walloon region (Department of Nature and Forests), University of Liège - Gembloux Agro-Bio Tech, Biodiversity and Landscape Unit, Natagora asbl and the Scheldt Plains Nature Park (Parc naturel des Plaines de l'Escaut).

Life in Quarries aims to develop and make sustainable the hosting capacity of biodiversity in active quarries in Wallonia. **The originality of this project is based on the implementation of biodiversity management actions during the extractive phase and not only as part of rehabilitation, at the end of works.** This integration during the operational phase requires the initiation of new biodiversity development approaches as well as an administrative and legal management. A dynamic management of biodiversity is intended to create a network of temporary habitats managed dynamically in time and space across the quarry in parallel with the extractive activity, ensuring a constant availability of suitable habitats for the development of pioneer species. For example, quarries commit to a fixed number of pioneer ponds on their site throughout the project. When the exploitation leads to the need to remove ponds, new water points are dug before the amphibian reproduction period in order to maintain a sufficient pool of pioneer ponds. Post-exploitation areas are also targeted by the projects actions. Permanent nature actions are implemented there with the aim to maintain the same habitat in an area permanently. The legal management goes through the definition of a management plan targeting species and habitats among which protected ones. The legal securing can go through a derogation under Article 16 of the EU Habitats Directive as proposed under the new *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive*.³

Within the project, 26 quarries help create a regional network for an integrated development of biodiversity actions, taking into account the specificities and potentialities of individual sites. Fourteen are defined as phase I quarries, nine as phase II.1 quarries and three as phase II.2 quarries. The phase I quarries are extractive sites that joined the project at its initiation in 2016. Phase II.1 quarries were added to the project at a later stage, in 2018, and phase II.2 quarries in 2019.

² <http://www.lifeinquarries.eu/en/>

³ [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:C\(2021\)7301](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:C(2021)7301)

A short description of Life in Quarries biodiversity actions (see Figure 4 for illustration)

Life in Quarries Temporary nature actions

Dynamic management of temporary ponds: The presence of temporary ponds is conducive to strengthen amphibian populations (Natterjack and Midwife toads) and dragonflies, linked to these habitat networks and stimulating the development of Stoneworts (Characeae), typical algae of nutrients poor (oligotrophic) ponds.

Dynamic management of pioneer grasslands: Often associated with temporary ponds but also occurring on drier substrates, pioneer grasslands house a large variety of annual plants and insects. In quarries, these grasslands encourage the reproduction cycles of birds, such as the woodlark and the Little-ringed plover. Multi-annual management allows the reopening of these pioneer environments and development of typical plant species.

Creation and refreshing of loose cliffs: In Wallonia, the scarcity of the natural habitat of the sand martin, following the stabilization of riverbanks, led it to colonize loose cliffs of quarries and other artificial sites. The creation and annual refreshing of soft sediment cliffs ensures the maintenance of a suitable habitat. These habitats may also encourage the development of solitary bee populations.

Installation of shelters: To host and develop biodiversity in smoothed areas of quarries, it is necessary to rebuild a favorable shelters and hides. This action includes the construction of shelters and hibernacula for reptiles, amphibians and insects.

Development of vascular plants: The seed lots development for patrimonial pioneer plant species allow developing new populations within areas presenting favorable conditions for their development.

Translocation of the Natterjack toad and the Great crested newt: The geographic isolation of quarries can act as a limiting factor in the recolonization of small wildlife, typical of pioneer environments. In order to benefit from the welcoming potential, the project strives to translocate new populations of Natterjack toads and great crested newts into active quarry sites.

Reintroduction of the yellow-bellied toad: In the Walloon region, the yellow-bellied toad is almost extinct following the disappearance of its habitat. Frequently observed in quarries abroad, this toad can flourish on operational sites. A project's objective is to reproduce and reintroduce a population of yellow-bellied toads on one site.

Life in Quarries Permanent nature actions:

Creation of permanent ponds: Through the creation of permanent waterbodies holding diverse habitats, the project ensures the subsistence – food and reproduction – of numerous plant and animal species, such as the Great crested newt and the Midwife toad.

Creation of gentle slopes for the installation of reed beds: Old quarrying pits are often flooded with exceptional quality water. However, the steep cliffs of the old operating fronts can limit the introduction of vegetation and associated wildlife. A goal of the project is to create gentle slopes favoring the installation of riparian vegetation.

Installation of floating platforms: Large lakes resulting from sites exploitation can be rapidly colonized by fishes. The lack of islets on these large bodies of water can limit the installation of ground nesting birds such as terns and the common gull. The aim of the project is to proceed with the installation of 16 nesting platforms.

Securing of bat galleries: The surroundings of quarries can host old limekilns, technical galleries, ancient houses or farms ... that may, upon securing within the project, provide hibernating grounds for bats.

Restoration and management of grasslands: The hay meadows are becoming increasingly rare due to the intensification of agriculture. Through restoration, the project aims at developing new areas for these diverse grasslands.

Restoration and management of grazed meadows: Quarry sites are an important opportunity for the restoration of limestone or acid-loving grasslands depending on the type of rocks concerned. The restoration of these environments requires different types of work such as clearing, deforestation, planting or transfer of hay and the fight against invasive plants (e.g. buddleia, acacia). Fencing and transfer of the management to herders allows for the restoration of this potential on inclined spoil heaps.

Creation of linear screes: The establishment of linear rocky structures aims at ensuring connectivity between habitats suitable for reptiles.



Figure 4. Illustration of the biodiversity actions implemented in the active quarries of the Life in Quarries (Sources: <http://www.lifeinquarries.eu> ; pictures: ©Maxime Séleck). 1. Dynamic management of temporary ponds, 2. Creation and refreshing of loose cliffs, 3. Installation of shelters, 4. Pioneer grasslands, 5. Creation of long-term water bodies, 6. Restoration and management of grazed meadows.

Life in Quarries: a project to raise biodiversity awareness in the extractive industry

Alongside with the promotion and implementation of actions creating and/or managing temporary and permanent habitats for rare and threatened species, the Life in Quarries developed an ambitious training and awareness-raising program for the extractive industry (under action E5). This action aimed at integrating biodiversity challenges as well as daily management practices at all companies' levels through adapted trainings. This action was complementary to on-site concrete nature conservation actions (actions C) and to basic monitoring (action D4) that promoted privileged exchanges through bilateral contacts between the project's expert team and quarry actors.

Life Project processes: The Life in Quarries process of implementing actions and monitoring species lead to a regular presence of experts in the field favoring exchanges with the sector's actors. Additionally, meetings organized with site managers, directors or environmental managers to keep track of the progress of actions further helped in raising awareness on biological stakes.

Trainings: Promoting autonomy in biodiversity management in quarries requires all the actors to be aware of and integrate basic concepts on biodiversity, temporary nature and its dynamic management. The level of knowledge should ideally increase from top managers to people directly involved in environmental management and/or day-to-day operations. This justified the development of specific training sessions during the project. These sessions were also the opportunity for feedback, increasing the feasibility of integrating biodiversity in the day-to-day operations. To reach this objective, trainings programs were provided at three levels of the command chain during the 6 years of the Life in Quarries:

CEO's training was oriented towards top managers: CEOs and site directors of 12 companies were involved. A presentation of the main project stakes and objectives consisted in a 45 minutes exchange with an expert. Life in Quarries video capsules (5*5 minutes) were provided as additional resources to further explore the topic. The training ended with a c. 15 minutes online self-evaluation. Environmentally trained managers played an important role in strengthening the ecological commitment of employees.

Mr./Ms. Biodiversity trainings targeted 40 biodiversity stewards - environmental and quarries managers. They consisted in four days sessions dedicated to theoretical training along with field practices and restitution works. The focus was set on habitats and species ecology, basic monitoring methods, techniques for habitats and species management, legislation as well as to planning of actions.

Field trainings for the workers allowed for a transfer - to c. 240 workers of 26 quarries - of information on specific target species of quarries and their habitats creation and maintenance. Trainings took place in the



quarries, in the daily work areas in sessions of c. 1 hour. The main subject was the temporary actions located in the active sectors of the exploitation.

Thematic trainings allowed completing workers and Mr./Ms. Biodiversity's trainings through practical examples of species identifications and concrete conservation actions implementation. It went through **Amphibians and reptiles training** (25 attendees) and specific **Methods for ponds creations** (9) and **Birds platform building** (9).



Support resources: Specific supports have been produced to illustrate biodiversity actions, facilitate monitoring of habitats and species by quarries actors, and provide basic and detailed information for implementation of concrete conservation actions. They increased the autonomy of quarries and served well beyond the project.

11 Factsheets on species and temporary habitat's creation and maintenance summarize key messages for management of the different taxonomic groups (Amphibians, Reptiles, Birds, Dragonflies, Flora) and /or habitats (Pioneer ponds, Pioneer grasslands, Sand

cliffs, Shelters and screes, Permanent ponds and Birds platforms). These factsheets are easy to use by managers and workers on the field and deliver easy and synthetic information focused on techniques.

5 Video capsules on temporary/permanent habitats' creation and maintenance interactively illustrate techniques for temporary habitats' creation and dynamic management as well as benefiting species.

An online picture database is accessible through the AMBREs interactive platform. Pictures allow site managers to further develop their own competencies on species identification.



AMBRES Platform: An interactive user-friendly platform, AMBREs, allowing quarries staff to monitor actions and species present on their site has been developed as a tool supporting the continued implementation of biodiversity management in quarries. This tool provides autonomy in an approach aimed at transferring responsibility from experts to the sector.



The platform provides several tools:

- Maps of actions on which the quarry managers can find in place or past actions;
- Sites' target and commitments in terms of species and actions;

- A planner that reminds managers at what time of the year it is appropriate to create or withdraw actions and to carry out monitoring;
- Access at all times to technical information on the actions and on target animal and plant species encountered or expected on their site.

General awareness campaign: In addition, to specific training and resources targeting quarry actors, the Life in Quarries developed an ambitious dissemination campaign.

Folders aiming at a general presentation of the project were produced and disseminated throughout the project events and to a diversity of established contacts.

A Newsletter was specifically dedicated to inform on the project's progress. While it targeted primarily quarries actors to explain actions and results on biodiversity, it was designed (message and layout) to be attractive to a broader audience (naturalists, schools, civil servants, layman ...).

A strong communication campaign was dedicated to raise awareness on the Life in Quarries through: (i) a series of oriented media in Belgium (nature conservation journal, Nature park newsletter, quarry sectors newsletter, scientific vulgarization journals ...), (ii) attendance to oriented events (nature film festival, nature manager days, scientific and nature conservation conferences ...), and, (iii) media for the layman (TV news and documentaries, radio, newspapers, etc.).

Presence on social medias (Facebook, LinkedIn, and Instagram) allowed for a higher visibility of the project and for a broader audience to be reached.



“If you want to build a ship, don't drum up the men to gather wood, divide the work and give orders. Instead, teach them to yearn for the vast and endless sea.”

Antoine de Saint-Exupery

Life in Quarries method to assess and monitor biodiversity perception in active quarries

To monitor the impact of its training strategy, the Life in Quarries developed a specific action (D6) evaluating extractive sector actors' biodiversity perception (consciousness) at the beginning (D6a) and the end (D6b) of the project. This action aimed at (i) identifying lockouts and opportunities for supporting actions implementation for biodiversity, and, (ii) evaluating precisely how the communication, dissemination and demonstration of the Life in Quarries lead to an evolution in the behaviors and motivations of the sectors. The action was based on surveys revealing biodiversity knowledge and values.

Surveys

The survey was based on two campaigns of structured⁴ interviews. The first campaign consisted of face-to-face interviews conducted between May and July 2016 while the second campaign took the form of a mix of face-to-face and videoconference interviews (due to the Covid-19 crisis), conducted from March to May 2021. The method allowed obtaining quantitative as well as qualitative data, and, interviewing a high number of persons at different positions in the companies. Interviews further allow a rewording of questions ensuring a good understanding and clarifying ambiguities (Primmer et al., 2014). The pre-project questionnaire (2016) aimed at defining a baseline assessment: this first survey of the perception of the quarry sector for biodiversity assessed the level of knowledge, awareness and concerns and the need for information on biodiversity of the quarry sector. The end of project questionnaire (2021) monitored biodiversity perception after 5 years allowing an evaluation of the Life in Quarries impact.


The 2016 questionnaire included seven distinct sections (see *Annex 3* for details) and three were added to the 2021 questionnaire (see *Annex 2* for details) to specifically evaluate the impact of the Life in quarries actions (Table 1):

- Respondents' profile (status, age, daily work, etc.) (questions 0 to 3);
- Level of knowledge on biodiversity (questions 4.1 to 4.3);
- Perception on ecosystem services in quarries (questions 5.1 to 6.3);
- Level of knowledge on biodiversity in quarries (questions 7.1 to 8.1);
- Interests and concerns regarding biodiversity in quarries (question 9 and questions 21.1 to 23);
- Availability of information about biodiversity (questions 10.1 to 10.4);
- Training (2021 specific) (questions 11.1 to 12.5);
- Level of knowledge on issues of the Life in Quarries (2021 specific) (questions 13.1 to 15);
- Involvement in quarries' biodiversity (questions 16.1 to 17.2 and question 20);
- Availability of information from the Life in Quarries (2021 specific) (questions 18.1 to 19.3).

The section of the topics and the questions were ordered to promote a reflection progressively investigating the subject. Knowledge was firstly assessed with questions on ordinary biodiversity, and

⁴ For a structured interview, the questions are pre-established and asked in a fixed order (Primmer et al., 2014).

then probed further with questions on biodiversity targets specific to the Life in Quarries (habitat/species). The sequence of the questions allowed respondents to answer first spontaneously with open questions and then to answer more precise closed questions with pre-established list of answers. The questionnaires were designed as not to reveal information that could be answered in the following questions by the respondents. Questions were sorted to influence answers as little as possible by showing species and information only following spontaneous mentions by respondents (e.g. question 7.1 “Have you been surprised by some animals in the quarry?” came prior to question 14 “I am going to show you several pictures of plants and animals. For each of them, could you tell me which one(s) have you seen in the quarry, its name, if it is native or not and if it is rare or in danger?”). The questions on the level of involvement of respondents in the monitoring of actions and species only appeared at the end of the questionnaires to avoid a feeling of knowledge judgment by deeply involved respondents.

 **Table 1. Examples of questions asked during the interviews (see Annex 2 and 3 for the full list of questions).**

Section	Question
Level of knowledge on biodiversity	<ul style="list-style-type: none"> ○ Have you ever heard about the term of “biodiversity”? (question 4.1; Knowledge) ○ Among these following statements, how well do you understand this term? (question 4.2; Knowledge) ○ In your opinion, what is the meaning of this term? (question 4.3; Knowledge)
Perception on ecosystem services in quarries	<ul style="list-style-type: none"> ○ Do you do one or several of these activities in the quarry? (question 5.1) ○ In your opinion, besides raw materials production, what are the services supplied by the quarry among the following list? (question 6.1)
Level of knowledge on biodiversity in quarries	<ul style="list-style-type: none"> ○ Have you been surprised by some animals in the quarry? (question 7.1; Knowledge) ○ Have you been surprised by some plants in the quarry? (question 8.1; Knowledge)
Interests and concerns regarding biodiversity in quarries	<ul style="list-style-type: none"> ○ I am going to read several statements regarding biodiversity in quarries. For each of them, can you tell to what extent do you agree on a five-point scale? (question 9; Value)
Availability of information about biodiversity	<ul style="list-style-type: none"> ○ Do you feel that you receive enough information on plants and animals in the quarry and the actions to set in place for them? (question 10.4; Impact)
Training	<ul style="list-style-type: none"> ○ Have you received any training on the subject of biodiversity? (question 11.1; Impact) ○ Among the following proposals, how did you find this/these training(s)? (question 12.2; Impact)
Level of knowledge on issues of the Life in Quarries	<ul style="list-style-type: none"> ○ I am going to show you several pictures of plants and animals. For each of them, could you tell me which one(s) have you seen in the quarry, its name, if it is native or not and if it is rare or in danger? (question 14; Knowledge) ○ In your opinion, are there some areas in the quarry that seem important for nature, plants and animals? (question 13.1; Knowledge)
Involvement in quarries’ biodiversity	<ul style="list-style-type: none"> ○ Are actions for nature, plants and animals implemented in the quarry? (question 16.1; Value) ○ Do you participate in the implementation of one or several of these actions? (question 16.3; Value)
Availability of information from the Life in Quarries.	<ul style="list-style-type: none"> ○ Have you ever heard of the Life in Quarries? (question 18.1; Impact) ○ What do you think is the best way to communicate with you about the project? (question 19.3; Impact)

In order to qualify the **perception**, the survey evaluated the **knowledge** of the sector on biodiversity and the **values** attached to it. The level of **knowledge** on biodiversity was assessed through the respondents’ answers to questions in sections “Level of knowledge on biodiversity”, “Level of knowledge on biodiversity in quarries” and “Level of knowledge on issues of the Life in Quarries” of the questionnaires.

The **values** attributed to biodiversity were defined from the respondents' answers to questions in sections "Interests and concerns regarding biodiversity in quarries" and "Involvement in quarries' biodiversity". **Impact** of the project was determined on the respondents' answers to questions in sections "Availability of information about biodiversity", "Training" and "Availability of information from the Life in Quarries".

The questions were based on a literature review of scientific papers and reports studying biodiversity awareness and nature or environmental issues in various economic sectors (Invasive species in the horticulture sector: Halford et al., 2011, Halford et al. 2013; Old growth forests in the forestry sector: Lathuilière & Gironde-Ducher, 2014; Ecosystem services in agricultural sector: Logsdon et al., 2015, Quinn et al., 2015; Biodiversity and land management strategies in agricultural sector: Waudby et al., 2012; Biodiversity awareness of members of organization: CNES, 2010; and of local communities: Laird & Black, 2013, Luck et al., 2011, Skandrani & Prévot, 2015, Progressive Partnership Ltd, 2009, TNS Political & Social, 2013). The wording of questions was carefully designed to make them understandable by the entire quarrying sector. As an example, the term "ecosystem services" was not directly used as it is rarely understood (Orenstein & Gover, 2015) and was rather replaced by "service" or "activity".

Sampling design

The survey was addressed to multiple quarry workers of Walloon sites depending on their position in the company and the level of engagement of their quarry in the project (Table 2).

Five positions were identified among the sector:

- Director (14 (2016), 24 (2021));
- Environmental manager (14 (2016), 26 (2021));
- Site manager (31 (2016), 16 (2021));
- Worker (29 (2016), 27 (2021));
- Subcontractor (14 (2016), 6 (2021)).

Four levels of engagement were considered for the sites⁵:

- FEDIEX sites part of project's Phase I (14 sites, 56 persons (2016); 14 sites, 48 persons (2021));
- FEDIEX sites part of project's Phase II: II.1 and II.2 (10 sites, 27 persons (2016); 12 sites, 32 persons (2021));
- FEDIEX non-project sites (not sampled in 2016; 3 sites, 10 persons (2021));
- Non-FEDIEX sites (7 sites, 15 persons (2016); 5 sites, 5 persons (2021)).

Three extractive industries' federations were also interviewed: FEDIEX as coordinator of the Life in Quarries and two that were not involved: 'Pierres et Marbres de Wallonie' and 'Ressources Naturelles Développement ASBL'.

⁵ A total of 26 quarries were partners of the project. Fourteen (14) are defined as phase I quarries, 9 as phase II.1 quarries and 3 as phase II.2 quarries. The phase I quarries are extractive sites that joined the project at its initiation in 2016. Phase II.1 quarries were added to the project at a later stage, in 2018 and phase II.2 quarries in 2019.



Table 2. Distribution of respondents among the positions and the levels of engagement in the project.

Position		Federations		Sites			Total respondents	
		FEDIEX	Other	Non-FEDIEX	Non-project FEDIEX	Project Phase I		Project Phase II
2016	Director	1	2	2		9	14	
	Environmental manager	1				11	14	
	Site manager			7		14	31	
	Worker			5		14	29	
	Subcontractor			1		8	14	
Total respondents 2016		2	2	15	-	56	102	
2021	Director	1	1	4	3	10	5	24
	Environmental manager	1	1	1	3	12	8	26
	Site manager				3	9	4	16
	Worker					14	13	27
	Subcontractor				1	3	2	6
Total respondents 2021		2	2	5	10	48	32	99

For each site, whenever possible, the site manager, a worker and a subcontractor were randomly selected and interviewed. In each company (often regrouping several sites) and in each federation, as far as possible, the director and the environmental manager were interviewed. With 102 interviews in 2016 and 99 interviews in 2021, 201 interviews were conducted among different positions of the quarrying sector and its level of engagement in the project.

Data analysis

Following both sequences of interviews, data were compiled and analyzed in order to extract evolution of the consciousness. Questions were categorized into close-ended questions – with answers being either ‘yes’ or ‘no’ or categorical answers - and open-ended questions requiring in-depth analysis.

For closed-ended questions, general statistics were computed.

For open-ended questions, several methods were used:

- Global level of knowledge on biodiversity was evaluated by analyzing answers to questions included in the section “Level of knowledge on biodiversity” (**Question 4.1 to 4.3**). Answers were compared with the definition of biodiversity proposed in the Convention on Biological Diversity (1992), i.e.: “*Biological diversity*” means the variability among living organisms from all sources including, inter-alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. This definition highlights 5 notions relating to biodiversity (1) variability; (2) all living organisms; (3) within species (genetic) diversity; (4) species diversity; (5) ecosystems diversity. Global level of knowledge was evaluated following criteria presented in Table 3.

Table 3. Criteria used to identify the global level of knowledge on biodiversity definition.	
Level of knowledge	Criteria
High	Interviewees who mentioned at least four notions of the definition
Medium	Interviewees who mentioned at least two notions of the definition
Low	Interviewees who answered “No” to the question “Have you ever heard about the term of «biodiversity»?” OR mentioned less than two notions of the definition

- The right and wrong answers were determined for the following questions:
 - *“I am going to show you several pictures of plants and animals. For each of them, could you tell me which one(s) you have seen in the quarry, its name, if it is native or not and if it is rare or in danger?” (Question 14);*
 - *“I am going to show you several pictures of animals and habitats in a quarry. Could you, for each habitat, tell me which animal(s) live(s) there?” (Question 15);*
- Answers were compiled into main categories for the following questions:
 - *“Which constraints for production represent plants, animals and nature in quarries?” (Question 9.5);*
 - *“Which opportunities for production represent plants, animals and nature in quarries?” (Question 9.7);*
 - *“Could you show me on this aerial photograph these areas and explain me why they are important for you?” (Question 13.2);*
 - *“Are actions for nature, plants and animals implemented in the quarry?” (Question 16.1).*

Because the sample sizes for participants to the project was larger than for non – participants, results are in general presented in detail for Life in Quarries participants. Due to the relatively small sample size for non-participants (15 respondents), only general trends and major differences with participants are highlighted to avoid over-interpretation of random variation.

Perception of biodiversity in the extractive sector and impact of the Life in Quarries - Results

Knowledge on biodiversity

Knowledge on the concept of biodiversity

At the beginning of the project (2016), almost every respondent (95%) had already heard of the term «biodiversity» (question 4.1). This percentage rose to 100% respondents at the end of the project (2021). The biodiversity definition of the participants to the Life in Quarries tended to be closer to the scientific definition (Convention on Biological Diversity, 1992) following the project implementation (sum of medium-high correspondence: 80%) as compared to 2016 (sum of medium-high correspondence: 53%) (Figure 5 -

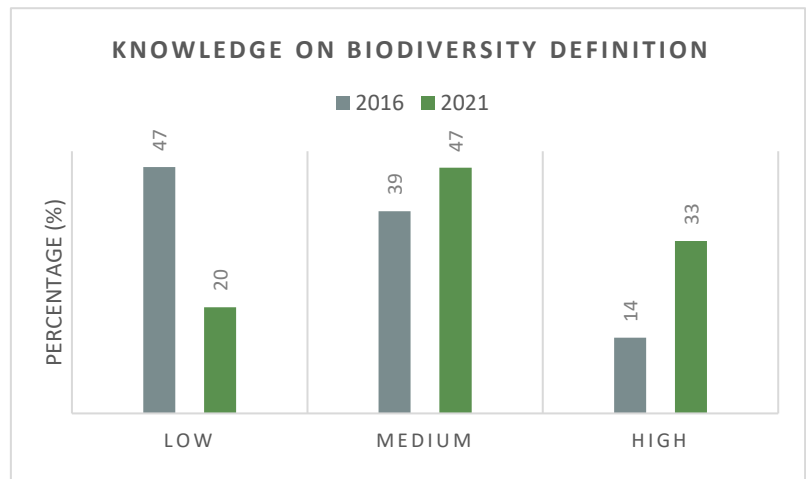


Figure 5. Level of knowledge on biodiversity definition in 2016 and 2021. Results from participant of the Life in Quarries sites.

question 4.3). Differences were mainly due to the citation of ‘diversity of all living forms’ and ‘diversity of ecosystems’ in 2021, as well as to a lower percentage of non-pertinent definitions (environmental challenges, conservation policies ...). An increase in biodiversity definition knowledge was also observed for non-participants to the project (medium-high : 27% in 2016, 86% in 2021)

The increased level of knowledge on biodiversity definition was dependent on the working position in the sector/quarry (Figure 6 - question 4.3). The project had a more important effect on the people directly involved in quarries operations, with workers increasing their scores between 2016 and 2021 (medium-high correspondence: +36%). Site managers, also involved in operations, improved their knowledge of the concept between 2016 and 2021 (+38%). Subcontractors also increased their level of knowledge on biodiversity concept between 2016 and 2021 (+37%). The level of knowledge of the directors (+9%) and environmental managers (+25%) rose with a more moderate trend as it was already high at the beginning of the project.

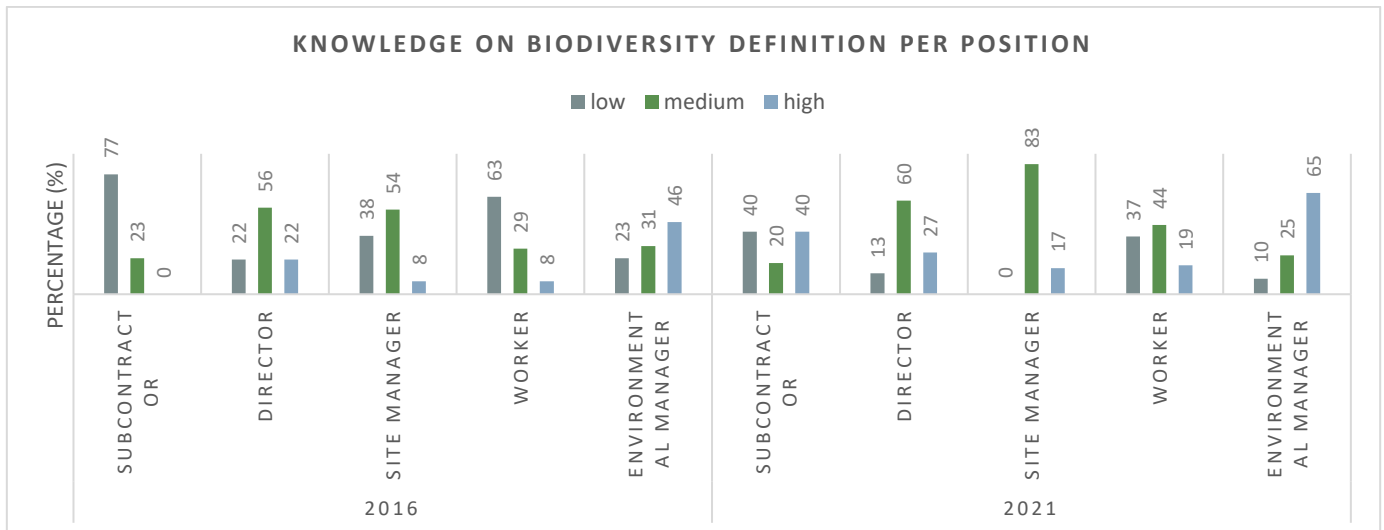


Figure 6. Level of knowledge on biodiversity definition, depending on the position in the company, in 2016 and 2021. Results from participant of the Life in Quarries sites.

Knowledge on species and habitats

Knowledge on ordinary biodiversity (i.e. widespread species) was rather high at the end of the project for most species (70% to 100% of correct identification), except for Canada goose which requires more naturalist competencies (29%). A significant increase in species recognition was observed for Roe deer (+18%) and Summer lilacs (+30%). This increased knowledge was also true for the Summer lilac status rightly associated to non-protected species (+18%) with a higher knowledge of its introduced status (+9%) (Table 4 - question 14). Level of knowledge on ordinary biodiversity was mostly similar or slightly superior for participants to the Life in Quarries project than for non-participants.

Species	Species name (%)	Variation (2016)	Native or introduced (%)	Variation (2016)	Protected/non-protected (%)	Variation (2016)
	Red fox (<i>Vulpes vulpes</i>)	100	0%	96	0%	88
Roe deer (<i>Capreolus capreolus</i>)	70	+18%	98	+4	91	+7%
Canada goose (<i>Branta canadensis</i>)	29	-12%	54	-13%	93	+5%
Summer lilac (<i>Buddleja davidii</i>)	73	+30%	66	+9%	98	+18%

At the end of the project, knowledge of the life in Quarries target species was variable ranging from 8% to 88% of correct identification on pictures (Table 5 - question 14 and Table 6 - question 15). 64% and 38% of the respondents recognized respectively Orchids and Stoneworts, which were not included in the 2016 questionnaire. The correct answer rates increased for species recognition in 2021 compared to 2016: the grass snake, Eurasian Eagle-owl were better identified, with respectively +17% and +37%

of correct answers (Table 5); so were the sand martin, smooth snake, Natterjack toad, wall lizard and great crested newt, with an increase of respectively 2%, 19%, 25%, 16% and 28% in correct answers (Table 6). Knowledge on species origin increased for grass snake, Eurasian Eagle-owl and stonecrop (respectively +19%, +13% and +33% of correct answers) (Table 5). We observed an increase in species status determination for Eurasian Eagle-owl and stonecrop (respectively +5% and +33% of correct answers) (Table 5). Species of interest of the Life in Quarries had been more frequently encountered at work by respondents (+3% to +42%, Table 5 and Table 6). As expected, the percentages of recognition increased when the sample only took into account respondents from sites where the species was actually present (see Annex 3). Lower percentages of recognition were observed for smaller and less emblematic species such as the southern skimmer (a dragonfly – 10%) compared to the iconic species of the project, broadly communicated on: the Natterjack toad (55%) or the highly popularized, easily identified Eurasian Eagle-Owl (88%). While detailed species recognition may vary depending on the species, the recognition of species habitat was much higher (from 63% to 96%) (Table 6).

Employees who participated in the training courses obtained better answers to the knowledge questions than those who did not. The difference was more pronounced for questions concerning the species at stake in the project, with an increase of 8% in correct answers when it came to questions on common biodiversity and of 16% when it came to species specific to the Life in Quarries.

The level of knowledge on target species of the project was higher for Life in Quarries participants than for non-participants, for all species with spectacular differences for Natterjack toad (55% vs 13%), Great crested newt (45% vs 13%), Little ringed plover (43% vs 7%), Stoneworts (38% vs 0%).

Species	Species name (%)		Native or introduced (%)		Protected non-protected (%)		Seen at work (%)	
	2021	Variation (2016)	2021	Variation (2016)	2021	Variation (2016)	2021	Variation (2016)
Grass snake (<i>Natrix natrix</i>)	65	+17%	89	+19%	56	-4%	28	+20%
Eurasian Eagle-Owl (<i>Bubo bubo</i>)	88	+37%	99	+13%	93	+5%	64	+12%
Stoncrop (<i>Sedum sp.</i>)	8	+1	48	+33%	58	+33%	65	+42%
Orchid (<i>Ophrys sp.</i>)	64	-	64	-	69	-	54	-
Stoneworts (<i>Characeae</i>)	38	-	79	-	69	-	86	-



Table 6. Percentage of correct answers in 2021 and variation as compared to 2016 on questions about species names (based on a picture), species habitat and percentage of respondents who have encountered the species in quarries, for target species of the Life in Quarries project. Results from respondents of the Life in Quarries sites.

Species	Species name (%)	Variation (2016)	Corresponding Habitat (%)	Variation (2016)	Seen at work (%)	Variation (2016)
Sand martin (<i>Riparia riparia</i>)	68	+2%	96	-2%	60	+21%
Smooth snake (<i>Coronella austriaca</i>)	19	+13%	96	+14%	18	+13%
Natterjack toad (<i>Epidalea calamita</i>)	55	+25%	81	-8%	65	+8%
Wall lizard (<i>Podarcis muralis</i>)	26	+16%	93	+27%	59	+20%
Great crested newt (<i>Triturus cristatus</i>)	45	+28%	78	-11%	26	+3%
Southern skimmer (<i>Orthetrum brunneum</i>)	10	-	70	-	93	-
Little ringed plover (<i>Charadrius dubius</i>)	43	-	63	-	46	-

The third question regarding biodiversity specific to the project was to name areas of the quarry favourable to biodiversity (question 13.2). In 2016, 93% of the respondents indicated that important biodiversity areas were present on their sites. In 2021, 100% of the respondents indicated that important biodiversity areas were present in their quarries (question 13.1). While in 2016, areas situated outside the exploitation zone - surrounding areas (33%), woodlands (30%) and backfilling areas (28%) - were identified as most important for biodiversity, in 2021, respondents identified a higher diversity of areas important for biodiversity. They identified active areas as supporting temporary - dynamic habitats. This was in accordance with the main targets of the Life in Quarries project: temporary ponds, pioneer grasslands, scree slope, bee bank, screes. As a result, 22% of respondents considered the whole quarry as a place for biodiversity in 2021 (3% in 2016) (Figure 7).

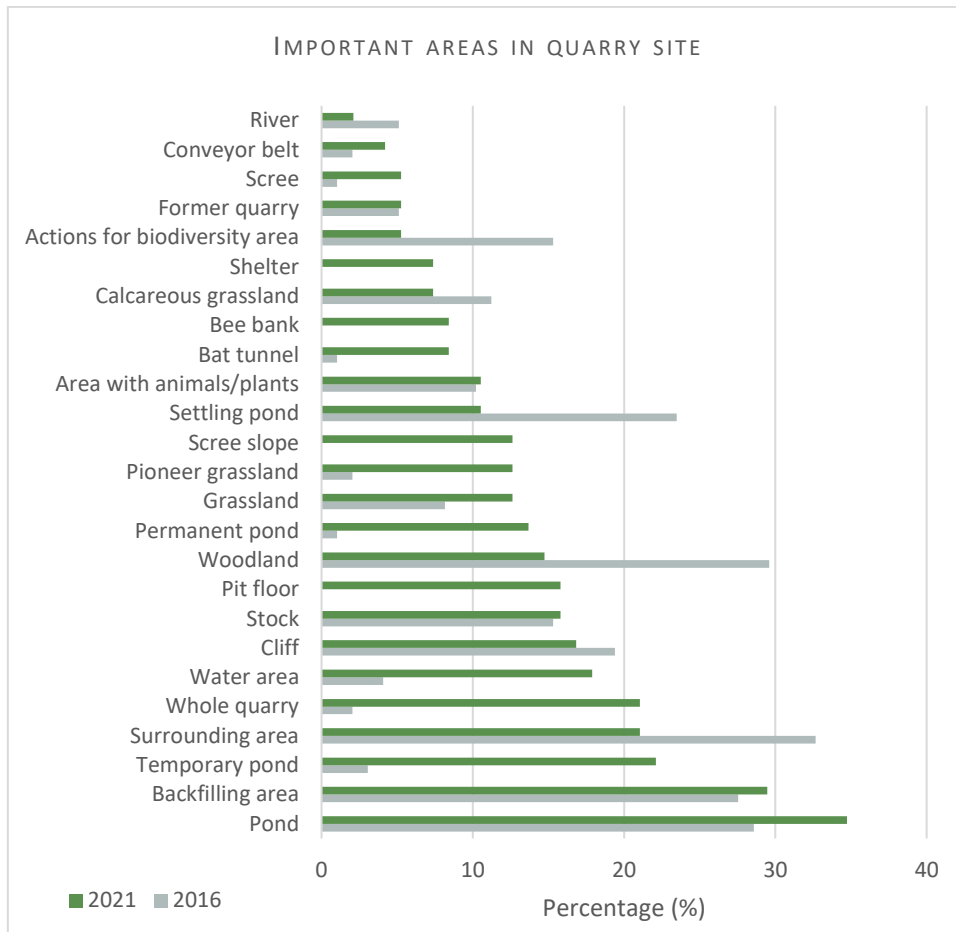


Figure 7. Important biodiversity areas in a quarry site mentioned by the respondents (with more than five occurrences in total) (All respondents except Federations).

Self-evaluation of biodiversity knowledge

Respondents had a high degree of self-evaluation of their understanding for the concept of biodiversity (Figure 8 - question 4.1 - question 9.4). At the beginning of the project 96% estimated they understood the term biodiversity “fairly well” to “very well”. There was no evolution during the project with self-evaluation categories staying rather stable (Figure 8). However, self-confidence on biodiversity knowledge was strongly lower when it came to precise species knowledge with only 29% of the sector's stakeholders feeling confident with their knowledge on species (flora and fauna) present in their quarries (Figure 9). This was higher than at the beginning of the project (12%) but still low when compared with the true knowledge on species (see *Knowledge on species and habitats*).

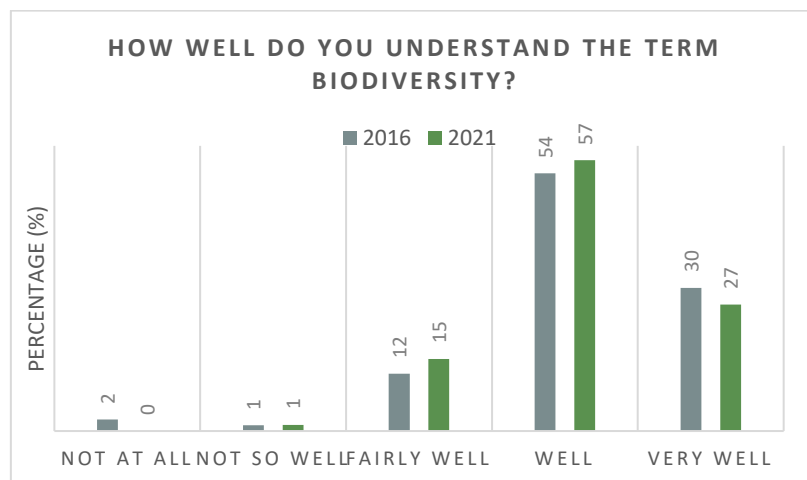


Figure 8. Self-evaluated level of knowledge about the term “biodiversity” Results from participant of the Life in Quarries sites.

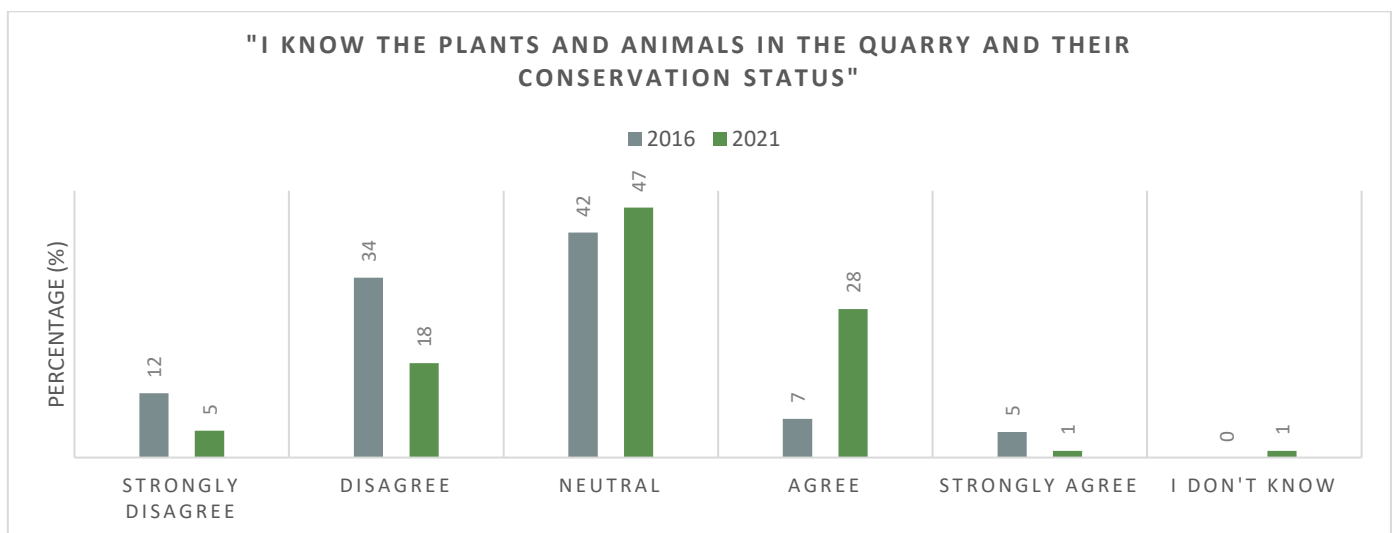


Figure 9. Level of agreement with the following statement, “I know the plants and animals in the quarry and their conservation status”. Results from respondents of the Life in Quarries sites.

Value attributed to biodiversity

The perception of biodiversity is built on the basis of the values attributed to it. Values identification was based on indicators of **Interest** in biodiversity, **Importance** attached to its presence and the **Willingness** to protect it in quarries, but also on how biodiversity is perceived in terms of constraints and opportunities for the extractive sector (sections 5 and 9 of the questionnaires - see *Surveys* and *Sampling design*).

Interest in biodiversity was high at the beginning of the project and increased during the project with a higher percentage of respondents interested (i.e. agreeing or strongly agreeing) in plant and animals in quarries in 2021 (91%) than in 2016 (81%) (Figure 10 - question 9.1). At the end of the project, almost all participants (93%) were interested in receiving feedback on the survey (question 23) demonstrating a high interest on the process.

Question 9.3: "I attach importance to the presence of biodiversity in my quarry."
"Before the project I would have answered "neutral", now I will say I strongly agree."

Site manager of a phase II quarry site, 2021

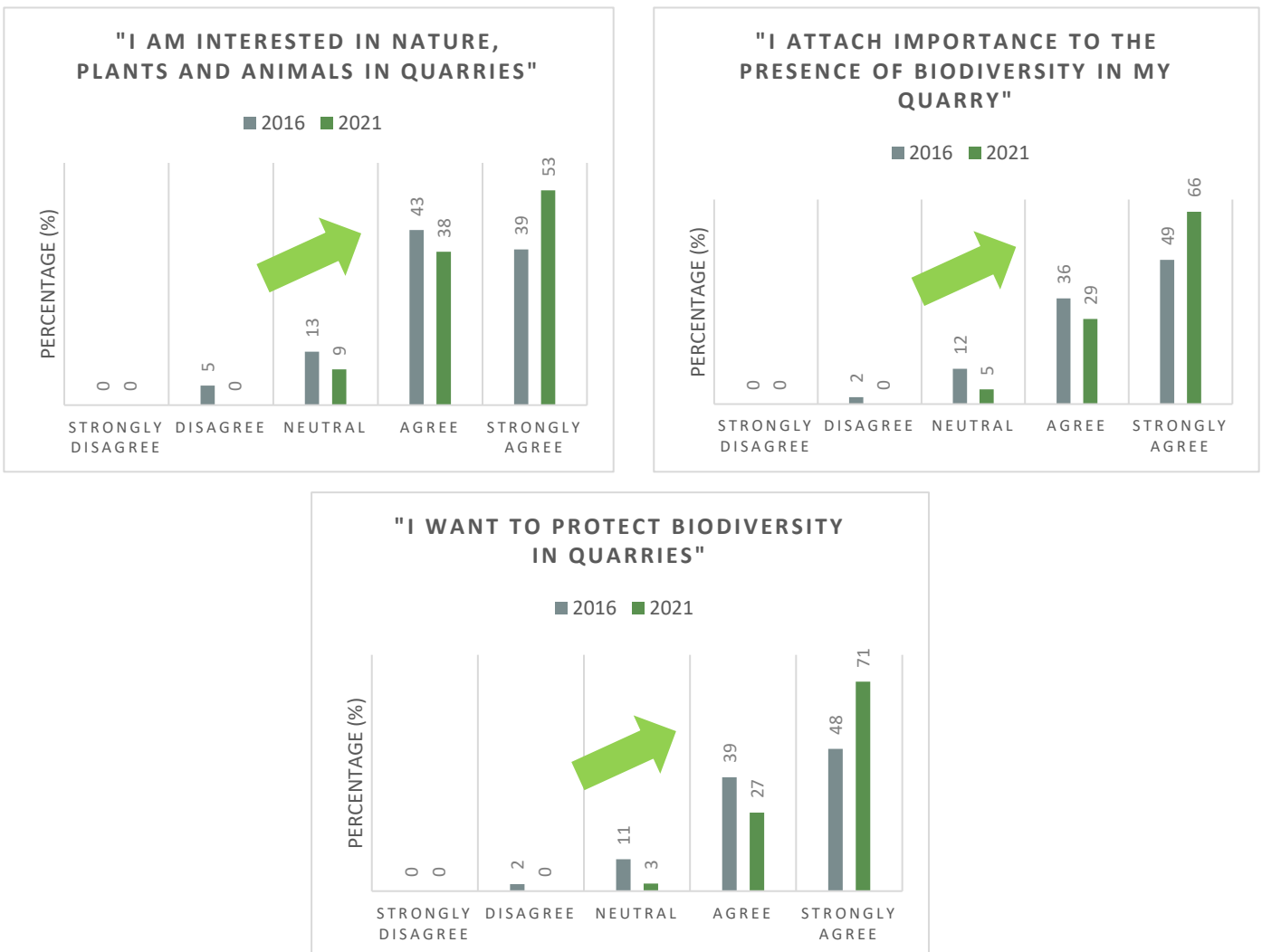


Figure 10. Level of agreement with the following statements: "I am interested in nature, plants and animals in the quarry". "I attach importance to the presence of biodiversity in my quarry», "I want to protect biodiversity in quarries" Results from respondents of the Life in Quarries sites.

As for interest, **Importance** given to biodiversity in the working place was high initially and even higher at the end of the project (2016: 85% respondent agreement; 2021: 95%) (Figure 10 - question 9.3).

Similarly, the **Willingness** to protect biodiversity in the working place was also high at the beginning and further increased during the project (2016: 86% respondent agreement; 2021: 97%) (Figure 10 - question 9.2). Both observations could explain the interest felt by the project's team for the implementation of actions.

Interest, importance and willingness to protect biodiversity was also high at the end of the project and increased for non-participants to the Life in Quarries project but levels of agreement/strong agreement were smoothly lower than for participants (respectively 73%, 87%, 80%).

Taking part in the Life in Quarries actions or observing them in the workplace brought positive feelings from respondents with: satisfaction (35%), well-being at work (23%), awareness (23%) and pride (18%) cited. Only a limited percentage cited constraints (1%) (Figure 11 - question 16.4). The impact of the project on relationship to nature was highly relevant as 75% of respondents part of the Life in Quarries answered an evolution in their relationships with nature following from the Life in Quarries (Figure 12).

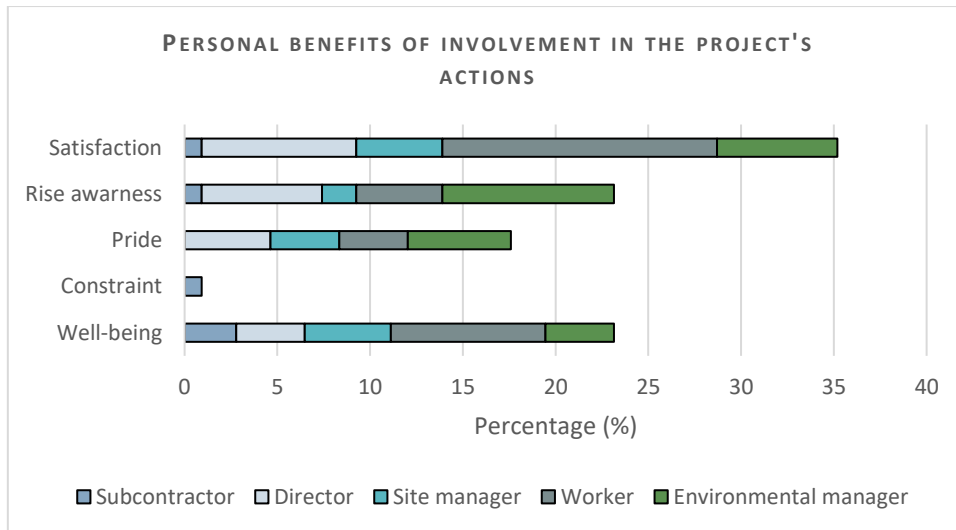


Figure 11. Percentage of citation of personal benefits gained from involvement in the Life in Quarries project. Results from respondents of the Life in Quarries sites.

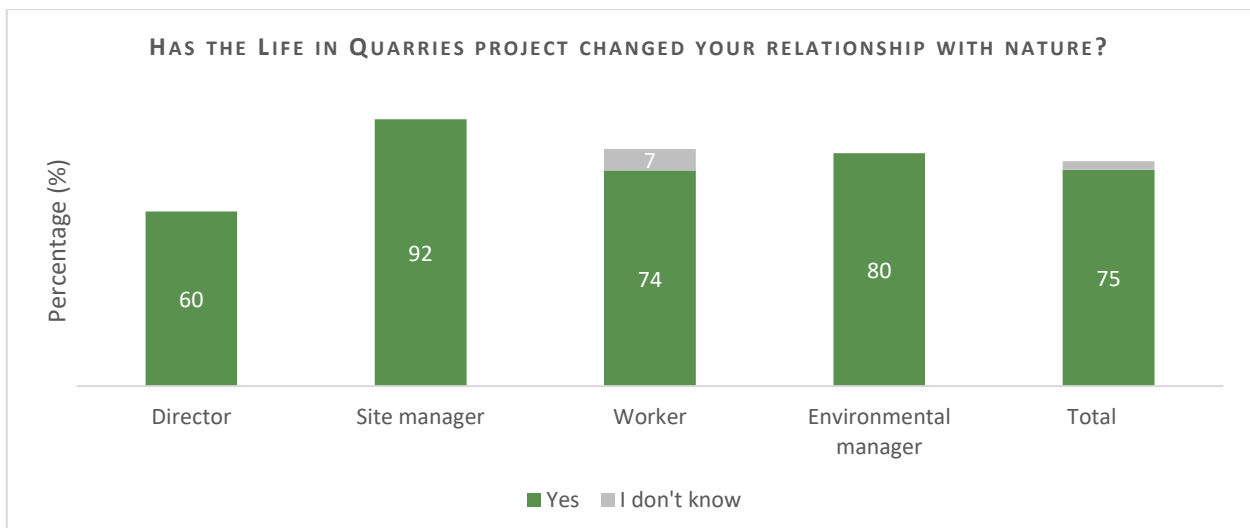


Figure 12. Percentage of respondents for whom the Life in Quarries project changed their relationship with nature depending on their position in the company. Results from respondents of the Life in Quarries sites.

Biodiversity was perceived as an opportunity for quarry production (i.e. agreeing or strongly agreeing): with a score of 33% in 2016 and 36% in 2021 (Figure 13 - question 9.5). In 2021, biodiversity in quarries was identified as an opportunity for the image of the sector towards the public, which may not be aware of species and habitats found in quarries (37%). The second most cited opportunity was the intrinsic value of biodiversity (20%), followed by the expected facilitation in the granting of permits (18%) and means of conserving the extractive sector activity (12%) (Figure 14 - question 9.6).

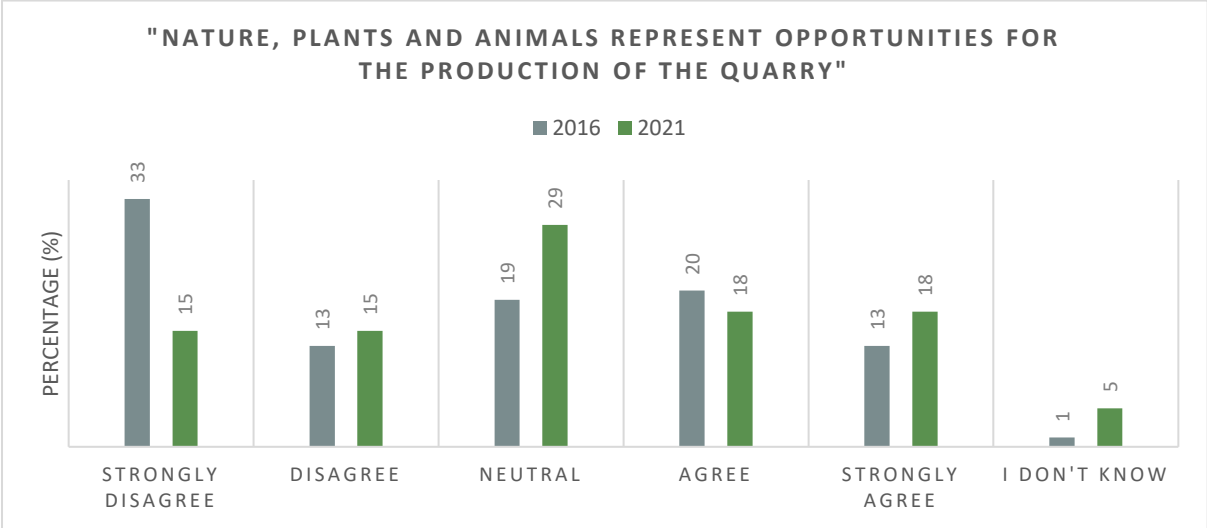


Figure 13. Percentages for the degrees of agreement with the statement “Nature, plants and animals represent opportunities for the production of the quarry”. Results from respondents of the Life in Quarries sites.

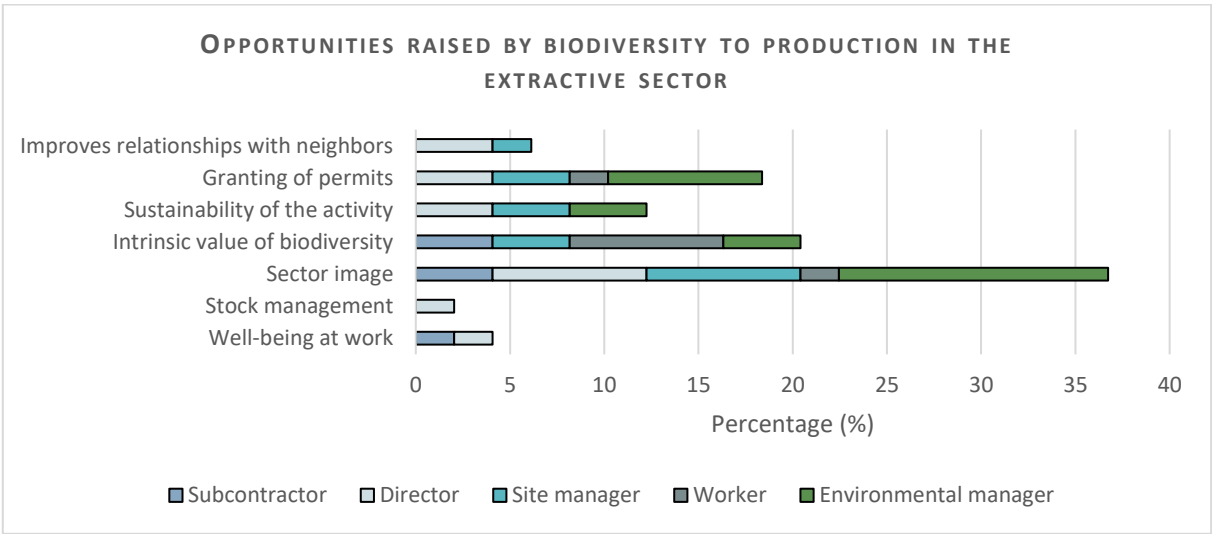


Figure 14. Percentage of respondents citing opportunities raised by biodiversity for production in the extractive sector Results from respondents of the Life in Quarries sites.

Question 9.7: “Nature, plants and animals represent constraints for the production of the quarry.” “Biodiversity must be perceived as an opportunity not a constraint even if it brings challenge with.”

Environmental manager of a phase I quarry site, 2021

In the same time, biodiversity management was more perceived as a constraint by the extractive sector in 2021 (41%) than in 2016 (26%) (Figure 15 - question 9.7). This was linked, in 2021, to a recognition of the need to plan actions in accordance with the life cycle of species (34%), followed by the constraint of implementing actions in the field (14%) and logistics (14%) (i.e. use of areas and machines that cannot be made available for production

during their assignment to the project). These factors were closely followed by the administrative management burden related to the Life in Quarries (13%) (Figure 16 - question 9.8).

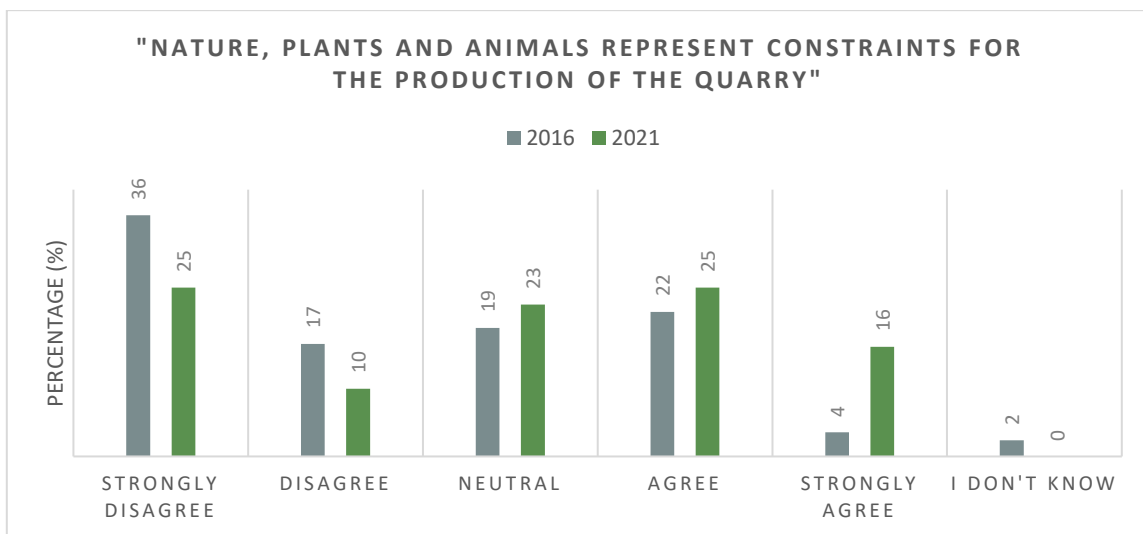


Figure 15. Percentages for the degrees of agreement with the statement “Nature, plants and animals represent constraints for the production of the quarry”. Results from respondents of the Life in Quarries sites.

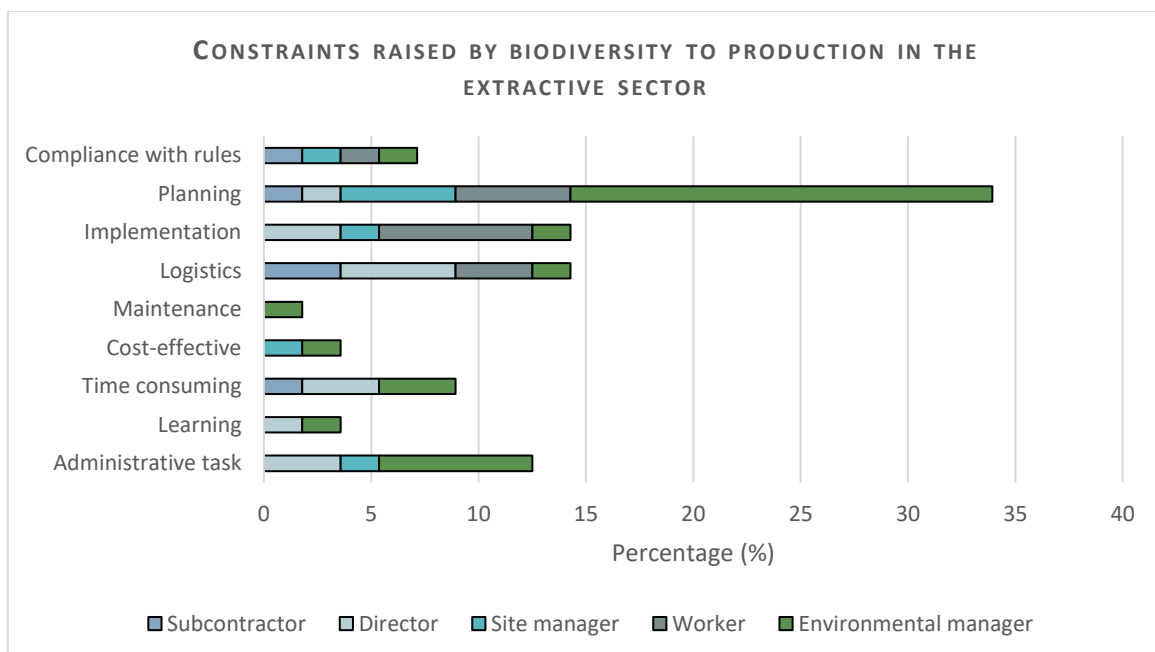


Figure 16. Distribution of respondents answers among constraints they raised (Constraints = 56, Respondents = 41, Subcontractor = 4, Director = 8, Site manager = 7, Worker = 8, Environmental manager = 14, analysis focused on respondents from Life in Quarries sites).

Diffusion of information on biodiversity within the extractive sector

To further allow enhancing the sector’s consciousness, it seems important to understand how the Life in Quarries helped to raise awareness, trained and disseminated information on biodiversity to the sector and which means of communication resulted as the most effective.

At the end of the Life in Quarries, almost the entire sector answered “yes” to the question “*have you ever been informed about biodiversity in your quarry?*” (98%), a 30% increase as compared to 2016 (68%). The newly informed were mainly workers (+48%), directors (+47%) and site managers (+20%). Logically, the environmental managers being already trained on the subject at the beginning of the project only slightly evolved from 93% to 96% (+3%) (Figure 17 - question 10).

The sector also appeared better trained: while in 2016, 18% of the employees of FEDIEX or of Life in Quarries sites had received trainings, in 2021, the percentage increased to 67% (question 11). 97% of trained staff found the trainings useful or very useful (question 12). Globally, the sector’ stakeholders felt better informed than at the beginning of the project as while in 2016, most of the directors (71%), site managers (68%) and workers (66%) did not feel enough informed whether they were part of Federations, the Life in Quarries or others sites, figures dropped to 33% for directors, 6% for site managers and 32% for workers in 2021 (Figure 18 - question 10). According to the sector, the best ways to obtain information on biodiversity was a mix of newsletters (34%) coupled with on-site trainings (34%) (Table 7 - question 19).

Question 16: “*Do you participate in implementation of actions in favour of biodiversity?*”

“No, but I would have liked my site to be a part of the project.”

Environmental manager of a Non-FEDIEX quarry site, 2021

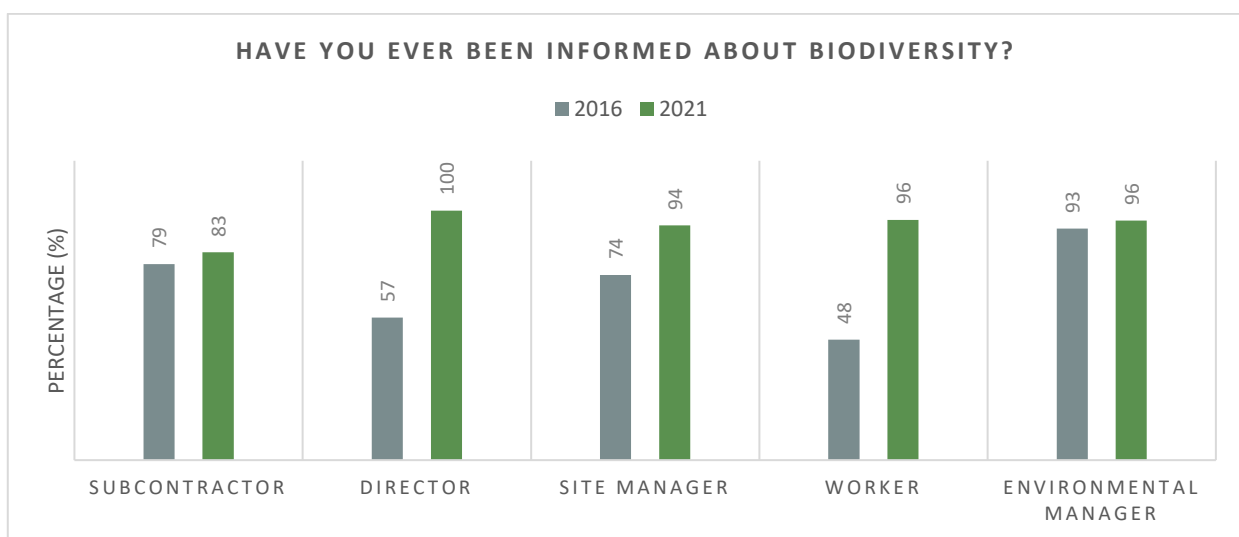


Figure 17. Proportion of respondents who declared having received information on biodiversity in quarries depending on their position in the company. All respondents.

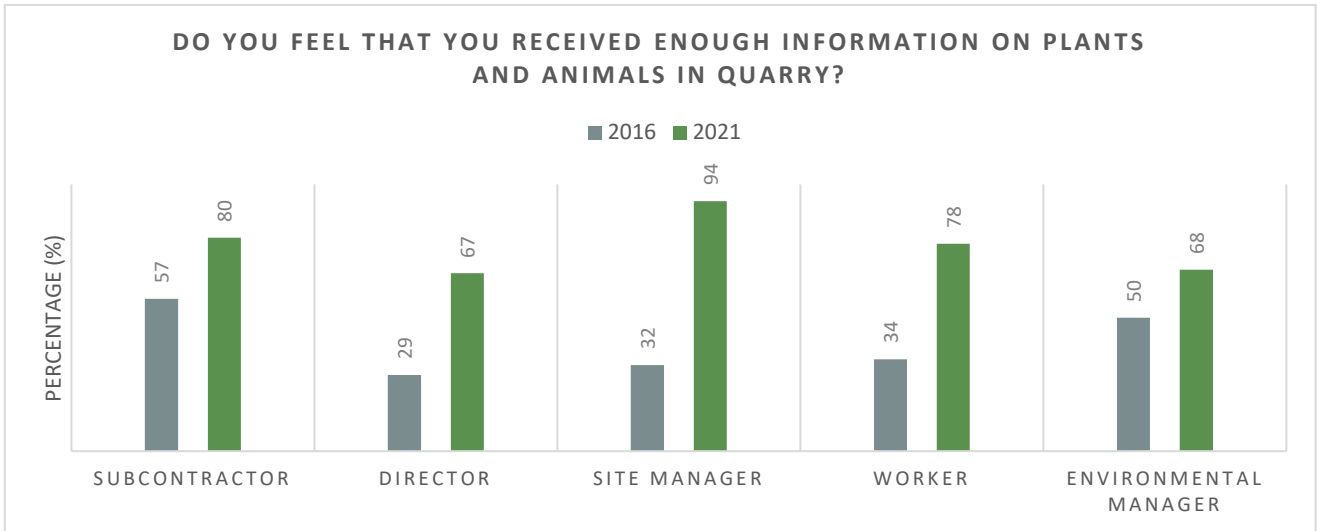


Figure 18. Proportion of respondents that felt enough informed on biodiversity in quarries depending on their position in the company All respondents.

Position	Table 7. Percentage of citation for preferred means of communication on information on biodiversity in quarries (2021). All respondents.							
	Through a colleague	On-site training	Media (television, radio)	Newsletter	Platform	Report	Social media	Conference
Subcontractor		1	1	1				
Director		5		11	1		4	1
Site manager		6	1	6	2	1		1
Worker		13	1	6	2	1		4
Manager	1	7	1	8	2		5	
Percent	1	34	4	34	7	2	9	6

Synthesis

Level of knowledge on biodiversity was high in the extractive sector and increased during the Life in Quarries project. Specifically, biodiversity definition was more similar to the definition used in biodiversity policies, and, knowledge on habitats important for biodiversity in quarries was high at the end of project. This increased knowledge is expected to make the sector more independent to manage biodiversity and facilitate dialogues with informed stakeholders such as NGOs, citizens and policy makers.

However, expert support remains important to biodiversity strategies success in the extractive sector. First, while there was a better level of knowledge of common and specific biodiversity targeted by the Life in Quarries in 2021 as compared to 2016, recognition of target species was highly variable depending on the taxonomic groups and the confirmed presence or absence of species on sites. Second, self-confidence of the sector on species knowledge decreased during the project, a typical Dunning-Kruger effect (Kruger and Dunning, 1999), summarized simply as "The more you know, the less you feel you know". At the end of their trainings, respondents have become aware of the great diversity of species that can be found on their sites and the challenge it represents for non-specialist to monitor it. Because, biodiversity management in the Life in Quarries is linked to legal obligations given access to derogations to the Walloon law on nature conservation (under Article 16 of the EU Habitats Directive), expert support will help to decrease legal risks that could be associated to incomplete monitoring and species identifications.

Not only knowledge but also values attached to biodiversity appeared to be important to the extractive sector and increased during the project resulting in a high interest for biodiversity, importance given to it and a true willingness to act for its development. Even though biodiversity was moderately seen as an opportunity for production, quarries staff identified a likely facilitation in the access to permits access. However, the main opportunities were linked to immaterial values linked to biodiversity: a better image of the sector and the conservation and development of the intrinsic value quarries represent for the fauna and flora. The importance of biodiversity presence on sites was also reflected in the personal gains resulting from participating in the project actions. Taking part in the Life in Quarries actions or observing them in the workplace brought: well-being at work, satisfaction, awareness (change of point of view on biodiversity through action and contribution of knowledge) and pride. For a large majority of participants, the Life in Quarries had a positive effect on the relation to nature.

Despite biodiversity actions raising constraints in quarries production for about 40% of respondents, interest and importance attached to biodiversity remained high. The most important constraint identified was the planning of actions in parallel to the daily work agenda linked to an active quarry. This

"I think it's important to have rare species and I'm proud to talk about it to people, saying that we're not just hole-makers, we also have a very specific and rare fauna and flora. When I show photos to people around me, they are impressed to see that we have a positive impact on biodiversity. We often sin by ignorance, the actions and the knowledge that the project brings makes us responsible."

Worker of a Phase II quarry site, 2021

additional task constrained by species ecology adds to an already complex agenda for managers. The AMBREs platform, a simple, interactive management tool adapted to the professional life of the sector developed during the project is expected to highly facilitate the day-to-day dynamic management of biodiversity. To a broader extent, we advocate that a larger share of efforts should be devoted to better interfacing biodiversity management with existing environmental management systems of companies.

Increased knowledge and value attached to biodiversity was supported by the success of the ambitious awareness training campaign promoted by the Life in Quarries' project. At the end of the project, almost all respondents were informed on biodiversity with strong increases for site managers and workers. Two main actions were identified as keys to promote sector information: dynamic web newsletters and trainings to biodiversity management. The biodiversity training program developed in the Life in Quarries proved particularly important to the project success, specifically for training actions including field works and targeted to direct implementation of biodiversity actions. The project concrete implementation by quarries staff positively affected the workers involved in the field. A greater change of knowledge was observed for workers implied in the implementation of actions. If knowledge increase was smaller for higher hierarchical level, it is to be linked to the fact that these positions had already been informed on biodiversity stakes in quarries. They therefore "discovered" fewer things.

Knowledge on target species of the program was higher for species present on sites and when staff had been trained and involved in creating habitat for them. This appears logical as trainings and expert interventions in quarries specifically targeted the site's species.

Face-to-face contact on site appeared as the most important means of training stakeholders. It presents the direct disadvantage of requiring more time and resources but has shown to be conclusive as it results in greater commitments. Trainings attendees present a better knowledge of biodiversity especially on species at stakes.

As a conclusion, the Life in Quarries case study further demonstrates that increasing perception and commitment to biodiversity is not only a matter of information campaigns, but rather a question of increasing competencies on biodiversity at all position in the business sector through dedicated and continuous training actions.

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Annexes

Annex 1. List of Life in Quarries actions

LIFE14 NAT/BE/000364 - C0

LIST OF ALL PROPOSED ACTIONS

A. Preparatory actions, elaboration of management plans and/or of action plans

- A1 Assessment of the state of the art on temporary nature management
- A2 Setting up of a set of indicators
- A3 Inventory and mapping of the main stakes
- A4 Analysis of the legal framework: suppression of the possible legal obstacle and support to the participating quarries
- A5 Construction of a quarry network
- A6 Evaluation of the ES significance of quarries in the landscape

B. Purchase/lease of land and/or compensation payments for use rights

C. Concrete conservation actions

- C1 Tests on the creation and maintenance of temporary habitats
- C2 Implementation of the temporary nature management plan
- C3 Implementation of the permanent nature management plan
- C4 Generalisation at Regional and International level

D. Monitoring of the impact of the project actions (obligatory)

- D1 Monitoring of tests and adaptation of techniques
- D2 Monitoring of biodiversity and ecosystem functions restoration
- D3 Monitoring of Ecosystem Services
- D4 Basic monitoring
- D5 Management plan update
- D6 Socio cultural monitoring of communication actions / consciousness of the sector for biodiversity

E. Public awareness and dissemination of results (obligatory)

- E1 Notice boards
- E2 Website creation
- E3 Networking with other projects
- E4 Redaction of the Layman's report
- E5 Good practices dissemination
- E6 Increased public awareness
- E7 Dissemination at the European Level
- E8 International workshop

F. Project management and monitoring of project progress (obligatory)

- F1 Overall project management
- F2 Financial audit
- F3 After-LIFE Plan
- F4 Indicators

Annex 2. Questionnaire 2021

General information

Date-time					
Interview location					
Weather					
Site type	<input type="checkbox"/> Phase I	<input type="checkbox"/> Phase II	<input type="checkbox"/> Non-Project FEDIEX	<input type="checkbox"/> Non- FEDIEX	<input type="checkbox"/> Federation
Gender	M – F - O				
N° of recording					
Comments					

0.1	In what age range are you?		
	<input type="checkbox"/> Twenties (18-29)	<input type="checkbox"/> Forties (40-49)	<input type="checkbox"/> Sixties (60-69)
	<input type="checkbox"/> Thirties (30-39)	<input type="checkbox"/> Fiveties (50-59)	<input type="checkbox"/> Seventies (70-79)
0.2	Can you give me your postal code?		
0.3	Do you live in the country or in the city?		

1	How long have you been working in your company/ quarry site?
2	What is your position?
3	Could you describe your daily work?

Level of knowledge on biodiversity

4.1	Have you ever heard about the term of “biodiversity”?				
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know		
Yes	Among these following statements, how well do you understand this term?				
	<input type="checkbox"/> Very well	<input type="checkbox"/> Well	<input type="checkbox"/> Fairly well	<input type="checkbox"/> Not so well	<input type="checkbox"/> Not at all
4.3	In your opinion, what is the meaning of this term?				

Perception on ecosystem services in quarries

5.1	Do you do activities in quarries?		
5.1	Do you do one or several of these activities in quarries?		
	<input type="checkbox"/> Logging <input type="checkbox"/> Fishing or hunting <input type="checkbox"/> Breeding animals <input type="checkbox"/> Collecting wild plants/fungi	<input type="checkbox"/> Walking, hiking <input type="checkbox"/> Outside sport <input type="checkbox"/> Engine sport <input type="checkbox"/> Picnic, barbecue	<input type="checkbox"/> Speleology, climbing <input type="checkbox"/> Animal watching, nature photography, etc. <input type="checkbox"/> Other:
5.3	Are there any activities (in this list) that you would like to do but for some reason you don't? If so, for what reason(s)?		
6.1	In your opinion, besides raw materials production, what are the services supplied by the quarry?		
6.2	In your opinion, besides raw materials production, what are the services supplied by the quarry among the following list?		
	<input type="checkbox"/> Walking place <input type="checkbox"/> Wood production <input type="checkbox"/> Agricultural production <input type="checkbox"/> Leisure area <input type="checkbox"/> Scientific interest <input type="checkbox"/> Education	<input type="checkbox"/> Living place for plants and animals <input type="checkbox"/> Cultural/spiritual <input type="checkbox"/> Capturing dusts <input type="checkbox"/> Protection from flooding <input type="checkbox"/> Protection from landslide	<input type="checkbox"/> Maintaining water quality <input type="checkbox"/> Supplying water <input type="checkbox"/> Climate mitigation <input type="checkbox"/> Limiting visual impacts and noise <input type="checkbox"/> Nothing <input type="checkbox"/> I do not know
6.3	Are there any services (in this list) that your quarry site could be providing but are not for some reason? If so, for what reason(s) do you think?		

Level of knowledge on biodiversity in quarries

7.1	Have you been astonished by some animals in the quarry?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
Yes	Which ones?		
No	What animals have you seen in the quarry?		
8.1	Have you been astonished by some plants in the quarry?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
Yes	Which ones?		
No	What plants have you seen in the quarry?		

Interests and concerns regarding biodiversity in active quarry

9	I am going to read several statements regarding biodiversity in quarries. For each of them, can you tell me to what extent do you agree on a five-point scale? 0: I do not know, 1: strongly disagree, 3: neutral, 5: completely agree						
Statement	0	1	2	3	4	5	
I am interested in plants, animals and nature in the quarry							
I would like to protect plants, animals and nature in the quarry							
I attach importance to plants, animals and nature in the quarry							
I know plants and animals in the quarry as well as their conservation status							
Plants, animals and nature in quarries represent opportunities for quarry production (and which ones?)							
Plants, animals and nature in quarries represent constraints for quarry production (and which ones?)							

Availability of information about biodiversity

10.1	Have you ever received any information on plants and animals in the quarry and the actions to set in place for them?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
Yes	Which mean of communication was used among the following list?		
	<input type="checkbox"/> Conference <input type="checkbox"/> Internet <input type="checkbox"/> Journal paper <input type="checkbox"/> Brochure or flyer <input type="checkbox"/> Media (radio or TV) <input type="checkbox"/> Formation	<input type="checkbox"/> Social network <input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newspaper <input type="checkbox"/> Poster <input type="checkbox"/> Newsletter	<input type="checkbox"/> Alongside your coworkers <input type="checkbox"/> Alongside your federation <input type="checkbox"/> Through the application of new work rules <input type="checkbox"/> Other: <input type="checkbox"/> I do not know
10.3	How often?		
	<input type="checkbox"/> Once	<input type="checkbox"/> Several times	<input type="checkbox"/> Frequently <input type="checkbox"/> I do not know
10.4	Do you feel enough informed about plants and animals in the quarry and the actions to set in place for them?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know

Training

11.1	Did you follow trainings about biodiversity?		
	Yes	No	I do not know
11.2	Which training(s) did you follow?		

12.1	Among the following list, which training(s) did you follow ?			
	Mr/Ms Biodiversity training given by Gembloux Agro-Bio Tech, ULg	Amphibians and Reptiles Training	Management/CEO training	Field implementation training for personnel
12.2	Among these following statements, how was the training?			
	Very useful	Useful	Not so useful	Useless
12.3	What did you find most useful in your learning?			
12.4	Do you find that additional training is needed?			
12.5	Do you have any recommendations for these trainings?			

Level of knowledge on issues of the Life in Quarries project

13.1	In your opinion, are there some areas in the quarry that seem important for nature, plants and animals?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
13.2	Could you show me on this aerial photograph these areas and explain me why they are important for you?		

14	I am going to show you several pictures of plants and animals. For each of them, could you tell me which one(s) have you seen in the quarry, its name, if it is native or not and if it is rare or in danger				
	Name of the species	Seen in the quarry	Native	Introduced	Rare or in danger
	Fox				
	Grass snake				
	Canada goose				
	Eagle owl				
	Butterfly bush				
	Stonecrop				
	Roe deer				
	Orchid				
	Chara				
15	I am going to show you several pictures of animals and habitats in a quarry. Could you for each habitat, which animal(s) live there?				

	Name of the species	Seen in the quarry	Bank	Temporary pond	Linear scree	Pioneer grassland	Permanent pond
Bank swallow							
Common toad							
Smooth snake							
Natterjack toad							
Common wall lizard							
Great crested newt							
Little ringed plover							
Southern skimmer							

Involvement in quarries' biodiversity

16.1	Are actions for nature, plants and animals implemented in the quarry?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
16.2	Which ones?		
16.3	Do you participate in the implementation of one or several of these actions?		
	<input type="checkbox"/> Yes <input type="checkbox"/> Yes but I would like to do even more <input type="checkbox"/> Yes but I would like to do less	<input type="checkbox"/> No <input type="checkbox"/> No but I would like to do more <input type="checkbox"/> I do not know	
16.4	What do you gain personally from taking part in or observing their actions?		
16.5	Do you have any other initiatives to propose?		
17.1	Do you feel that you received enough information on how to implement these actions?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
17.2	Which mean of communication was used among the following list?		
	<input type="checkbox"/> From the Life In Quarries project <input type="checkbox"/> From your coworkers <input type="checkbox"/> From your federation <input type="checkbox"/> Brochure or flyer	<input type="checkbox"/> Social network <input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newspaper <input type="checkbox"/> Media (radio ou TV)	<input type="checkbox"/> Poster <input type="checkbox"/> Newsletter <input type="checkbox"/> Formation <input type="checkbox"/> Other: <input type="checkbox"/> I do not know

Availability on information from the Life in Quarries project

18.1	Have you ever heard of the Life In Quarries project?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know

18.2	By which means of communication did you learn about this project?		
	<input type="checkbox"/> Notice board <input type="checkbox"/> Conference <input type="checkbox"/> Internet <input type="checkbox"/> Journal paper <input type="checkbox"/> Brochure or flyer <input type="checkbox"/> Media (radio or TV)	<input type="checkbox"/> Social network <input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newspaper <input type="checkbox"/> Poster <input type="checkbox"/> Formation	<input type="checkbox"/> Newsletter <input type="checkbox"/> From your coworkers <input type="checkbox"/> From your federation <input type="checkbox"/> Through the application of new work rules <input type="checkbox"/> Other: <input type="checkbox"/> I do not know
19.1	Do you consider that the project provides high-quality information?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
19.2	Do you find this information sufficient?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
19.3	What do you think is the best way to communicate this information to you?		

20	Are you responsible for the monitoring of the actions or have you already accompanied a supervisor in the Life project?
21.1	Has the Life project changed your relationship with nature?
21.2	How, by which means?
22	If you had to improve the Life project or future projects in your career, what recommendations would you make?
23	Would you like to have feedback on the knowledge questions?

Annex 3. Questionnaire 2016

The numbering has been adapted to match questions asked in the 2021 version. Greyed out questions correspond to the ones which number have been changed to match 2021 questionnaire and dark greyed - “X” correspond to the ones not included in 2021.

General information

Date-time			
Interview location			
Weather			
Site type	<input type="checkbox"/> Phase I	<input type="checkbox"/> Phase II	<input type="checkbox"/> Non-FEDIEX
Gender	M – F		
N° of recording			
Comments			

1	How long have you been working in your company/ quarry site?			
2	What is your position?			
3	Could you describe your daily work?			
12.1	Did you follow the Mr/Ms Biodiversity training given by Gembloux Agro-Bio Tech, ULg?			
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know	
Yes	Which year did you follow this training?			
	<input type="checkbox"/> 2013	<input type="checkbox"/> 2014	<input type="checkbox"/> 2015	
12.2	Among these following statements, how was the training?			
	<input type="checkbox"/> Very useful	<input type="checkbox"/> Useful	<input type="checkbox"/> Not so useful	<input type="checkbox"/> Useless

Level of knowledge on biodiversity and ecosystem services

4.1	Have you ever heard about the term of “biodiversity”?				
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know		
Yes	Among these following statements, how well do you understand this term?				
	<input type="checkbox"/> Very well	<input type="checkbox"/> Well	<input type="checkbox"/> Fairly well	<input type="checkbox"/> Not so well	<input type="checkbox"/> Not at all
4.3	In your opinion, what is the meaning of this term?				

X	In your opinion, is the term “biodiversity” different from “nature”?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
X	What are the differences between these two?		

Perception on ecosystem services in quarries

5.1	Do you do one or several of these activities in quarries?		
	<input type="checkbox"/> Logging <input type="checkbox"/> Fishing or hunting <input type="checkbox"/> Breeding animals <input type="checkbox"/> Collecting wild plants/fungi	<input type="checkbox"/> Walking, hiking <input type="checkbox"/> Outside sport <input type="checkbox"/> Engine sport <input type="checkbox"/> Picnic, barbecue	<input type="checkbox"/> Speleology, climbing <input type="checkbox"/> Animal watching, nature photography, etc. <input type="checkbox"/> Other:
6.1	In your opinion, besides raw materials production, what are the services supplied by the quarry among the following list?		
	<input type="checkbox"/> Walking place <input type="checkbox"/> Wood production <input type="checkbox"/> Agricultural production <input type="checkbox"/> Leisure area <input type="checkbox"/> Scientific interest <input type="checkbox"/> Education	<input type="checkbox"/> Living place for plants and animals <input type="checkbox"/> Cultural/spiritual <input type="checkbox"/> Capturing dusts <input type="checkbox"/> Protection from flooding <input type="checkbox"/> Protection from landslide	<input type="checkbox"/> Maintaining water quality <input type="checkbox"/> Supplying water <input type="checkbox"/> Climate mitigation <input type="checkbox"/> Limiting visual impacts and noise <input type="checkbox"/> Nothing <input type="checkbox"/> I do not know

Level of knowledge on biodiversity in quarries

7.1	Have you been astonished by some animals in the quarry?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
Yes	Which ones?		
No	What animals have you seen in the quarry?		
8.1	Have you been astonished by some plants in the quarry?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
Yes	Which ones?		
No	What plants have you seen in the quarry?		
13.1	In your opinion, are there some areas in the quarry that seem important for nature, plants and animals?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
13.2	Could you show me on this aerial photograph these areas and explain me why they are important for you?		

14	I am going to show you several pictures of plants and animals. For each of them, could you tell me which one(s) have you seen in the quarry, its name, if it is native or not and if it is rare or in danger (status)				
	Name of the species	Seen in the quarry	Native	Introduced	Rare or in danger
	Fox				
	Grass snake				
	Canada goose				
	Eagle owl				
	Butterfly bush				
	Stonecrop				
	Roe deer				

15	I am going to show you several pictures of animals and habitats in a quarry. Could you for each habitat, which animal(s) live there?							
	Name of the species	Seen in the quarry	Bank	Temporary pond	Linear scree	Shelter	Permanent pond	Scree
	Bank swallow							
	Natterjack toad							
	Smooth snake							
	Common wall lizard							
	Great crested newt							
	Common midwife toad							

Interests and concerns regarding biodiversity in active quarry

9	I am going to read several statements regarding biodiversity in quarries. For each of them, can you tell me to what extent do you agree on a five-point scale? 0: I do not know, 1: strongly disagree, 3: neutral, 5: completely agree						
Statement	0	1	2	3	4	5	
I am interested in plants, animals and nature in the quarry							
I would like to protect plants, animals and nature in the quarry							
I attach importance to plants, animals and nature in the quarry							
I know plants and animals in the quarry as well as their conservation status							
Plants, animals and nature in quarries represent opportunities for quarry production							
Plants, animals and nature in the quarries represent constraints for quarry production							

Availability of information

10.4	Do you feel that you received enough information on plants and animals in the quarry and the actions to set in place for them?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
10.1	Have you ever received any information about that?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
Yes	Which mean of communication was used among the following list?		
	<input type="checkbox"/> Conference <input type="checkbox"/> Internet <input type="checkbox"/> Journal paper <input type="checkbox"/> Brochure or flyer <input type="checkbox"/> Media (radio or TV) <input type="checkbox"/> Formation	<input type="checkbox"/> Social network <input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newspaper <input type="checkbox"/> Poster <input type="checkbox"/> Newsletter	<input type="checkbox"/> Alongside your coworkers <input type="checkbox"/> Alongside your federation <input type="checkbox"/> Through the application of new work rules <input type="checkbox"/> Other: <input type="checkbox"/> I do not know
10.3	How often?		
	<input type="checkbox"/> Once	<input type="checkbox"/> Several times	<input type="checkbox"/> Frequently <input type="checkbox"/> I do not know
18.1	Have you ever heard of the Life In Quarries project?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
18.2	Which mean of communication was used among the following list?		
	<input type="checkbox"/> Notice board <input type="checkbox"/> Conference <input type="checkbox"/> Internet <input type="checkbox"/> Journal paper <input type="checkbox"/> Brochure or flyer <input type="checkbox"/> Media (radio or TV)	<input type="checkbox"/> Social network <input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newspaper <input type="checkbox"/> Poster <input type="checkbox"/> Formation	<input type="checkbox"/> Newsletter <input type="checkbox"/> From your coworkers <input type="checkbox"/> From your federation <input type="checkbox"/> Through the application of new work rules <input type="checkbox"/> Other: <input type="checkbox"/> I do not know
19.1	Do you consider that the project provides high-quality information?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know

Involvement in quarries' biodiversity

16.1	Are actions for nature, plants and animals implemented in the quarry?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
16.2	Which ones?		
16.3	Do you participate in the implementation of one or several of these actions?		
	<input type="checkbox"/> Yes <input type="checkbox"/> Yes but I would like to do even more <input type="checkbox"/> No	<input type="checkbox"/> I do not know	


17.1	Do you feel that you received enough information on how to implement these actions?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
X	Have you ever received any information about that?		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> I do not know
17.2	Which mean of communication was used among the following list?		
	<input type="checkbox"/> From the Life In Quarries project <input type="checkbox"/> From your coworkers <input type="checkbox"/> From your federation <input type="checkbox"/> Brochure or flyer	<input type="checkbox"/> Social network <input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newspaper <input type="checkbox"/> Media (radio ou TV)	<input type="checkbox"/> Poster <input type="checkbox"/> Newsletter <input type="checkbox"/> Formation <input type="checkbox"/> Other: <input type="checkbox"/> I do not know
18.2	Which mean of communication was used among the following list?		
	<input type="checkbox"/> Conference <input type="checkbox"/> Internet <input type="checkbox"/> Brochure or flyer <input type="checkbox"/> Social network	<input type="checkbox"/> Report, summary sheet <input type="checkbox"/> Newsletter <input type="checkbox"/> Report <input type="checkbox"/> Poster	<input type="checkbox"/> Formation <input type="checkbox"/> From the Life team <input type="checkbox"/> Other: <input type="checkbox"/> I do not know

General information

0.1	In what age range are you?		
	<input type="checkbox"/> Twenties (18-29) <input type="checkbox"/> Thirties (30-39)	<input type="checkbox"/> Fourties (40-49) <input type="checkbox"/> Fiveties (50-59)	<input type="checkbox"/> Sixties (60-69) <input type="checkbox"/> Seventies (70-79)

Annex 4. Knowledge table with focused sample

Percentages of correct answers on questions about species names (based on a picture), species origin (is the species native or introduced), species status (is the species protected, rare or is it unprotected, ordinary) to assess the level of knowledge on the Life in Quarries and common biodiversity for 2021 respondents from sites where the species was actually present (2021: n = 79). Greyed out figures indicate lower percentages compared to 2021 unfocused sample.

 Focus sample, answers of respondents from sites where the species was actually present			
Species	Species name (%)	Native or introduced (%)	Protected/ non-protected (%)
Red Fox (<i>Vulpes vulpes</i>)	100	96	87
Roe deer (<i>Capreolus capreolus</i>)	67	96	91
Canada goose (<i>Branta canadensis</i>)	40	61	89
Summer lilac (<i>Buddleja davidii</i>)	77	71	100
Grass snake (<i>Natrix natrix</i>)	69	100	69
Eurasian Eagle-Owl (<i>Bubo bubo</i>)	95	100	91
Stonecrop (<i>Sedum sp.</i>)	9	47	55
Orchids (<i>Ophrys sp.</i>)	72	70	67
Stoneworts (Characeae)	36	80	70
<i>Life in Quarries specific species</i>	Species name (%)	Right Habitat (%)	
Bank swallow (<i>Riparia riparia</i>)	87	100	
Smooth snake (<i>Coronella austriaca</i>)	39	96	
Natterjack toad (<i>Epidalea calamita</i>)	65	88	
Wall lizard (<i>Podarcis muralis</i>)	41	97	
Great crested newt (<i>Triturus cristatus</i>)	59	79	
Southern skimmer (<i>Orthetrum brunneum</i>)	11	69	
Little ringed plover (<i>Charadrius dubius</i>)	47	65	